1933.

NEW ZEALAND.

DEPARTMENT OF AGRICULTURE.

ANNUAL REPORT for 1932-33.

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

Wellington, 30th September, 1933.

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, 1933.

The report again reveals the large and varied volume of work carried out by the Department in the interest of all our primary production industries, and shows that its many services and research activities have been well maintained. The work accomplished indicates a true keenness to do the best possible under difficulties resulting from the current financial position. Special mention may be made of the thorough and effective measures adopted by the veterinary staff and the assisting Inspectors in dealing with the recent outbreak of swine fever, complete success in eradicating the disease resulting.

As regards primary production, the past year must be regarded as an excellent one generally, a favourable season, combined with extra effort on the part of the farmers, having led to increased output in most branches, notably the dairy industry. The total sheep stock registered a further shrinkage (due to well-understood economic reasons), but with breeding-ewes once more on the up-grade the position is capable of fairly rapid rectification. Further increases in cattle and pigs have lent additional potential strength to the dairy-produce, beef, and pork sections.

The period covered by the report witnessed generally the lowest ebb of price-falls in the Dominion's staple products as affected by the economic depression. It is therefore extremely satisfactory to be able to record a decided improvement since the close of the year, especially in butter, wool, and lamb. It is to be hoped that the resulting increases in farm income will before long react beneficially on farm practice at various important points. Of special importance would this be in checking the renewed fall recorded in fertilizer consumption, by enabling our grassland farmers to restore or increase their essential top-dressing programmes.

A chief care of the Government's policy in this critical period has been to keep hard-pressed primary producers on their farms, and to thus maintain the means of external trading power so essential to the country's financial structure. Among the measures taken with this object are subsidies on the manufacture and railage of fertilizer, together with subsidized railway rates on primary produce under certain conditions. Additional funds for this purpose are being allocated to the budgetary estimates of the Department of Agriculture for the current financial year. This accounts for the increased total proposed expenditure shown; the Department's services proper, unfortunately, have had to bear some further share of economy.

The most encouraging feature for our agriculture at the present time is the decided industrial improvement manifested in Britain, bringing with it better purchasing-power on the part of our best customer. It can be most sincerely hoped that a steady return to sound prosperity in the Mother-country will eventuate, with the natural result of a steady improvement in conditions here.

I have, &c.,

CHAS. E. MACMILLAN,

Minister of Agriculture.

His Excellency the Governor-General.

REPORT OF THE DIRECTOR-GENERAL.

Wellington, 31st August, 1933.

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 divisional 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 AND PASTORAL POSITION.

The production season 1932–33 has in every respect been favourable to primary producers. Climatic conditions have on the whole been conducive to the growth of both arable crops and pastures, and are reflected in heavy per-acre yields of grain and an extensive advance in butterfat output.

The percentage of the total estimated butterfat production exported has varied slightly year by year, but on the whole exhibits a definite upward trend, especially over the past eight seasons, having risen in that time from 72 per cent. to 79 per cent., losses in separation for all buttermaking being credited to local consumption. Local consumption of dairy products, however, was well maintained during this latter period, and that for butter has actually risen by roughly 2 lb. *per capita* per annum since the depression began, the *per capita* consumption for 1931–32, based on the total population as at 31st December, 1931, working out slightly in excess of 37 lb., which is the highest rate in the world for all countries having such data available. (Had the mean population figure been used it would work out higher than 37 lb.) Export shipments of butter and cheese for the twelve months ended 31st July, 1933, according to grading port returns, amounted to 124,376 tons and 100,672 tons respectively.

The total number of dairy cows in milk or dry as at 31st January, 1933, was approximately 1,839,000. The rapid increases recorded during the past three years are associated with the general price level for farm products. Many sheep-farmers have gradually built up herds of varying sizes to augment their cash income. It is to be expected, however, that a return to more normal price conditions for meat and wool will be accompanied by a regressive movement in this respect. A similar trend was experienced in the slump years of 1920–21, and was followed by a four-years static period from 1923 onwards, consequent upon sheep-farmers giving up milking for factory supply.

The estimated average production per cow for the 1932–33 season is in the vicinity of 218 lb. butterfat, or an advance of approximately 18 lb. over that of 1931–32. Although in matters of this kind it is impossible to correctly relate this to the individual responsible factors, it may be accepted that all the increase cannot be credited to the difference in seasons experienced. It must be remembered that the number of dairy cows has increased so rapidly of late years that the average age must now be lower possibly than ever before, and as a result lower average production might be anticipated. With rapid increases in stock numbers culling is neither so effective nor so heavy as with smaller increases in total herd, and the proportion of replacement young stock coming forward, being greater, is not so select. Also the amount of top-dressing applied per cow has fallen materially for the last two or three seasons. Therefore we arrive at the conclusion—and there are many supporting indications at present discernible—that dairy-farm management as a whole has improved appreciably to make up for the various handicaps experienced. Undoubtedly most farmers have made a real effort to offset lower prices by increased production. With the knowledge that appreciable improvement of land partially developed or not previously utilized is too costly under present price conditions, there remains but one main avenue to increased production, and this is by way of improved management.

The sheep industry continues to feel the full force of the price depression, although there are indications that wool, at least, is likely to be in better demand than for the past three seasons. Although the most noticeable advances in price have been in respect of fine wools, it is to be expected that the movement will be reflected in the coarser types representing the major portion of the Dominion's clip. The most serious aspect of the financial stringency among sheep-farmers is reflected in the reduction of breeding-ewes by over half a million in 1932. This movement is typical of depressions, flock-owners being forced into realization on mature stock and lambs in an attempt to find liquid cash. If this trend can be permanently arrested rapidly, recovery in sheep numbers will be expedited.

The 1933 enumeration of ewes, which is now to hand, shows an advance of approximately 147,000 compared with 1932, indicating that the breeding flock should reassert its influence at an early date. The drop in breeding-ewes last year was offset by a favourable lambing of over 2 per cent. higher than in 1931. This increase has facilitated the partial recovery in ewe numbers, and has enabled the industry to kill comparatively heavily, particularly in lambs, during the 1932–33 season. The total figures for the year ended 31st March are 9,718,585 and 8,689,196 lambs slaughtered for 1932–33 and 1931–32 respectively; the sheep totals for the same periods are 3,569,598 and 4,464,894. Thus while lamb slaughterings rose by approximately one million, mature sheep showed a decline of 895,296.

As the financial year includes the latter four months' killings of the previous season it does not truly indicate the flock position as it pertains at the present time. The figures given above would suggest that a greater number of the 1932 lamb crop was slaughtered than for 1931, but this is not the case. Killings from the 1931 lambing were well sustained right up to July, 1932, this being reflected in the figures quoted. The returns now to hand for the seasonal slaughterings as for the year ended 31st July show that lambs killed at meat-works and abattoirs numbered 8,953,009 in 1933, compared with 9,065,752 in 1932, the figures for sheep being 2,921,594 and 4,159,446 respectively for the same periods. These facts, taken in conjunction with a good lambing in 1932, suggest that the flock position in 1934 should be materially improved.

The details of mutton and lamb exported during the year ending 31st March show a comparatively sound position. The quantities exported indicate that there was a carry-over from the previous season's killings. Lamb carcasses totalling 2,774,458 cwt., and valued at £6,585,743, were exported in 1932–33, compared with 2,243,609 cwt., valued at £5,749,076, in 1931–32. The relative figures for mutton were 1,244,338 cwt., valued at £1,419,832, in 1932–33, and 1,105,322 cwt., valued at £1,408,982, in the previous season. Restrictions of meat imports into Great Britain, combined with the internal exchange position, should be reflected in prices expressed in New Zealand currency during the ensuing season.

For some years past there has been a feeling among the sheep farmers and breeders of the Dominion that the quality of our wool is not all that can be desired. A realization that the suitability of the sire is the true basis of any improvement in wool has led to an agitation culminating in the foundation of a committee to formulate plans and proposals calculated to bring about the desired improvement. The outcome of this movement is as yet uncertain, but must be watched with interest by those concerned for the future of the industry.

The position of beef production in the Dominion's farming programme has attracted some attention consequent upon the successful trial shipments of chilled beef made during the year. The increase in breeding-cows of beef type during recent years has naturally led to an advance in killings, as reflected in the season's slaughtering of 354,271 cattle, compared with 269,916 during the season ending July, 1932. Should a chilled-beef trade be developed, however, it is questionable to what extent our present stock can be considered suitable. Undoubtedly greater attention will need to be paid to beef type, and in this connection breeding-bulls must receive special consideration. Any extensive development of export of chilled beef of a type other than that represented by our present supply must of necessity take some years to build up. In anticipation of such a development, information is required as to the returns to be secured from moderately young specially bred beef cattle raised on high-yielding pastures of a dairying type. It has been proved in the past that returns from lamb meat can be favourably compared with returns from milk produced on the same type of pastures. The question arises as to whether chilled beef from stock somewhat younger than that at present being frozen can similarly compete. In this connection, many areas of high-class dairying pastures at present inadequately fenced and watered for dairy cows is suitable for rapid production of beef, but it is necessary to know the returns to be secured per ton to grass consumed.

An interesting and far-reaching movement associated with the price depression is evidenced in the tendency for horses to replace tractor power. The demand for working-horses has resulted in an acute shortage and high prices being paid for the animals offered. This movement is actually the tangible evidence of the recognition by farmers that expenditure in farm management which can be largely credited to the farm itself is an effective method of bridging the gap between production cost and realized prices. The outstanding instances which may be quoted are the production of feed for horses rather than the purchase of benzine and oil; the almost general replacement of culled dairy stock by heifers reared on the farm; and the gradual trend towards the breeding of weaner pigs rather than purchase from other breeders at high prices.

The Lesser Primary Industries.

In addition to the progress registered in the main industries of the Dominion, there has been considerable activity in products of lesser importance individually, but nevertheless valuable adjuncts in the diversification of primary production.

It has been realized by dairy-farmers in particular that pigs properly managed can be so exploited as to increase the gross returns from butterfat by as much as 2d. per pound, despite the low prices ruling for pig products. The realization is reflected in an increased slaughter for the twelve months ended 31st March last, the total of 508,623 killed in 1931–32 being exceeded by 48,833 carcasses. The actual figures for pigs killed at meat-works and abattoirs for the season ended 31st July, 1933, were 522,182, compared with the previous season's total of 370,469. The quantity of pork exported reached a total of 186,652 cwt., compared with 104,882 cwt. for the corresponding previous period. An additional indication of the farmers' awakening interest in pigs is found in the difficulty at present experienced in the purchase of brood sows.

It is realized officially, however, that much remains to be done to place this industry in the position it warrants, and to expedite matters a special Pig Industry Committee has been established. This Committee commenced to function in July, 1932, and has held six meetings in Wellington. Its personnel is comprised of representatives of the Department of Agriculture, Department of Scientific and Industrial Research, Meat Board, Dairy Board, Massey Agricultural College, Canterbury Agricultural College, Waikato Pig Recording Club, N.Z. Co-operative Pig Marketing Association, Bacon Curers' Association, Pig Breeders' Association, and the New Zealand Farmers' Union. This Committee so far has been mainly concerned with the drafting of provisions for a uniform system of pig grading for the local and export markets, these now having been gazetted. In addition, recommendations have been considered for the establishment of a pig-recording scheme on national lines, and for the certification of purebred sows on a performance basis. It is anticipated that this Committee will eventually be responsible for investigation into pig management methods generally, and will undertake propaganda calculated to encourage and direct production of pig products.

The poultry industry has received a considerable amount of attention during the year, particularly in respect to organization calculated to improve the co-operation of producers themselves. It is recognized that the industry cannot be placed on a sound footing from the production and marketing viewpoints until poultry-keepers have a truly representative organization. During the year some 5,264 cases of eggs in shell and a small consignment of pulp were exported, but it has been appreciated by producers and the egg trade generally that a more determined effort must be made to control the flush-production period by export of a greater quantity during that time. To this end, action has been taken to set up egg export committees in each of the four main centres, with a central executive committee stationed in Wellington to co-ordinate activities. In each instance, producers, selling-agents, and the Department of Agriculture are represented on the committees. It is hoped that this organization will facilitate export in the future.

So far as fruit is concerned, the apple crop in the 1932–33 season was below the average in production, but other classes of fruit were in excess of the previous year. The export season of 1932 accounted for the shipment of approximately 1,596,000 cases of apples and pears, or an increase of 240,000 cases over the 1931 exports. The prices procured overseas were relatively satisfactory, the net cost to the State under the Government guarantee being in the vicinity of £2,000 only. The export season of 1933, just ended, closed with a total export of approximately 1,430,000 cases, and records to hand indicate that the returns from later sales will be distinctly disappointing. A feature of the year was the prohibition of imports of fruit and vegetables grown in the Commonwealth of Australia. During the year experimental exports have been undertaken in association with the Scientific and Industrial Research Department, notably of plums and peaches. Work has also been undertaken to test the practicability of keeping onions in cool store for the purpose of spreading supplies of the Dominion-grown article on the local market.

As regards the honey industry, production was again low, prices received by beekeepers being also disappointing. An effort to place the industry on a better footing all round is in progress.

The hemp industry continues to feel the full force of the depression, despite financial assistance from the Unemployment Board in the way of a bonus on export hemp. Some hope is centred on the proposed establishment of a factory at Foxton for the manufacture of woolpacks and sacks from flax fibre, but some time must elapse before its effects on the industry generally are felt. The weak feature in the hemp industry at the present time is that Australia and New Zealand are mainly relied upon as avenues of disposal. In order to secure any permanence in expanding output, it is essential to more firmly establish our fibre on the American and European markets, where, provided regular delivery of uniform material can be guaranteed, recognition of its undoubted qualities for cordage purposes should rapidly be regained.

During the year there has been considerable activity with respect to the certification of various types of crops for seed production. This phase of the Department's work has resulted in two definite features—namely, an increased income for the farmers adopting the regulations laid down, and a general improvement in pastures consequent upon the use of certified strains of seed in laying down new pastures. The case of perennial rye-grass is particularly outstanding, the area offered for certification in the season 1932–33 being 25,000 acres, compared with 9,709 acres in the previous season.

The General Production Viewpoint.

From a general production viewpoint, the 1932–33 season has been remarkably good, increased output of the various commodities going a long way towards offsetting any easing in commodity prices. In view of our proven potential ability to further expand in supplies of exportable foodstuffs, the trend towards nationalism in consuming countries, as exemplified by discussion and in many instances action taken to limited markets through conscious control of imports, must be viewed with a considerable degree of apprehension by individuals and organizations connected with primary industries. It is evident that no efforts must be spared to find additional outlets for our produce.

The Initial Small Farm Plan.

In April, 1932, an amendment to the Unemployment Act, 1930, made provision for the settlement of unemployed workers on areas of cultivable land. At the request of the Right Hon. J. G. Coates, then Minister in Charge of Employment, it was agreed by yourself that the Department of Agriculture would administer this Amendment, adequate finance being made available for the purpose. The immediate supervision of the Act was placed in the hands of the Assistant Director General, the Farm Economics Section of the Department being made responsible for Head Office administration.

Field work in connection with the acquisition of land and the establishment of families was placed under the control of eight District Executive Officers, these officers being either District Superintendents of the Live-Stock Division or Fields Superintendents of the Fields Division. To facilitate control and to prevent overlapping of effort, the field staffs of the Live-Stock and Fields Division were amalgamated for this work, officers of either Division operating under the particular Executive Officer for the district concerned. This involved much strenuous work, and the zeal exhibited by all concerned in carrying it out is highly appreciated.

The experience gained by this Department during the first six months' operations clearly indicated that the power given under the amendment to the Unemployment Act was not sufficient to ensure rapid settlement. Steps were therefore taken to have further legislation framed, and in the early session of 1933 the Small Farms (Relief of Unemployment) Act was passed. Under the provisions of this Act, its administration was placed under a Ministerial committee and a Board of five members. The Department of Lands and Survey then became responsible for the acquisition of land and the settlement of unemployed, and the Department of Agriculture made arrangements to transfer control of established and partly established holdings to the new administration. The first meeting of the New Board was held on 12th March, 1933.

The Department of Agriculture was actively engaged on settlement for less than twelve months, and undertook the task in the first place without previous experience in the intricacies of land acquisition. It was, however, fully alive to the soundness of the principle of settling unemployed families in positions where they could earn something from the land and partially provide themselves with food, &c. Rapidity of establishment therefore became essential. Upon representation to the Department by a number of owners of large herds of dairy cows, provision was made to enable owners to erect share milkers' cottages and cowsheds, provisional upon the engagement of men then registered as unemployed. This avenue of absorption proved effective in expediting the placement of families.

When the Department of Agriculture ceased active operations in land acquisition in March, 1933, it was able to report a certain amount of progress even with the restricted conditions under which it had been working. The position at that time is summarized as follows:—

Number of families settled—		
On small farms	367	
Share milkers	214	
	—	581
In course of establishment prior to settlement—		
Small farms	121	
Share milking	51	
	—	172
Total		753

In addition, the Department was able to hand to the new Board a considerable number of propositions which had been investigated and brought to a stage facilitating rapid decisions, and also details of properties offered but which required further investigation prior to acceptance. The Board has, in fact, since acted upon the recommendations made by this Department in a number of cases.

Animal Diseases.

Apart from the usual troubles associated with fairly intensive stock management, the greater part of the Dominion has been free from serious outbreaks. Anthrax made itself evident on one dairy farm in the Northern Wairoa district, eleven head of cattle dying before the outbreak was controlled. The source of infection could not be definitely determined, but is believed to have been unsterilized animal manure introduced many years ago.

Close attention has again been given to the prevalent diseases of dairy cows, particularly in regard to sterility, mammitis, and the condition termed grass staggers. Mr. Blake, at Hamilton, has followed up the line of sterility investigation discussed in last year's report, and has examined some 500 samples of seminal fluids for abnormalities. The percentage of bulls classified as poor or lower on such examination indicates the importance of this line of investigation, and the necessity for following it up thoroughly. Mr. Webster, in Taranaki, is co-operating in this, and is making a close study of the sterility problem in all its aspects. The co-ordination of the work being done in the Waikato with laboratory research at Wallaceville into the effect of diet on sterility of the male should lead to a fuller understanding of this aspect of dairy herd disease. A new method of treatment for grass staggers is being tried this season, but it is too early yet to speak of results. Research at the Veterinary Laboratory led up to this.

The grouping system of milking dairy cows, commenced last year, for the control of mammitis in herds has been continued and has given promising results. The scope of this work experimentally is controlled by the staff available, as the arrangement of cows in order established by preliminary microscopic examination of milk and the subsequent examination necessary entails extensive concentration on detail. The reports to hand and covering fifty herds over two seasons show that distinctly beneficial results have been obtained, and the scheme can be definitely advised under ordinary conditions.

Good results are being obtained from the methods adopted for controlling lymphadenitis in sheep on sheep stations, the percentage of affected animals being already largely reduced. Mr. Dayus, District Superintendent for the South Island, and Mr. Hopkirk, Officer in Charge of the Veterinary Laboratory, have been prominently associated with the satisfactory progress of this work.

With regard to pulpy kidney in lambs, Mr. D. A. Gill has demonstrated that the immediate cause of death is the absorption of a bacterial toxin from the small intestine. Considerable field work has been carried out to test a vaccine and antitoxin as means of preventing the disease. Their trials were mitigated against owing to the limited evidence of the disease in the experimental flocks. There are definite indications, however, that the anti-toxin is beneficial, and its use on stud lambs may be possible and advantageous.

Swine Fever.

Early in May of this year an outbreak of swine fever occurred in the Johnsonville and Lower Hutt districts. Steps were immediately taken to confine and control the outbreak. All farms on being confirmed as infected were declared "infected places," and an area comprising the whole of the Hutt and Makara Counties, including all city and town areas therein, was gazetted an affected area and the movement of pigs outward prohibited, while movement within the area was controlled.

All pigs on affected farms were destroyed and buried, and all buildings, &c., used in connection with the piggeries were demolished and destroyed by burning, compensation being paid on stock and plant according to valuation. It is satisfactory to note that no outbreaks have occurred outside the gazetted area, and no further outbreaks have occurred within the zone since the beginning of July, when the last herd was dealt with. Outbreaks occurred on thirteen farms in all, and 1,920 pigs, most of these being contacts, were destroyed. All the buildings in which the pigs were housed were demolished and burned.

Close and prolonged inquiry was made with a view of determining the means by which infection was introduced, but nothing definite came to light. It is significant, however, that on all the affected farms the pigs were fed on garbage collected in the City of Wellington.

The effective manner in which this outbreak was stamped out reflects great credit upon the Director, the veterinary officers concerned, the Wallaceville Laboratory staff, and the Stock Inspectors who were associated with them.

Animal Nutrition.

Perhaps the most remarkable and far-reaching aspect of animal nutrition ever experienced in the Dominion's history has been brought about by the widespread adoption of the advice given by the Chief Chemist in the use of limonite for the rectification of those stock conditions associated with iron deficiency and generally known as "bush sickness." The use of finely ground high-grade limonite can now be looked upon as a standard farm practice on all known bush-sick country, and is rapidly extending to the marginal areas where the condition is present in a modified form. The treatment is so well recognized that the distribution of the material has been taken up by commercial agencies, some operating on an extensive scale. Successful treatment of iron deficiency by such simple means is proving a godsend to farmers in affected country.

Although the North Island is mainly affected, limonite has been used experimentally in the South, particularly on one localized deficiency area. The results to date are not conclusive, but nevertheless can be regarded as most encouraging.

In connection with animal nutrition, a great deal of analytical work has been carried out during the year on pasture plants from different localities and under varying manurial treatments. Detailed accounts of this work will be found in individual appended reports.

Use of Artificial Fertilizers.

The usage of artificial fertilizers in the maintenance of pastures continues to give some anxiety for the future. As indicated in my 1931–32 report, the position appeared to be improving following the subsidizing of superphosphate manufacture with a corresponding drop in cost to farmers. It is significant of the narrow margin of working capital under farmers' control that the failure in recovery of the price trend of dairy produce in November, 1932, was followed by a marked falling-off in the use of fertilizers, despite the continuance of the Government subsidy. Fortunately, climatic conditions were favourable to grass growth and no serious effects are noticeable in the present stock-feed position, but should less favourable conditions be experienced during the ensuing season, depletion of fertility may be expected to make itself manifest. The figures for artificial fertilizers for all purposes delivered during the period January–June for the past five years are as follows:—

	Tons.	Decrease from 1929. Tons.
1929	228,000	..
1930	212,000	16,000
1931	152,000	76,000
1932	222,000	6,000
1933	137,000	91,000

The drastic reduction portrayed becomes even more significant when it is remembered that dairy cows have increased from 1,371,063 in January, 1929, to approximately 1,840,000 in January, 1933. Thus the effective use of fertilizer per cow has fallen greatly, and the continued increase in production noted this season can only be accounted for by improved pastures, improved cows, and improved farm management generally, all of which reflect the policy adopted by the Department in improving pasture strains, in the dissemination of knowledge generally, and in its encouragement of herd testing.

Noxious Weeds Control.

The major activity in noxious weeds control has been the Department's co-operation with the Unemployment Board in the using of unemployed men to combat ragwort. Sodium chlorate still proves to be the efficacious control specific, but its use has several disadvantages. Its high price when purchased in small quantities limits its application, the records for a number of years indicating that 400 tons per annum is the limit likely to be reached for some time to come, whereas 1,000 tons could be used each year to advantage. The possibility of ignition, particularly when clothes become impregnated with the compound, does to some extent constitute a danger where care is not exercised. The practice of certain persons using sodium chlorate as an ingredient for home-made explosives is also to be deprecated. It may be mentioned that the Department has instituted inquiries calculated to encourage research work on the manufacture of an equally efficacious chemical compound without its disadvantages, and work is also being undertaken to this end in our own laboratories.

Ruakura State Farm and Farm Training College.

The returns from the Ruakura Farm have reflected the price depression in common with primary industries generally, although production has been well maintained. The time has now arrived when consideration could well be given to the future of this undertaking. The property is a large one, and the requirements of the Department, including the training school established on the farm, could be adequately met by a smaller area, leaving the balance available for close settlement. The activities of the school itself are well maintained, and the facilities given for practical instruction in farming methods and management continue to serve a useful purpose.

Te Kauwhata Horticultural Station.

The greater portion of the land at Te Kauwhata Horticultural Station has gradually been converted into dairy farms and settled, leaving only the vineyard, wine-manufacturing plant, and buildings, together with a small area of land. It has now been decided to dispose of this remaining portion of the property, and it will accordingly be offered for sale at an early date.

The Plant Research Station and Related Experimental Areas.

The Plant Research Station, at Palmerston North, continues to be operated in co-operation with the Department of Scientific and Industrial Research. Restricted finance has necessitated an adjustment of the wide activities of the Station, but has resulted in a greater concentration of detailed research connected with crops and pastures, such work being possible on the areas adjacent to Palmerston North, or in the laboratories themselves. In this connection special commendation must be given to the selection work in connection with pasture plants, and also the study of plant diseases, on the Station area.

The experimental area at Marton continues to be used for the study of pasture response under varying conditions of manuring and stocking, and particularly allows of research work in experimental technique.

During the year the recently leased experimental area on the Canterbury Agricultural College farm at Lincoln has been developed under the name of the Government Pure Seed Station, and fills the long-felt need of a suitable area for detailed experiments, particularly on cereals and potatoes. The association with Lincoln College is most advantageous, and is fully appreciated by the staff of the Plant Research Station.

Wallaceville Veterinary Laboratory.

This institution has continued its far-reaching activities on sound and progressive lines. It forms a valuable and essential adjunct to the work of the field officers of the Live-stock Division in not only controlling disease but also in advising stock-owners as to preventive and curative treatment and animal management generally. The extent of its activities can be gathered from the report of the Officer in Charge which is appended. The staff has been strengthened by Dr. I. J. Cunningham, of the Chemical Laboratory, carrying out his work at Wallaceville, where he specializes in animal nutrition matters. He had previously spent a period of study at the Rowett Institute, Aberdeen. Dr. Moir, of the Dairy Division, is also at Wallaceville, thus enabling the immediate advisory and consulting scientific services to the field officers of the two Divisions dealing with live-stock and live-stock products to be concentrated in the one establishment.

The Chemical Laboratory.

A large volume of good work has been carried out at this Laboratory by Mr. Aston, Chief Chemist, and his staff, much of which was in connection with soil deficiency, the troubles arising therefrom, and the measures necessary in order to rectify it. Soil analyses have also been carried out extensively in connection with the areas raised in elevation by the Hawke's Bay earthquake, soil reclamations by the Public Works Department, and soil surveys by the Scientific and Industrial Research Department, together with fertilizers, stock licks, and stock remedies.

Full details of what has been done will be found in the appended report by Mr. Aston. The work has been of very material assistance to field officers of the Department. In addition, the administration of the Fertilizers Act has been satisfactorily carried out. Recently steps were taken to institute a system of charging fees for fertilizer registrations.

Land Development.

The Department of Agriculture continues to be closely associated with the Lands Department in the development of pumice country in the Rotorua district. A further portion of the land grassed at Ngakuru has been subdivided and dairy herds established. Continued high production from newly established pastures on this class of country indicates the possibilities of greatly extending the dairying zones of the Dominion, provided the marketing outlook warrants it and prices recover sufficiently to warrant the initial cost of establishment. During the year some 1,930 acres of the Galatea Estate has been cultivated and sown to grass, in addition to 568 acres of annual crops.

Advisory and Instructional Work.

The year's work has been outstanding in that the various activities of the fields staffs of all Divisions have, if anything, been more diversified than ever, despite the limitations imposed by the need of economy in administration. Contact with the farming community necessitated by the administration of the initial Small Farm Plan has facilitated a great deal of personal advice being given. At the same time, routine work in connection with all inspectional activities has been maintained, together with instruction, to the fullest extent compatible with the restrictions imposed by limited finance. The manner in which all field officers have done their best to meet the position to the best advantage is highly appreciated.

Publications and Publicity.

The general financial restrictions necessitated some reduction in expenditure on the Department's publications, but measures were taken to prevent the efficiency of this service being seriously impaired. The *New Zealand Journal of Agriculture* continues to be our principal medium for the publication of instructional and informative matter in all branches, also for purposes of record. In regard to the latter function, the *Journal* possesses a definite additional value by helping to keep New Zealand "on the map" in the scientific world abroad. During the year there was also a steady output of instructional matter in pamphlet or leaflet form, while the usual amount of miscellaneous printing connected with the Department's many activities was undertaken.

The service of weekly radio broadcast lecturettes from Station 2YA, Wellington, was continued throughout the year by officers of the Department's various branches. A very wide range of subjects was covered, and there was again much evidence of the appreciation of this activity in all parts of the Dominion.

Subsidies.

The administration of governmental measures calculated to assist the farming community in meeting the difficult position resulting from low commodity prices has kept the Head Office particularly busy. The measures of major importance are the railway subsidies on fertilizers and lime, concessions on railway transport of primary produce, and subsidy to manufacturers of superphosphate. In addition, minor duties have embraced the control of subsidies or advances in connection with the feeding or transport of stock from droughty areas.

General.

It should be noted that the appended detailed reports on Section and Division activities apply fairly strictly to the work of the financial year ended 31st March, 1933. Although this course is necessary, it has the decided disadvantage of not covering the results of each project as portrayed in the season's output. To overcome this shortcoming as far as possible, I have indicated in my summary the seasonal position in production of some of our branches of primary industry.

In conclusion, I must express my sincere appreciation of the good services rendered by the Assistant Director-General, the Secretary, Divisional Directors, and all members of the staff.

C. J. Reakes, D.V.Sc., 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.

PARTICULARS are supplied herewith regarding the thirteenth year of operations at Nauru and Ocean Islands since the industry came under Government ownership. The year ended on 30th June, 1933, and the shipments compare with the two previous years as follows :—

	1930–31. Tons.	1931–32. Tons.	1932–33. Tons.
Nauru	240,855	289,340	436,100
Ocean	145,122	142,200	224,200
	385,977	431,540	660,300

An increase of 228,760 tons on the previous year will be noted, and the figures constitute a record year's work, the previous highest being 593,340 tons shipped in 1926–27, a difference of 66,960 tons.

Distribution of the output was as follows : Australia, 438,685 tons ; New Zealand, 177,915 tons ; other countries, 43,700 tons. The proportion of output coming to New Zealand is 26·95 per cent., compared with 33·89 per cent. in 1931–32, and 31·85 per cent. in 1930–31.

Importations of phosphate to New Zealand, compared with the two previous years, are as follows :—

	1930–31. Tons.	1931–32. Tons.	1932–33. Tons.
Nauru–Ocean	112,873	163,250	184,388
Outside	22,935	20,437	13,963
	135,808	183,687	198,351

It may be noted, however, that the higher figures for 1932–33 do not in this case mean a higher consumption of superphosphate, but that the stocks of raw phosphate held by the manufacturers were materially built up, a useful provision against bad-weather risks at the islands.

During the year under review, fine weather mostly prevailed, and conditions were favourable as regards health, labour, &c.

An important development was brought into operation during the year in the speeding-up of the cantilever at Nauru, with the result that on several occasions steamers arriving in the early morning loaded their cargoes of up to 8,300 tons during daylight hours of the same day. This quick work favourably affects the freight rate, and minimizes the risk entailed by having vessels moored close inshore in an open roadstead. The system of shipping at Ocean Island has also been speeded up satisfactorily, and other developments in connection with the mining, drying, and transport operations at both islands are proving very satisfactory as they come into operation.

It is anticipated that with these various developments, Nauru and Ocean Islands will be in a much stronger position for dealing with an increased demand from New Zealand and Australia as it eventuates.

LIVE-STOCK DIVISION.

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

General Conditions.

Speaking generally, the season just past has been one of the best which we have seen for many years. The winter, which was an exceedingly mild one, was followed by spring and summer conditions which were ideal for pastures and all classes of crops. Under these conditions all classes of stock did well and a record season was experienced.

The exceptions to this are the Wairarapa, Canterbury, and North Otago districts. In the Wairarapa drought conditions were in evidence from the previous summer and feed for dairy cows had to be brought from other districts. In parts of Canterbury and North Otago, although spring and early summer conditions were favourable for the production of cereals, the latter part of the season was too dry for the production of root crops, and these in many parts of the district are more or less a failure, and the settlers are faced with a shortage of winter feed. Taking into consideration the condition of the pastures, the amount of hay and ensilage saved, and the ordinary winter conditions prevailing, we can look forward to all classes of stock wintering satisfactorily.

Health of Live-stock.

HORSES.

In my last report of last year I remarked that it was regrettable that more heavy horses of the right type were not being bred. This remark has been justified, as the demand for this type of horse is more in evidence at the present time than has been the case for years. In addition to this, the demand is increasing in Australia, and horses of both sexes are being exported there in increasing numbers and at satisfactory prices. This is a branch of farming which could be made remunerative to those who have the time and means to devote to it.

The health of this class of stock has been good, and with the exception of a few cases of strangles in young horses there has been no disease worthy of mention.

CATTLE.

Tuberculosis.—The total number of cattle condemned in the field as a result of clinical examination and the tuberculin test amounted to 4,270. The total number of cattle examined at the various abattoirs and meat-export slaughterhouses was 337,301, an increase of 70,453 over last year's figures. Of these, 17,277, or 5·1 per cent., were found affected in varying degrees, a large percentage being only slightly affected.

Actinomycosis.—The number of animals condemned and for which compensation was paid was 535, a decrease of 104 over last year's figures. The number condemned represents advanced cases of the disease, mostly affecting bony tissues and not amenable to treatment. In addition to these a large number of cases were subjected to treatment with satisfactory results. In those cases where the soft tissues only are implicated the disease is more amenable to treatment than where hard or bony tissues are concerned. Treatment to be satisfactory should be undertaken in the early stages of the disease.

Malignant Growths.—The number of animals condemned and for which compensation was paid was 281, a decrease of 150 over last year's figures.

Johne's Disease.—In recent years a number of cases of this disease have been discovered in the Taranaki district. Eleven head of dairy cows and two bulls were condemned and destroyed during the year. In all cases confirmation of the disease was made at the Veterinary Laboratory, Wallaceville. Inspectors have been instructed to be on the watch for this disease, and although a few farms are concerned there is no fear of the disease assuming epidemic propensities.

Blackleg.—The incidence of this disease can again be considered satisfactory both as regards the number of outbreaks and the number of deaths recorded, which were considerably less than those of last year. It is to be regretted that a few cases took place in the Kaitaia district, where it has not previously been seen. A vigilant watch is being kept in all districts, and by inoculation carried out early in the season it is hoped the incidence of the disease will be reduced to a minimum. The new formalinized vaccine is giving every satisfaction.

Cattle Tick.—The position regarding this pest can be considered satisfactory. In some districts an increase has to be reported, whereas in other districts a corresponding decrease is seen. With regard to the control of ticks, the District Superintendent, Auckland, remarks: "There is increasing evidence to show that on farms that are properly grazed and top-dressed ticks soon decrease in numbers." In my previous reports I have pointed out the necessity for destroying all cover in which the ticks hibernate during the winter months. On well-grazed dairy-farms this presents little difficulty. On the rougher grazing-runs, however, this is a different matter and requires constant attention if the pest is to be kept in control. Owners of such properties should see that, if possible, all covering where the ticks winter should be destroyed by fire. In the B area a careful watch is being kept on any fresh outbreak that may occur, and every precaution is taken to cope with the invasion. On a number of properties the tick has apparently been stamped out through the action taken.

Anthrax.—It is to be regretted that an outbreak occurred during the year on a dairy-farm in the Northern Wairoa district. In all, eleven head of cattle died. Unfortunately, before it was reported a number of cows had already died and been cut up, thus seriously contaminating almost every part of the farm.

Mammitis.—Reports from the various districts where dairying is extensively carried on go to show that the incidence of this disease has not diminished to any appreciable extent, and the number of dairy cows which the dairy-farmer is compelled to reject on account of bad and faulty quarters is still far too high. The mammitis-control scheme inaugurated by the scientific workers at Wallaceville is still in force. It was felt by many dairy-farmers that to carry out the scheme in its entirety was a task beyond their capabilities, but at the same time there are many who claim that by putting the scheme into operation in their herds they have been rewarded, and that the number of cases of mammitis has been very considerably reduced. For those who are willing to give the scheme a fair trial I am satisfied that considerable benefit will be derived. Much may be done to lessen the incidence of this disease if only dairy-farmers in general will pay more attention to the sanitary conditions of their sheds and surroundings, and the cleanliness of their milking machines and manipulation, also the rotation with which they are placed on the cows. Every farmer can by careful manipulation and examination of the milk secretion tell when a cow is suffering from mammitis. By this means he can regulate the order of the cows coming into the shed. Animals whose udders are free from disease should be milked first and the affected cows milked afterwards in rotation according to the degree of infection, and at no time should the teat-cup be placed on an affected quarter. If this procedure is carried out, combined with proper sanitary precautions, it will go a long way to lessen the incidence of the disease.

Contagious Abortion.—Reports from all districts indicate that this disease is less in evidence than formerly. This suggests that a high degree of immunity has been attained amongst our herds. Although the disease is still in evidence in all dairying districts, in no district did it assume alarming propensities. The agglutination test has been largely availed of, and, as the District Superintendent, Wellington, remarks, "There is a notable trend on the part of dairy-farmers to put into practice the precautionary measures recommended regarding isolation and disinfection of the aborting cow. Dairy-farmers are also making more use of the agglutination test. This is commendable, showing as it does a greater desire on their part to control the disease."

Sterility.—Reports from all districts indicate that this trouble is still very much in evidence and is the source of considerable loss and annoyance to many dairy-farmers. Experimental work has been carried out by the scientific workers of this Division on the genital organs of the bull, and while this indicates that the bull is responsible for a considerable percentage of cows failing to get in calf he cannot be held responsible for all cases. The pathological and bacteriological aspect of this complaint has received considerable attention, while the functional aspect has been somewhat neglected. With regard to this the District Superintendent, Dunedin, remarks that very little is known about the physiology of reproduction, genetical influences, influence of environment, and methods of feeding. With reference to methods of feeding it is surprising that many of our dairy-farmers still fail to provide sufficient sustenance to carry their herds through the winter properly, with the result that the herds come to the milking season in anything but a fit condition. Again, the calves in many instances are badly reared and with difficulty get through the first year of their existence. In addition to this owners of dairy herds are looking for increased production year by year. Under these conditions it is only to be expected that the general functions of the body are somewhat impaired. Observations made in the field point to the fact that where the dairy herd is properly looked after all the year round, and any mineral requirement lacking is supplied, the incidence of this trouble is considerably lessened. Anent this the District Superintendent, Wellington, remarks: "Leaving aside the question of certain specific causes, which no doubt in many instances are responsible, I feel that the incidence of this trouble could be materially lessened if improved conditions of feed and shelter were maintained in the herd during the most trying period of the dairy cow's existence—namely, midwinter."

Parasitic Disease in Young Cattle.—The incidence of this condition has been less in evidence during the past season than for many years, probably due to climatic conditions. Dosing with a solution of bluestone, together with supplementary feeding, gives the best results.

Redwater.—Due to better management of the pastures, so-called redwater is not so much in evidence as formerly. A few cases were seen in the Rotorua district, where the stock were feeding on turnips, and one outbreak was noticed in the Marlborough district where the cows were depastured on rough herbage of a poor type. Until such time as improvement in pasture conditions is brought about on the one hand, or the feeding on turnips is balanced by a nitrogenous diet, we can look for recurrences of this trouble.

Eclampsia (Grass Staggers).—With the exception of the Waikato district, this disease has not been so much in evidence as in previous seasons. Investigation is still being made by the scientific workers of this Division, but as far as treatment is concerned the best results in this direction, such as they are, have been obtained from the administration of chloral hydrate. It is worthy of note that the disease is more frequently seen on those farms which are well cultivated and receiving and give a luxuriant growth as the result of a liberal top-dressing of phosphates. There is also a definite relationship with feeding on new fresh pastures. It has come under the observation of the District Superintendent, Auckland, that where pastures had been shut up for some time milking stock was liable to suffer when placed thereon. That was brought out in several herds where from five to eight cows were affected on the second and third day after being placed on such pastures. This would point to some lack of balance in the food supply.

Ragwort Poisoning.—This complaint still exacts a toll from stock in ragwort-infested districts. With the exception of sheep, stock will not deliberately eat this weed, and the fact that a considerable number of deaths has occurred in both horses and cattle goes to show that the weed in such pastures is so plentiful that stock cannot avoid eating it with the grass. It is to be regretted that pastures are allowed to become contaminated to this extent, and landowners should see that the pastures are treated. Now that an excellent means of destroying ragwort has been discovered, combined with the use of otherwise unemployed labour, there is no excuse for such a state of affairs, and it is imperative that those farmers whose lands are infested with the weed take advantage of the facilities available for effectively dealing with it.

SHEEP.

A successful year has been experienced with regard to this class of stock. The wool-clip has been up to the average and the lambing percentage has been good. Lambs arrived at the meat-works in excellent condition, a large percentage being killed directly from the mother. Disease has been less in evidence than for many years past. Unfortunately, however, prices for all classes have been low. The price paid for wool has also been low, though showing signs of improvement.

Lymphadenitis.—In my last report it was stated that when evidence of the disease is seen at the meat-works the sheep are traced to the holdings from which they came and advice given with reference to the control of the disease. In spite of this there does not appear to be any marked decrease in the number of cases found on slaughter. Sheep-farmers for the most part are too apathetic in this matter, and would apparently rather put up with the few losses incurred than go to the trouble of segregating their flocks and getting rid of the affected animals. The incidence of this disease can be controlled as shown by the work carried out on a station in Central Otago by the District Superintendent, Dunedin, the results of which show that the disease can be definitely controlled. In 1931 the whole of the ewes on this property were examined and the affected sheep segregated with the ultimate object of getting rid of affected animals. In that year 11,196 were examined, when 1,046 (9·34 per cent.) were found affected; in 1932 10,129 were examined, and 377 (3·72 per cent.) were found affected; in 1933 11,319 were examined, and 209 (1·85 per cent.) were found affected. As a direct result of this work other flockowners are asking that their flocks be examined. The extension of this practice will go a long way in removing the incidence of the disease in affected flocks. This disease is contracted chiefly through wounds made at shearing and docking, and it behoves every flockowner to see that the instruments used in these operations are thoroughly disinfected and the yards and surroundings kept in a sanitary condition.

Renal Congestion in Lambs.—The loss of lambs from this trouble, with the exception of the Clyde inspectorate, was below that experienced in recent years. Mr. Gill, of the Veterinary Laboratory, again spent some time in the district during the season making investigation into the disease, and the result of this investigation was incorporated in an article written by him in the *Journal of Agriculture* for December, 1932. As a preventive measure a number of lambs were treated with a vaccine and a further number inoculated with antitoxin, with the result that vaccination was found to be of little or no value, whereas antitoxin was definitely effective. While the result of the antitoxin was effective, it is doubtful, except in cases where mortality is high, if inoculation will be used by the flockowners to any great extent. It is felt that for the saving of about 3 per cent. it would not compensate for the disturbance amongst the remainder of the flock. Preventive inoculation, however, will be of decided economic value on those farms where the mortality is known to be high.

Parasitic Diseases.—This trouble has not been in evidence to such an extent as in the previous season. A few isolated outbreaks were seen, but in no instance was the mortality high. Sheep-farmers generally are beginning to pay more attention to their flocks by providing more suitable food and by drenching earlier in the season before the effects of the parasites begin to take effect. This is a step in the right direction. The difficulty with this trouble is to satisfactorily check it when once it has become established on a farm.

Ante-partum Paralysis in Ewes.—Very little of this trouble was seen throughout the season. A few isolated cases were noticed and advice given by officers of the Division.

Lice and Ticks.—It was found during the season that these pests were more in evidence than in previous seasons, and it was necessary to enforce the penal provision of the Act against offenders, with the result that owners are taking precautions to see that their sheep are clean before being placed in the yards for sale.

Maggot-fly.—As a whole, this pest has been less in evidence than in previous seasons. One or two districts in northern areas suffered severely. So far the natural enemy liberated has not succeeded in keeping the fly in check, and for the present flockowners will have to resort to preventive methods such as trapping, also to burying all dead carcasses and other material that afford the pest a breeding place.

General.—A number of minor ailments were seen which were attended to and advice given by the various field officers of the Division.

PIGS.

The number of pigs slaughtered for the season was 508,623, an increase of 48,833. The quantity of pork exported was 186,652 cwt., as compared with 104,882 cwt. for the previous season, an increase of 81,770 cwt.

The type and quality of pig carcasses are improving, and there is a general desire on the part of the dairy-farmer to better his feeding methods and to improve his stock. The prices paid for pigs, although not showing a sufficient margin of profit, were higher on the whole than during the previous season. This class of farming showed a better return for the labour expended than almost any other. Farmers are beginning to realize this and are paying more attention to pig-raising, and as regards housing, feeding, and the improvement of the breed.

If in addition to this the farmer would consider the advisability of producing pork and bacon throughout the whole season, so that bacon-curers in Great Britain could depend upon receiving uninterrupted supplies, I feel sure that pig-farming would be placed in a much better position than it occupies to-day. The quality of our pigs is satisfactory to British buyers, and with the plentiful supply of meat-meal which we have at our disposal, in addition to the food crops that can be grown on the farm, more can be accomplished.

Mange.—During the season a few outbreaks were seen. These were all successfully treated with crude petroleum. A sharp lookout is being kept by Inspectors in the field and also at meat-works, and should any further cases arise they will be effectively dealt with. The position is now well in hand.

Abscesses.—This is a condition that is still too frequently met with on slaughter. The majority of such abscesses are due to the pigs being placed in insanitary sties after being castrated. If pig-keepers would only see that after castration pigs were placed on clean grass pasture or in a clean pen that has been previously prepared to receive them the complaint would be less in evidence. A number of pig carcasses are condemned each season from this cause alone.

Necrosis.—The incidence of this complaint was in evidence to a considerable extent. In one instance in the Southland district fairly heavy mortality was experienced. The indications of the disease are ulcerating sores on the legs and under-parts of the body. As a general rule the mortality from this cause is not great, yet the monetary loss through unthriftiness is considerable. It is invariably associated with insanitary conditions.

Pasteurellosis.—A number of cases of this was seen in various districts, but in no case was the mortality high.

General.—A few other ailments, which were attended and advice given were in evidence. In no case did they assume serious proportions. On the whole, the health of this class of stock has been satisfactory.

Live-stock Statistics.

The 1932 sheep returns showed that sheep-flocks in the Dominion dropped by 1,100,728 to a total of 28,691,788. A decrease of 545,669 also occurred in the number of breeding ewes. The number of sheepowners has decreased by 340 to a total of 30,449.

The number of cattle in the Dominion has fallen to 4,072,383, being a decrease of 8,142. The number of dairy cows, however, increased by 100,387 to a total of 1,702,020.

The number of pigs in the Dominion as revealed in the 1932 enumeration was 513,416, being an increase of 37,222 on the previous year's figures.

Horses have continued to show a decline, the number being 280,994, a reduction of 14,749.

Slaughter of Stock.

The numbers of sheep and lambs slaughtered were again very heavy. The total numbers of stock slaughtered at registered premises were: Sheep, 3,569,598; lambs, 9,718,585; cattle, 393,608; calves, 599,335; swine, 532,123.

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

Stock.	Year ended 31st March, 1933.	Year ended 31st March, 1932.	Increase.	Decrease.
Cattle	197,218	131,624	65,594	..
Calves	541,668	537,003	4,665	..
Sheep	2,561,306	3,430,176	..	868,770
Lambs	9,463,846	8,459,244	1,004,602	..
Swine	347,998	246,048	101,950	..

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.	1929–30.	1930–31.	1931–32.	1932–33.
Sheep	1,982,550	1,671,493	2,614,378	1,649,363
Lambs	4,431,424	5,531,021	5,822,728	6,433,741

These figures show an increase of 611,013 lambs and a decrease of 965,015 sheep 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, 1933: Cattle, 337,301; calves, 597,943; sheep, 3,326,457; lambs, 9,684,604; swine, 479,326.

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

Stock.	Abattoirs.	Meat-export Slaughterhouses.	Bacon-factories.
Cattle	140,083	197,218	..
Calves	56,275	541,668	..
Sheep	765,151	2,561,306	..
Lambs	220,758	9,643,846	..
Swine	131,328	347,998	30,583

Stock slaughtered at ordinary slaughterhouses during the year ended 31st March, 1933, was as follows : Cattle, 56,307 ; calves, 1,392 ; sheep, 243,141 ; lambs, 33,981 ; swine, 22,214. Carcasses of pork killed and dressed by farmers and sent into butchers' shops and small factories and examined by departmental officers numbered 34,554.

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, 9,505 ; calves, 1,707 ; sheep, 139,050 ; lambs, 75,792 ; swine, 8,805.

Compensation paid for Stock and Meat condemned.

Compensation to the amount of £6,780 1s. 5d. was paid out during the year for animals condemned in the field for disease under the provisions of the Stock Act, and £10,581 16s. 5d. for carcasses or 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 following imported animals were placed in quarantine during the year for the respective periods required : Horses, nil ; cattle, 3 ; sheep, 2 ; swine, 17 ; dogs, 25.

Exportation of Stud Stock.

During the year under review the following stud stock was exported : Sheep, 2,413 ; cattle, 79 ; swine, 9 ; horses, 47 (draught). There was the usual movement of racehorses to and from Australia.

Dairy Inspection.

Again those farmers supplying the raw material for city use have experienced considerable difficulty owing to falling prices. Notwithstanding this, the standard, both as regards the health of the cows and the sanitary condition of the sheds, has been well maintained, and in many instances has been improved upon. There is a desire on the part of many dairymen to improve their herds, sheds, and surroundings, and thus supply a better article. A spirit of rivalry is in evidence which will produce a better article for the benefit of the consumer.

Approximately there are 5,000 registered dairies supplying our cities and towns throughout the Dominion. During the year these dairies are kept under strict supervision as regards sanitary conditions, and all milking machines and other utensils in connection with the dairy are periodically inspected to see that they are kept clean. In addition to this the health of the cows is well maintained. Clinical examinations of these herds are frequently made and any animals found diseased are destroyed, while suspected animals are subjected to the tuberculin test and if diseased they are eliminated. In addition to this, composite samples of milk are taken from a large number of herds and subjected to the biological test, and should positive results be obtained the whole herd is subjected to the tuberculin test and any diseased animals eliminated.

The sediment tester has also been largely in use. In all districts samples of milk are taken and subjected to this test, and where it is found necessary to bring about improved milking conditions the farm is visited and instructions given to effect this.

At Wallaceville during the season just ended 441 composite samples of milk were subjected to the biological test. Of this number six proved to be positive. The herds were immediately tested and the diseased animals eliminated.

It is satisfactory to report that a steady improvement is taking place in the manner in which the herds and premises are kept, and every endeavour will be made by the officers of this Division to see that this improvement is maintained.

The Poultry Industry.

This section of the Division's responsibilities has been given considerable attention during the year with a view to assisting the industry to better organize itself. This weakness in the poultry industry has been remarked on previously, but the necessity for a better system of organization was never more felt than now in order that the spring and early summer surplus of eggs may be exported with equal benefit to all concerned. In other words, the industry requires and desires to be given the means to organize itself and enable the export of eggs to be carried on without relying on Government assistance. The preparation of the Poultry Amendment Bill was an honest attempt to assist towards this, and it is hoped that the measure will be reintroduced during the coming session of Parliament.

This industry is still in a more or less struggling condition, having had rather a trying time with high-priced food-stuffs, but has bravely managed to weather the storm. It has now arrived at that point where without some help it is in danger of getting into a position from which it will be unable to extricate itself. The production of eggs as a side-line has helped many farmers' wives to stand up against the hard times of the past few years.

The following remarks are extracted from the report of the Chief Poultry Instructor (Mr. F. C. Brown) :—

The past year was not a highly profitable one to the average poultry-keeper. Heavy supplies of eggs reached the markets during the spring and summer months, resulting in prices not being sufficiently remunerative to show the desired margin of profit over cost of production, but from this remark it is not to be inferred that the limit of production has been reached. The low prices which ruled were chiefly due to want of organization amongst producers. Had proper organization existed it would have allowed sufficient of the surplus eggs to be exported to balance the position.

The Local Market.—During recent years some improvement has taken place in the quality of eggs marketed in the Dominion. There is, however, a decided need for further reforms in this direction. The worst feature connected with the local egg trade is that too often the quality of the eggs marketed cannot be depended upon. The average consumption of eggs is not likely to increase unless the quality is generally improved, as obviously the better the quality the greater the demand.

Export.—During September and October of last year 5,264 cases of eggs containing 30 dozen each were shipped to London. The eggs arrived in excellent condition and gave entire satisfaction to those who purchased them. Complimentary reports to this effect have been received by the Department, and it is satisfactory to note that notwithstanding the depressed state of the London market some shippers have reported that the returns for eggs exported by them gave the producer at least a price equal to that obtainable on the local market in the respective centres when the eggs exported were being packed for shipment.

During the year a small consignment of egg-pulp was sent to the London market. This opened up in splendid order, but unfortunately the account sales go to show that there is little prospect of exporting our surplus eggs at remunerative prices in the form of pulp.

Wallaceville Poultry Station.—This establishment continues to carry out good work for the advancement of the industry. Its chief functions are to demonstrate up-to-date methods in the management of poultry, to supply sittings of eggs, day-old chicks, and birds for breeding from tested stock at moderate prices; also to conduct experiments by way of investigating problems connected with the various branches of poultry work which are beyond the average poultry producer to carry out. The knowledge thus gained is in turn diseminated for the benefit of producers and the industry generally by means of lectures and printed matter.

Wool.

The position of the wool market showed practically no improvement on the previous year's average returns, but it appeared that bottom had been reached, and any movement of price was of an upward tendency. This became more marked towards the end of the season, when a decided improved tone became manifest.

In so far as the necessity for economy permitted, the Department's services have continued to be directed towards bringing about improvement in wool generally and in the manner of its get-up. Advice has been given by lectures, demonstrations, publications, correspondence, and by examination of wool fibres, and there is a desire shown to improve the quality of wool by paying more attention to the selection of the ram. A considerable quantity of wool which has been held in store from previous years has now been disposed of, and by the beginning of next season's sales there should not be a great quantity of past seasons' wool in store. The number of bales of wool offered for sale up to the 31st March was 633,988, as compared with 575,680 for the previous year.

The following are extracts from the report of the Wool Instructor :—

The wool this year was well grown, most of it being suitable for combing purposes and giving a good clean yield.

During the year we carried out a practical test on a branding fluid manufactured by the British Wool Research Association, called the "Improved Economic Sheep Branding Fluid." Two prominent sheep-farmers placed 100 and 50 sheep respectively at our disposal for testing this, and 86 sheep at Wallaceville were also branded, making a total of 236. The sheep were branded and photos taken the same day, and when the shearing season came round I again visited each of the above places and took photos of these branded sheep when carrying their full fleece. Unfortunately, the result was not entirely satisfactory. A report on the tests, together with samples from the branded portion of the fleeces, was forwarded to the High Commissioner, London, for the information of the Association.

Microscopic examination of rams' wool: A fair amount of this work has been done, and reports thereon have been sent to the farmers concerned as a guide to them in avoiding the use of faulty rams in their ewe flocks.

Rabbit Nuisance.

In general, rabbits are under a fair measure of control, particularly in Rabbit Board areas, but in many districts an increase causing some concern is noticeable. This increase, where it exists, is attributable to several causes—namely, the mild weather experienced during the early breeding season, the low prices then offering for skins, and the fact that many landowners for financial reasons were not in a position to purchase materials for control. Very few localities have got into a really bad rabbit-infested state, but when such places came under notice stern measures were taken.

A considerable number of farmers availed themselves of the Unemployment Board's scheme for utilizing unemployed labour for rabbit suppression. A good many men were put on to this work, and it was undoubtedly of great assistance not only to the unemployed, but to landowners as well. Where experienced rabbiters were available and the owners exercised adequate supervision the scheme was quite successful, but where inexperienced men had to be employed and the supervision was in any way lax the results were not so satisfactory. On the whole, however, good results have been achieved. Inspectors are fully alive to the seriousness of the position, and are making every endeavour to get settlers to take simultaneous action in combating the pest.

Rabbit Boards throughout the Dominion have functioned well, and, taken as a whole, have the pest well under control. In the case of some Boards practically no rabbits are now in evidence. Control by Boards has been most effective, and it is pleasing to record that several new Boards were constituted during the year.

Industrial Rabbits.

As regards industrial rabbits, this Department is only concerned with the issue of permits for their safe custody and periodic inspection. It is understood that the market value of Angora wool has been maintained, but the pelts of Chinchilla and other short-furred breeds have been of little value.

Noxious Weeds.

A good deal of useful work in the clearing of noxious weeds was carried out during the season by the utilization of unemployed labour under the schemes of the Unemployment Board. Ragwort has been by far the most troublesome weed on account of its rapid spread and poisonous effect on stock, and the weather conditions this past season have been particularly favourable for its luxurious growth. Other weeds such as blackberry, sweet-brier, Californian thistle, gorse, &c., although giving trouble in some districts, did not reach the prominence of ragwort. For this weed sodium chlorate has again been largely used, it being applied either as a spray or in a dry state as a top-dressing mixture along with lime or other material for efficient spreading. Since the introduction of sodium chlorate as a weed eradicator large areas of farm lands have been rendered practically free of ragwort, though complete eradication may not yet have been effected owing to reinfestation from seed on the ground or wind-borne seed. Ragwort is more difficult to deal with on the high fern-infested country, even with the aid of sheep. It is a matter for regret that owing to the continual financial depression settlers generally were unable to carry out sufficient clearing, nevertheless much useful work was undertaken in co-operation with the Unemployment Board.

Staff.

It is satisfactory to record that members of the staff of all grades have given good and loyal service throughout the year, and I have to express my appreciation of the manner in which they have carried out their duties.

FIELDS DIVISION.

REPORT OF J. W. DEEM, DIRECTOR.

Arable Crops.

Throughout the past season arable crops have done remarkably well, except in one or two districts where practically drought conditions prevailed. The yields obtained from the wheat and oat crops to date of writing are appreciably in excess of those obtained from such crops for the whole of the previous season.

As regards the wheat crop, that portion threshed during the period January–March, 1933, gave an average yield of 38·52 bushels per acre, as against an actual yield for the 1931–32 season of 24·49 bushels. At the rate of 38·52 bushels per acre a total of 7,052,090 bushels of wheat had been procured during the January–March period. With the wheat crop still in stack, it is estimated that the production for the 1932–33 season will be more than sufficient to meet the Dominion's requirements, and there should be somewhere in the vicinity of 2,500,000 bushels available for export. It was estimated early in the season that a total area of 294,000 acres was sown to wheat in the 1932–33 season, as against an actual area of 271,939 acres harvested the previous year.

So far as oats are concerned, the position is just as satisfactory as it is with wheat. The estimated area sown to oats for 1932–33 was 407,000 acres, against an actual area harvested the previous season of 297,182 acres. Actual threshings for the January–March period disclose a per-acre yield of 48·52 bushels, as against an actual yield over the whole Dominion for the 1931–32 season of 41·03 bushels. The area from which oats were threshed for the five seasons ended with 1931–32 averaged 24·28 per cent. of the total area under that crop. Assuming that a similar proportion is threshed this year, the total yield of grain should be approximately 50 per cent. greater than that of the season 1931–32.

With regard to barley, it is estimated that 19,000 acres were sown for the 1932–33 season, as against an actual area harvested the previous season of 19,131 acres. As in the case of both wheat and oats, the yield per acre in the barley crop for 1932–33 is estimated to be several bushels per acre more than for the season 1931–32. The actual yield per acre for the latter season was 29·45 bushels, while the estimated yield for the 1932–33 season is 34·33 bushels per acre.

The area in potatoes in 1932–33 was estimated at 21,300 acres, as against an area in the previous season of 23,786 acres. It is anticipated that the yield that will be obtained from the potato crop for 1932–33 will be in excess of that obtained for the previous season, and after meeting Dominion requirements there should be an appreciable quantity available for export. It is hoped in this connection that satisfactory arrangements can be made with the Australian authorities to allow of the importation into Australia of New-Zealand-grown potatoes.

Artificial Fertilizers.

The top-dressing of pastures with artificial fertilizers, while still viewed by the farming community as one of the main features in pasture production, has been carried out to a lesser extent than had been expected during the season, almost entirely on account of the financial stress which has existed. The amount of artificial fertilizer actually delivered at officered railway-stations throughout the Dominion shows an increase of approximately 35,000 tons over that delivered for the 1931–32 season, and it is undoubtedly due to financial stress that this increase was not considerably greater. One knows that towards the end of the year large orders for artificial fertilizers for top-dressing purposes had to be reluctantly cancelled by farmers. Nevertheless, it is pleasing to know that the actual quantity used during the season did not show a decline on that used the previous season. The national wealth of the country is so bound up with its primary products that any falling-off in top-dressing is to be deprecated. One can only hope that conditions will improve to such an extent as will allow of farmers once more taking up whole-heartedly the top-dressing of their pastures.

Instruction in Agriculture.

As reported in my last annual report, requests for advice on agricultural matters of all descriptions are exceedingly numerous, and are stimulated to an appreciable extent by the unusual conditions through which the country is at present passing. Our personal connection with the farming community has been continued and extended, but it is unfortunate that lack of finance, and the fact that many officers of the Division have for the major portion of the 1932–33 season had to devote considerable of their energies to Small Farm Plan work, has not enabled us to give personal advice to the fullest extent. Nevertheless, wherever personal calls have been impossible owing to the staff being fully employed, all inquiries have been promptly attended to by correspondence.

Experimental Farms and Areas.

Puwera.—As recommended in my last annual report, this farm was relinquished and handed back to the Lands Department at the end of the 1931–32 dairying season.

Marton.—Work on the Marton Experimental Area has, as in the last year or two, been confined almost entirely to work of an intensive technical nature, and has been conducted by the specialist officers engaged in grassland research work. The work carried on has consisted mainly of rye-grass strain trials, manurial trials, and the technique connected therewith. Full reports on the work at Marton during the year will be furnished later.

Gore.—As in previous years, experimental and investigational work has been conducted on this property during the year. The number of farmers who have visited the area is evidence of the fact that the work conducted thereon is of special interest to them. A separate report on the year's operations at Gore will be submitted later.

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. The same may be said of the much smaller demonstration area situated at Katere, near New Plymouth.

Ruakura Farm of Instruction.

Pastures on the Ruakura Farm of Instruction were fairly good in the spring, but consequent on a dry period in early summer they were short in December and January. However, good rains were experienced early in February and these brought about an abnormal autumn growth, and the farm is going into the winter with an abundance of feed. The rainfall for the year was only 38·66 in. against an average annual rainfall of 50·21 in. The farm, like all others, has felt the effect of low prices for produce and stock. This was particularly reflected in the last annual sale, when the bulls sold averaged 14·5 guineas, as against an average of 22 guineas for the previous year. Pigs also were down in price, and those sold averaged 4·32 guineas, against 7·74 guineas at the previous annual sale. The health and condition of the stock has been good, and practically all lambs were fattened on their mothers. The lambs were exported on consignment, and accounts sales for the two main drafts show a net average return of 14s. 6d. per lamb. Approximately 250 tons of hay and 200 tons of ensilage were saved.

Ruakura Farm Training College.—This school continues in popularity, and during the year the available space was fully occupied. The health of the students in residence has been generally excellent, and taking all in all the school continues to fill an important requirement in the teaching of practical agriculture to the youth of the Dominion.

Boys' and Girls' Agricultural Clubs.

Unfortunately, owing to a reduction in the vote from which expenditure for boys' and girls' clubs is met, and the fact that many officers were unable to give much time at important periods of the year to this work owing to their being fully employed on Small Farm Plan operations, club work has not received the support of the Department which is desirable, seeing the effect of the work of the clubs is so far-reaching. During the 1932–33 season, although no moneys were available from the Department as hitherto for the purchase of seeds and manures and the payment of subsidies on moneys collected by the clubs, the work has continued. In most cases the seeds and manures have been donated by seed and produce merchants. It is satisfactory to be able to record such an interest by merchants and others in this club work as allowed of the work to be carried on. There is no doubt that the work performed by the clubs is of very great value from an agricultural instruction viewpoint, and it is suggested that, if at all possible, Government assistance be again rendered so that the work may at least maintain its previous standard. As intimated above, I view the results as very far-reaching in the agriculture of the Dominion and would like very much to see more assistance granted, even if the same amount as was granted prior to the 1932–33 season cannot be given.

Land-development Schemes.

This Division has continued to be actively interested during the year in several land-development schemes on behalf of the Government. In addition to Ngakuru Blocks 1 and 2, near Rotorua, work has been carried on by way of development on the Galatea Estate, Whangamarino Block, and the Easterfield Block.

Following satisfactory results obtained from the demonstration dairy-farm on Ngakuru in the 1931–32 season, a portion of Ngakuru was subdivided and share-milkers located thereon during 1932–33. The results have been good. On portion of the Ngakuru country further cottages and milking-sheds have been erected, and definite arrangements are being made for the selection of share-milkers to occupy these sections and commence dairying on a share basis for the 1933–34 season.

Development work on the Galatea Estate was commenced in 1932, and by the end of March, 1933, 1,930 acres had been sown in grass and 568 acres in annual crops. Shelter-planting, clearing, and other improvement work was also carried out. At the moment we are working in close touch with the Lands Department on the development of Galatea, and it is anticipated that considerable advancement in the development of this estate will be accomplished during the coming season.

So far as the Whangamarino Block is concerned, the area, with the exception of 40 acres, was sown out to grass during the autumn. The work which has been in hand in connection with a small area of pakihi land near Westport was advanced during the year to the point where a small cottage was erected and a man continually employed. In addition to ordinary work this man milked a few cows on the property, being paid a small wage and getting the proceeds of the cows. Arrangements are now contemplated for milking from twenty to twenty-five cows on the block next year.

Farmers' Field Competitions.

Farmers' field competitions were carried on in various parts of the Dominion on much the same lines as in past years. There has been little or no extension of this work, and, as in previous years, the Division's assistance has been mainly along the lines of judging the competitions. The results of these competitions continue to be of much interest, and the information forthcoming for those farmers interested is invaluable. Some 850 crops were judged.

Noxious Weed Control.

Several new specifics were tried during the year. Generally they proved useless for the purpose. In addition, several further tests were made with chlorates, and these go to show that sodium chlorate is still the most efficacious and cheapest for the treatment of ragwort. Occysol was further tested and gave very fine results at a strength of 5 per cent. Calcium chlorate at the same strength gave about an 80-per-cent. kill.

Field Experiments.

The programme of field experimental and demonstration work has been carried on during the year and has related to variety, manurial, and other trials on all classes of roots and grains and the manuring of grassland. Owing to the necessity during the year for the strictest economy the work was reduced as far as possible; nevertheless, with the increased duties in other directions, the staff has been hard-pressed to watch, finalize, and report on the various experiments. With the careful summarizing of the results valuable information continues to be procured, and this information is disseminated to farmers throughout the Dominion by means of the Department's *Journal* and the instructional staff. During the year 568 experiments were conducted, as against 596 the previous year.

Crop Certification.

The areas of the various agricultural crops to which the Department is certifying have increased to a considerable extent. From information available it is apparent that for 1932–33 there is an increase in the area coming forward for certification in respect of each crop being certified. In some cases the increase is phenomenal, particularly with respect to perennial rye-grass. In connection with this crop the area offered for certification for 1932–33 was 22,500 acres, as against 9,709 acres in 1931–32. It might be of interest to mention that in 1930–31 we sealed and certified 46,000 bushels of machine-dressed perennial rye-grass seed, in 1931–32 81,000 bushels, and while the final figures for 1932–33 are not yet available it is estimated that we will seal and certify over 200,000 bushels. This quantity represents about two-thirds of the total New Zealand production of perennial rye-grass seed in pre-certification days.

The certification of seed is one of the operations which in these difficult times has helped the farmer. Not only has he benefited financially, but we are rapidly coming to the point where many of the pastures of the Dominion are much improved as a result of being resown with certified seed. The output from these better pastures, together with the income which must be forthcoming from a considerable export trade in New Zealand seeds, must have a very beneficial effect on the national prosperity of New Zealand.

The amount received in certification fees during the financial year was £2,627 3s. 10d.

Ensilage.

Two or three seasons ago the staff of the Division attempted a vigorous ensilage drive throughout the Dominion. The energy expended in this direction was followed up subsequently, and one of the good features of the current season is the appearance of largely increased numbers of ensilage stacks, pits, and trenches throughout the various farming districts, but, of course, more so in some districts than in others. One would say unhesitatingly that the quantity of feed conserved in the making of ensilage during the 1932–33 season is considerably in excess of any previous season, and consequently many farmers are this year, owing to the making of ensilage, in a better position to meet, from a stock-feed point of view, adverse conditions than ever previously. A general improvement in the quality of the silage being made is apparent.

Purchase of Seeds and Manures for Government Departments.

As reported in my last annual report, an arrangement had been made by the Stores Control Board for the Division to be the purchasing body for all seeds and manures required for Government Departments throughout the Dominion. This arrangement has operated during the year 1932–33, and some requisitions for large quantities have been dealt with. The system of check-testing of samples drawn from bulk supplies, which is an integral part of the purchasing arrangement, has worked well and enables the office to keep a close watch over the quality of the seeds actually supplied. One is quite convinced that this arrangement is a good forward move, which, owing to the system of purchasing only on purity and germination, proved very much to the advantage of the various Government Departments concerned.

Small Farm Plan Scheme.

The Small Farm Plan brought into operation about the middle of 1932, called for a considerable amount of the time of the field officers of my Division. In the North Island this amounted to 31·71 per cent. and in the South Island 18·87 per cent. of the working time. In addition several officers performed a great deal of night work in connection with Small Farms.

The Hemp Industry.

During the past couple of seasons—1930–31 and 1931–32—the hemp industry has been experiencing a particularly bad time, and unfortunately this still continues. This industry is one which under normal conditions employs a considerable number of men, and with the non-operation of the mills a large number of mill employees have been thrown out of employment.

Still, the quantity of hemp graded during 1932–33 showed, during the latter half of the year, an increase on the amount graded for the similar period of the previous year. As a total, during 1932–33, 25,733 bales were graded, as compared with 13,561 bales in 1931–32. The increased output during the latter half of 1932–33 has, however, not been maintained, and present indications are that the industry will again fall away very considerably. It is evident that at the present time the price obtainable for the finished product is, as has been the case during the last two or three years, not a payable proposition, and under these conditions one can hardly expect any improvement in the industry. It is understood that a factory for the making of wool packs, sacks, and so forth is likely to take definite shape in the near future at Foxton. Information is not available as to what quantity of hemp fibre the proposed factory will utilize or whether the prices paid for fibre will be of material benefit to the hemp miller. It is hoped, however, that millers, in the Manawatu at least, will find times much more prosperous when the factory in question commences operations.

Departmental Photography.

As in past years, the Photographer attached to the Fields Division has performed excellent service, and has carried out photographic work for all branches of this Department and occasionally for other Departments. The whole of the photographic work of the Department has been indexed, and this has had the effect of considerably reducing the annual expenditure on photographic material.

Staff.

The past season has been a particularly arduous one, and I am pleased to record that all officers have worked unsparingly. To one and all I desire to tender my best thanks for their loyal co-operation and excellent work.

DAIRY DIVISION.

REPORT OF W. M. SINGLETON, DIRECTOR.

The Season.

Throughout most of the dairying districts this year may be regarded as being very favourable for the production of butterfat. With the exception of Southland and parts of Otago, where a dry spring was experienced, pastures were in good heart throughout the spring and early summer months. During February and March a rather dry spell was experienced, North Otago and South Canterbury especially suffering considerably from lack of rain. North Auckland, however, has been favoured more than other districts, having experienced a splendid summer and autumn. For the Dominion as a whole the dairying season has been remarkably good.

Production.

A great increase in the production of dairy-produce during the year has to be recorded. Owing to the adverse economic conditions many suppliers of milk and cream to dairy factories increased the number of cows in their herds, and many wool-growers established dairy herds as a side-line, these, together with the favourable season, being the contributing factors. During the year 123,112 tons of butter and 97,660 tons cheese came forward for grading, as compared with 102,087 and 85,258 tons respectively for the previous year, an increase of 21,025 tons of butter, equal to 20·59 per cent., and 12,402 tons of cheese, equal to 14·54 per cent. Reduced to butterfat equivalent, there is an increase of 22,290 tons, or 18·91 per cent.

Creamery Butter.

Despite the great increase in the quantity of butter manufactured and the difficulty experienced at a number of factories in coping with the increased supplies of cream, the quality of the better brands of creamery butter has been well maintained, and a decided improvement evidenced at some of the lower-grading factories. Butters showing a fuller flavour have been more in evidence. Body and texture continue to be uniform, and the salt and moisture content has been given more attention. Owing to the exceptional growth of pastures, feed flavours were more difficult than usual to eliminate. "Toppy," or timber taint flavours have been reported on from London. It is desirable, therefore, that butter-boxes for future use should be made only of timber that is least likely to produce this taint. Some instances of faulty packing and finish also came under notice. The planing of butter-box timber on both sides and the universal use of butter-moulding machines would materially assist towards the elimination of faults in this connection.

The quantity of "Finest" butter, it is pleasing to record, is 2·49 per cent. in excess of the previous year, the totals being 79·99 and 77·50 per cent. respectively. Butters scoring "First" totalled 19·17 per cent., and under First 0·82 per cent., the average grade for all creamery butter graded being 93·127 points, as compared with 93·068 for the previous year.

Whey Butter.

Although some factory-managers give considerable care and attention to the manufacture of this class of butter and turn out a good quality article, there appears to be little effort made by the majority to improve quality. The exercise of more care in handling the cream, and a more frequent delivery would materially assist towards this end. During the year 1,787 tons came forward for grading, an increase of 333 tons over last year's total. The Dairy Produce Board has arranged with one British firm to handle all whey and second-grade creamery butter exported as from 1st May, 1933, and so dispose of it that it will not come into competition with finest or first-grade creamery.

Cheese.

Cheese which the Dominion has exported this season has been more favourably reported upon in Britain, these reports indicating the major portion as of good commercial quality. A quantity of the previous season's cheese, more especially that made in the autumn and early winter, was blemished by discoloration, which caused a certain amount of loss to producers. It is satisfactory to record that this serious defect has not come under notice this season. Of the 97,626 tons graded, 19·31 per cent. were scored "Finest," 78·6 per cent. "First," and 2·08 under First, the average grade being 91·692.

Owing to supplies of milk increasing to such an extent a night shift at a number of factories was required to handle supplies offering, which was not conducive to as good a cheese being made as would have been possible had the position been normal. Flavours on the whole have been fairly sound and uniform, openness again being the chief defect, and in an endeavour to overcome this some makers have been oversalting, to the disadvantage of the body of the resultant cheese.

Cheese bandages and cap cloths of an inferior quality have been used by quite a large number of dairy companies during the year, and attention has had to be drawn to the necessity for providing bandages and cap cloths of a higher standard of quality. With a general use of good quality bandage and cap cloths a further improvement in finish will be shown, and the possibility of cracked rinds and mould penetration greatly minimized.

Temperatures at which the previous year's cheese were held in cool store awaiting shipment ranged from 50° to 55° F. Experience has proved that for summer- and autumn-made cheese, which is usually held longer in store than that made in the spring, lower temperatures were more satisfactory. Arrangements were therefore made to hold this season's cheese at from 50° to 54° F. to 1st December; 47° to 49° to end February, and from 42° to 44° from March to end of July.

Cheese made from pasteurized milk totalled 87 per cent., and 78 per cent was wax-coated.

QUANTITIES OF BUTTER AND CHEESE FORWARDED FOR GRADING FOR YEARS ENDED 31ST MARCH, 1933, AND 31ST MARCH, 1932.

Port.	1933.		1932.	
	Butter.	Cheese.	Butter.	Cheese.
	Cwt.	Cwt.	Cwt.	Cwt.
Auckland	1,666,285	385,538	1,372,589	304,081
Gisborne	50,684	1,814	32,532	1,296
Napier	73,093	3,120	46,564	2,002
New Plymouth	166,291	391,858	162,755	345,387
Patea	30,661	417,734	41,811	383,283
Wanganui	64,122	53,486	61,873	49,729
Wellington	290,354	329,292	240,122	295,037
Lyttelton	63,225	23,098	48,477	18,720
Timaru	12,591	13,507	5,346	15,220
Dunedin	30,886	50,427	18,061	44,708
Bluff	14,046	283,336	11,619	245,716
Totals	2,462,238	1,953,213	2,041,749	1,705,178

EXPORT VALUES.

Not for many years have the prices of butter and cheese reached so low a level, prices of butter during the year ended 31st March having fluctuated between 72s. and 115s. and cheese between 41s. and 67s. per hundredweight. The extraordinary increased production, together with the higher exchange operating during the latter months of the year, has, however, resulted in the aggregate value of all dairy-produce being higher than the previous year's figures by £2,097,078. Taking the Customs figures of exports, values of butter, cheese, dried milk, casein, condensed milk and cream, and milk sugar totalled £16,284,137, as compared with £14,187,059 for the previous year.

CASEIN.

The casein graded this year is less than that graded for the previous year by 293 tons, the quantities being 1,346 and 1,639 tons respectively. The grading of this produce is, however, not compulsory, and in consequence a fair proportion is shipped overseas ungraded. The total exports for the year amounted to 2,364 tons valued at £67,816. The grading is carried out at Auckland, New Plymouth, and Castlecliff, the quality of that graded being of a high standard.

TESTING BUTTER FOR MOISTURE AND SALT CONTENT.

In order to minimize the possibility of creamery butter containing over-moisture reaching overseas markets, the usual practice of testing a box from each churning forwarded for grading has been carried out, and during the year 176,096 tests were made. This represents 22,111 tests in excess of those for the previous year, and the remarkably low percentage of 0·5 which exceeded the legal limit of 16 per cent. is a striking testimony of the accuracy of this phase of the work as carried out by buttermakers. All over-moisture butter was returned to the factories to be reconditioned.

In addition 159,137 churnings were tested for salt content, the legal requirement of which ranges from 1·5 to 2 per cent. A margin of 0·25 per cent. below the legal minimum has been permitted, and the percentage of churnings containing irregular salt content outside this range totalled 0·8. These were withheld from export. A limited number of shipments of butter containing over 2 per cent. of salt have been permitted in cases where evidence has been forthcoming that these were sold to fill special orders.

CREAM-GRADING.

The grading of cream and the payment of differential prices according to grade is now well established, and, generally speaking, cream-graders are carrying out their duties in a satisfactory manner. In a few instances a tightening-up of the grading has been necessary where graders have been inclined to develop easy standards. Where grading is carried out in strict accordance with the recognized standards excellent results are being achieved, and less friction exists between the suppliers and the company where this course of action prevails.

Milk-grading.

The improvement in butter quality consequent on the general adoption of cream-grading, with compulsory differential prices for the various grades, made the grading of milk appear to be a wise move in the direction of improvement in cheese quality. The general consensus of opinion among cheese producers was such that milk-grading was given a trial, without compulsory differential payments, commencing during March, 1932, and continuing until May, 1933. It was then deemed wise to adopt the principle of compulsory differential payments for two compulsory grades, with the option for dairy companies to use a further higher grade and a further differential in price.

At a number of cheese-factories there was an improvement in the quality of the milk-supply as the result of grading without a penalty by way of payment for the lower grade. Some suppliers who had a natural pride in doing things right responded to the influence of such grading very satisfactorily indeed. Others can be moved only by differential payments, and experience has proved the necessity for making the differential payments for the various grades compulsory. It is expected that the effects of this movement will be evidenced in some improvement in cheese qulaity.

Farm Dairy Instruction.

The more evidence the Division obtains the more is realized the urgent need for the work of farm dairy instruction to become Dominion-wide in its application, in order to raise the quality of the milk and cream to the standard desired. A notable feature of the work carried out by the Farm Dairy Instructors has been the great improvement shown in the quality of the cream from suppliers who previously forwarded a low-quality article. It is evident, therefore, that the nationalization of this service would be an effective step towards the delivery of a greatly improved milk-supply.

During the year thirty-four farm dairy instructors, which is one in excess of the previous year, were employed by seventy-seven dairy companies with approximately 31,000 suppliers, and these companies forwarded 72,854 tons butter and 41,764 tons cheese for grading. As there are approximately 70,000 suppliers to dairy companies it will be seen that approximately 39,000 receive little or no instruction in the care and handling of their supplies.

Inspection of Milking-machines on Installation.

Special attention is given to the inspection of new and renovated milking-plants installed during the year, this duly being carried out by the Farm Dairy Instructors and elsewhere by the butter and cheese instructors. The majority of the milking-machine firms are keen to make these installations in conformity with the regulations, and in cases where structional alterations are required no great difficulty has been experienced in having these carried out. During the year notifications of 2,042 installations were received by the Division.

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

Since the introduction of check-testing at dairy factories of suppliers' milk and cream samples for butterfat content, the methods of conducting the tests have shown a great improvement, both in the application of the tests and in the testing-room equipment. The testing officers in most of the factories are reliable men, keenly interested in their work, which is now performed in a more methodical and accurate manner than was practised prior to the commencement of check-testing by the Division. During the year 486 check-tests were made, a pleasing feature of the work being the small variation found between the factory results and the check-tests.

Dairy Laboratory Work.

The work carried out at the Division's Laboratory at Wallaceville has been continued under the direction of Dr. G. M. Moir, Dairy Chemist. During the year investigations of discoloured cheese have been continued whenever possible. Examinations of cheese showing bleached and muddy defects have provided further examples of the damage which is likely to arise when mould grows freely in trier holes or cracked rinds. Another defect, mottled colour or seaminess in green cheese, has also been studied. By keeping affected cheeses until they matured somewhat the defect was found to be still present. Experienced cheesemakers have frequently observed that this trouble develops in green cheese made from slimy milk, so that the detection and elimination of such milk by means of the curd-test would seem to provide the best remedy. Experiments have been undertaken with a view to reducing the incidence of cracked rinds. In this connection an effort has been made to encourage factory-managers to take more interest in the maintenance of correct temperatures and humidities in cheese-curing rooms by means of regular observance of wet and dry bulb temperatures. A good deal of time has been devoted to various aspects of milk-grading and suitable tests therefor. Ample scientific evidence is available to justify the use of two tests, one the curd test to detect milk excessively contaminated with bad types, the other the methylene blue test (or, alternatively, the microscopic count) to reveal milks with excessive number of germs.

With the co-operation of Dairy Instructors a considerable number of starters in use in cheese factories have been forwarded for routine laboratory examination. The results reveal the fact that the purity of many starters leaves a great deal to be desired. If such examinations could be made more frequently no doubt the improvement already effected could be further extended, leading in turn to better cheese-quality. In addition to carrying out a considerable number of routine examinations for various purposes a little time has been devoted to examinations of the sanitary conditions in a few cheese-factories; also those in a butter-factory where mould infection of unsalted butter had given trouble. Apart from specific causes of infection which were investigated, evidence was obtained showing the need for more thorough sterilization of factory plant—both butter and cheese.

The Dairy Laboratory has for the past year been without the services of Mr. G. F. V. Morgan, N.D.A., N.D.D., who for nearly four years capably carried out the duties of Dairy Bacteriologist. It is particularly unfortunate that economic conditions have prevented the appointment of a successor to him, as there is a great deal of useful bacteriological work in association with the Division's instructional service—*e.g.*, that aimed at improved control of starters—which might be undertaken.

Inspection of New Zealand Dairy-produce in Britain.

Owing to the greatly increased volume of butter and cheese exported the three officers in London engaged in the work of inspection of this produce on arrival have had an unusually busy year. Detailed reports on the quality and condition of the produce examined have been received by each mail in greatly increased numbers, all of which have been forwarded to the dairy companies concerned.

Mr. E. C. Wood, Dairy-produce Grader, Auckland, who temporarily assisted Messrs. W. Wright and F. H. Taylor, returned to New Zealand early in August last and was replaced by Mr. G. V. Were, Dairy Instructor, Wellington.

Certificate-of-record Testing.

First-class certificates of record were issued to 486 cows in 1932, and of this total 443 cows qualified in the Yearly Test Division and the remaining 43 in the 305-day Division. In addition 25 second-class certificates were issued. These totals compare with 737 first-class and 35 second-class certificates issued in 1931.

During 1932 a new classification, to be known as "III Class C.O.R.," was introduced at the request of the New Zealand Jersey Cattle Breeders' Association and with the approval of those other breeders' associations whose breeds are represented in the C.O.R. testing. This class is for those cows which qualify for first- or second-class C.O.R. in all respects save subsequent calving.

The outstanding feature of the past year's testing was the performance of the four-year-old Jersey cow Woodlands Felicie, whose production of 1,220·89 lb. butterfat from 17,332·6 lb. milk was a world's record for the Jersey breed and is still so on an age basis. This cow was bred by Mr. H. C. Sampson, of Hillsborough, Taranaki, and was owned and tested by Mr. P. J. Petersen, of Waitara. Another individual performance worthy of mention is that of the Friesian cow Totara C.R. Buttercup, bred and tested by the Piri Land Co., who last year gained a certificate for 1,079·14 lb. butterfat from 27,108·1 lb. milk on a record commenced at the age of 4 years 267 days.

Up to the close of 1932 nine New Zealand cows had gained first-class certificates of record on production of 1,000 lb. butterfat or over.

Government Official Herd-testing.

The official herd-testing year closes on 30th September, and to that date in 1932 had completed five years operation. So far as the past year is concerned, the position must be considered satisfactory, 1,798 cows having been tested under this system, these being in the herds of 160 C.O.R. testing breeders. This represents a decrease of 438 cows and 15 breeders from the 1930–31 year. Using all cows in milk 180 days or more as a basis, the average yield of the cows tested under this system last year was 289·94 lb. butterfat, as compared with 298·17 for the preceding twelve-month.

Ordinary Herd-testing.

Some 259,857 cows were systematically tested during the 1931–32 season, a decrease of 11,547 cows from the preceding season. Over 90 per cent. of these cows were tested under the Group system, while 25,111 cows were tested under the Association own-sample system, and the balance of 219 by dairy companies on behalf of their suppliers. The tested cows represented approximately 16·4 per cent. of the total cows in milk. The average butterfat-production of the test cows was 236·87 lb. as compared with 241·05 lb. for 1930–31.

Herd-testing received considerable assistance for the past season by way of subsidies. The New Zealand Dairy Produce Board made a grant of £6,000, while the Government contributed approximately £7,700. This meant that newly formed groups were in most cases fully reimbursed for expenditure on purchase of plant, and that herd-owners received 11d. per cow if testing under the Group system or 5½d. per cow if testing under the Association own-sample test.

The Herd Testing Central Executive or its sub-committee met on various occasions during the year, and rendered considerable assistance to the herd-testing movement by way of allocation of subsidy and general organization.

Appreciation.

Consequent upon the greatly increased quantities of dairy-produce handled, all members of the staff have had an exceptionally busy year, and I desire to thank one and all for their enthusiastic co-operation. Thanks are also extended to the Department's Chief Chemist, the State Forest Service, Dairy Produce Board, the various freezing-companies handling dairy-produce, the firms handling milking-machines, and the cattle breeders' associations for their helpful assistance.

HORTICULTURE DIVISION.

REPORT OF J. A. CAMPBELL, DIRECTOR.

The Fruitgrowing Industry.

The past season's fruit crop, with the exception of apples, was a good average one. While a heavy crop of apples was produced in the Central Otago district, the returns in the other commercial fruitgrowing districts were considerably lighter than those of the previous year. As a result of the climatic conditions the apple crop matured some two weeks earlier than usual, and a considerable percentage consisted of oversize fruit which was unsuitable for export.

In common with the other primary industries of the Dominion, fruitgrowing is suffering from the effects of the world-wide depression. Notwithstanding the economic crisis, however, it is satisfactory to note that the bulk of the growers are showing an optimistic spirit, which is evidenced in the maintaining of their orchards in good condition and the carrying-out of improvements for the better conduct of their business.

Dry weather experienced resulted in a greater prevalence of insect pests such as red mite, codlin moth, &c., but was against the development of black-spot and other fungoid diseases. A careful watch has been kept on fireblight disease by the officers of the Division, and reports to hand indicate that there has been no further spread of the infection during the year. The cutting-out of fireblight cankers and eradication of hawthorn hedges in the infected areas is keeping the disease well within bounds.

There were no extensive plantings in pip or stone fruits during the year, any operations carried out in this respect being mainly replacements in existing orchards where the trees had become unprofitable. The total area in commercial orchards for the whole of the Dominion stands at approximately 27,000 acres.

Citrus culture is still receiving a good deal of attention, especially in the Bay of Plenty District, where an additional 120 acres of lemons have been planted during the last three years, and extra curing-shed accommodation has had to be provided to deal with the increasing supplies of fruit coming to hand. An improvement is noticeable in the grades and keeping-qualities of New-Zealand-grown lemons offered for sale on the local markets, but further efforts in this direction are still desirable. The total acreage in citrus fruits in the Dominion is approximately 1,600 acres, the bulk of which is located in the Auckland District.

Considerable quantities of passion-fruits are now being produced in the North Auckland district, but the matter of finding a profitable market for the surplus crop is one that is still exercising the minds of growers. A small company has commenced operations at Kerikeri, converting all the second-grade fruit into pulp and juice with the view of working up a trade in this product.

Export of Fruit.

As the result of a heavy crop of pip-fruits, the 1932 export season was a particularly busy one for both fruitgrowers and the inspecting officers attached to the Division at the different points of inspection, the total quantity shipped overseas reaching the record figure of close on 1,600,000 cases. Of this total, 1,268,656 cases apples and 92,513 cases pears were shipped to Great Britain; 166,921 cases apples and 1,967 cases pears to the Continent of Europe; 50,834 cases apples to South America; and 15,167 cases apples to Canada. Reports to hand indicate that while some varieties showed wastage to a more or less extent, the bulk of the consignments opened up in good condition. In view of the depressed state of the markets, the prices realized were generally speaking considered fairly satisfactory.

The bulk of the fruit was exported under the Government guarantee of 11s. per case for Extra Fancy and Fancy grades and 7s. for Good grade. The guarantee was also conditional on each exporter contributing 1½d. per case on all fruit exported under the guarantee—the fund thus created to be utilized to offset claims arising from market and transportation losses. In the event of the fund not being sufficient to meet such claims, the Government undertook to bear the balance of any expense that might be involved. The total levy collected on the 1932 season's shipments did not cover all claims made on the guarantee, and the amount of £3,000 was met by the Government. [Note.—£1,112 of this amount has since been recovered as a result of successful claims on account of storage defects.]

The following figures show the total number of cases of apples and pears exported from the Dominion during the last five years: 1928, 1,026,986 cases; 1929, 992,151 cases; 1930, 1,330,891 cases; 1931, 1,349,895 cases; 1932, 1,596,058 cases.

A small consignment of Poorman orange was shipped from Auckland in August last for the purpose of testing the London market for this class of fruit. Advice to hand indicates that the shipment arrived in good condition, but further details are not yet available at date of writing.

A further experimental shipment of thirty-six packages of passion-fruit was forwarded to London on 1st March last.

During the year (1932–33) 100 crates of plums from Hawke's Bay and 42 crates of peaches from Central Otago were forwarded to London for the purpose of testing their carrying qualities and the possibilities of opening up an export trade in these fruits. The reports on the result of these shipments will be awaited with interest.

Owing to the present season's apple crop being a light one, and a large proportion of the fruit oversize for overseas markets, it is anticipated there will be a considerable reduction in the quantity available for export during the 1933 export season.

Local Markets for Fruit and Vegetables.

The inspection of locally grown fruit and vegetables in shops and auction rooms in the main marketing centres received regular attention during the year. The bulk of the lines offered for sale was of good quality and well packed. Prices received by growers were, however, on the low side, and anything but higher-grade produce was difficult to dispose of. The returns for stone fruits were considerably reduced by the presence of brown-rot disease. Although the "topping" of consignments was less in evidence, it was found necessary to take legal proceedings against a number of persons for breaches in this respect. It is only by strict enforcement of the regulations that this fraudulent practice can be overcome. Damage caused by the white butterfly (*Pieris rapae*) and the diamond-back moth was reflected in the scarcity of cabbage and other vegetables of the brassica family, and high prices ruled for any good quality lines offering. Assistance was given by officers of the Division in connection with the growing of vegetables by the unemployed in the main centres.

The regulations relating to the sale of New-Zealand-grown fruit for sale for consumption within the Dominion were amended in respect to standard packages in which fruit is sold, and were brought into operation on 24th November last.

Imported Fruit, Plants, &c.

The inspection of all imported fruit, plants, bulbs, &c., has been carefully carried out at the ports of Auckland, Wellington, Christchurch, Dunedin, and Bluff. The quantity condemned for disease infection was comparatively small.

A slight increase is noticeable in the quantities of fruit imported during the year from Fiji and Tonga, while Australian and Norfolk Island consignments ceased in December last, consequent upon the prohibition of the importation of fruit and vegetables grown in the Commonwealth of Australia. Oranges and bananas from Fiji showed considerable improvement in grading and packing.

Fruit Cool Storage.

The fairly extensive programme instituted last season in connection with fruit cool storage matters, &c., received close attention during the past year, and many important features were dealt with. These include maturity tests with apples and pears, fungal rots, scald control, soil-type experiment, &c., carried out in co-operation with the Department of Scientific and Industrial Research.

Several experimental lots of fruit were shipped to London for the purpose of testing the effect of a number of factors considered likely to influence the quality and wastage of exported fruit, a number of cases from each consignment being held in cool storage in New Zealand as controls. Officers of the Cambridge Low Temperature Station and the Empire Marketing Board, England, co-operated in connection with these experiments.

Supervision of the loading and stowage of fruit exported overseas has been maintained. Further steps have been taken to minimize the rough handling of fruit on the wharves and coastal steamers, and although some improvement is noticeable there is still room for complaint.

Cool Storage of Onions.

Further experimental work was instituted in the cool storage of onions, some 80 tons of onions being stored under the supervision of the Cool Storage Officer during the season. The onions were placed in storage in February-March, when prices were low. In common with other perishable products, this commodity requires careful handling during gathering, and in storage the main factors are proper stowage, temperatures, ventilation, and humidity. Throughout the storage period temperatures were maintained at a minimum of 31° F. and a maximum of 33°, and relative humidity at 78 per cent. All the onions remained in excellent condition. Losses from damaged and double onions amounted to about 1 per cent. at the end of the storage period. Placed on the market in good condition during the months of August, September, and October, higher prices were realized.

Instructional and Experimental Work.

The demand on the officers of the Division for advice and instruction on the many phases connected with horticulture continues to be considerable. With a curtailed expenditure, however, it was not possible during the past year to give the same amount of attention to inspection and instruction matters in the field as heretofore.

Fruit-packing classes were again conducted in a number of the commercial fruitgrowing centres, and certificates of competency were gained by a number of candidates who sat for the Departmental examination in this subject.

Further progress has been made in connection with the orchard research scheme inaugurated two seasons ago in conjunction with the scientific officers attached to the Plant Research Station, Palmerston North. The operations cover a wide field, and embrace the testing of spraying specifics and other materials for the better and more economic control of diseases and insect pests, orchard manurial experiments, root-stock experiments, &c., and involve a considerable amount of detail work on the part of the field officers concerned. Some very satisfactory results have already been obtained which should ultimately prove of great value to the fruitgrowing industry in the Dominion.

Experimental work, both spraying and manurial, on a fairly extensive scale has also been carried out at the Research Orchard, Redwood's Valley, Nelson, where the operations are being conducted in co-operation with the Department of Scientific and Industrial Research.

Viticulture and Winemaking.

Humid weather experienced in the Northern grape-growing districts was against the development of wine grapes, and as a result the crop was below the average. In the Hawke's Bay District, however, excellent conditions prevailed, and a heavy crop of well-ripened grapes was gathered. With the coming into bearing of newly-planted areas it is estimated the season's output of wine will be in the vicinity of 104,550 gallons—a slight increase on last year's figures, and representing a wholesale value of £36,592. An increase is noticeable in the area planted in table grapes, the crop of which was above the average, especially in the case of the Albany Surprise variety. Good crops were secured by growers of grapes under glass, and a number of new vineries were erected during the year.

Cider-making.

The quantity of cider manufactured from the 1932 apple crop is estimated at 40,000 gallons, valued for commercial purposes at £10,000.

Te Kauwhata Horticultural Station (Lower Waikato).

Climatic conditions were favourable to farming operations and growth generally throughout the year. Abundant feed was available for grazing purposes, a quantity being turned into hay for future requirements. Six acres of cleared wattle land was laid down in grass for pasturing. The returns from the sale of live-stock, wool, and skins amounted to £228.

Good weather was experienced during the growth and development of the grape crop, from which 8,200 gallons of wine was made. Sales of wine amounted to 8,543 gallons, which realized £4,119, a considerable increase on the previous year's figures. This was no doubt in a large measure due to the wine being now made available for sale from depots established in the main centres of the Dominion.

Tobacco-culture.

Considerable expansion has taken place in the growing of tobacco, the total area under this crop in the Dominion having now reached 3,154 acres. The main progress has taken place in the Motueka district, Nelson, which has proved eminently adapted for the production of tobacco. In this locality some seven hundred growers were engaged in tobacco-growing on a commercial scale during the past season, the area cultivated being approximately 2,500 acres, which produced an estimated yield of 2,000,000 lb. of leaf, of an approximate value of £170,000. About 150 kilns are operating in the Motueka district for the flue-drying of the leaf. The industry is also making good progress in the Auckland District, where some 590 acres are under cultivation, and to a lesser extent in Marlborough, the area in this district being 63 acres. Satisfactory progress is being made in the culture of tobacco at the Pongakawa Settlement in the Bay of Plenty District, where twenty families have been settled under the Small Farm Plan.

The bulk of the leaf at present grown in the Dominion is raised under contract to the local manufacturing companies at satisfactory prices to the grower. A commencement has not yet been made in the export of tobacco leaf, this phase of the industry being entirely dependent on a satisfactory overseas market being found for any surplus not needed for New Zealand requirements. Any person intending to take up tobacco-growing commercially is therefore strongly advised not to commence operations before making satisfactory arrangements for the ultimate disposal of his crop.

A further quantity of tobacco-seed was produced during the past season on the plot established in the Auckland District, the operations being carried out under the supervision of the Department's Instructor in Tobacco Culture.

Hop-culture.

The season's production of hops was quite up to the average and the quality good, very little disease being apparent. Owing to the unstable market, there has been a considerable falling off in the area grown under hops during recent years. A more hopeful outlook is, however, now being manifested, and there are indications of the acreage being increased in the near future. The quantity of hops exported from the Dominion during the year ended 31st March was 3,192 cwt., valued at £13,793.

Tung Oil.

Considerable advancement has been made during the year in the planting-out of tung-oil plants in the North Auckland district, where a number of companies are operating, the area already planted comprising several thousand acres. While some of the plantations appear to be progressing satisfactorily, it is not possible to give an expression of opinion as to the future prospects until such time as the trees reach a bearing stage and nuts are available for analysis, testing, and sale.

New Zealand Institute of Horticulture.

Good progress continues to be made by the New Zealand Institute of Horticulture, and many matters of considerable importance connected with horticulture generally received attention during the year. The educational scheme inaugurated by the Institute has been further extended to include

the conducting of examinations in fruit-culture and the issue of certificates in this subject. This movement will undoubtedly prove of ultimate benefit to the fruit industry in the Dominion, particularly with respect to the youth of to-day who are destined to become the orchardists of the future.

The fourth Loder Cup competition for the best collection of New Zealand native plants took place in Wellington in January last, and was awarded to Messrs. Thos. Waugh and Sons, of Lower Hutt, Wellington, whose display of trees, shrubs, and herbaceous plants was a very comprehensive and interesting one.

Orchard Registration and Orchard-tax.

The total number of registered orchards in the Dominion now stands at 6,293, of which 2,883 are taxable and 3,410 non-taxable. A sum of £1,687 was collected in orchard-tax, and this amount, less the cost of collection, was paid over to the New Zealand Fruitgrowers' Federation, Ltd., on behalf of the growers, to be utilized in furthering the interests of the fruitgrowing industry generally.

Fireblight-tax was also collected in six commercial fruitgrowing districts during the year, and the proceeds, less cost of collection, were handed over to the fireblight committees concerned, to be expended in their respective districts for purposes directly or indirectly associated with fireblight.

Registration and Inspection of Nurseries.

This work has proceeded satisfactorily, the bulk of nursery stock being well up to standard and clean and free from disease. An increase is recorded in the number of nurseries registered, the total being 686, as against 659 for the previous year. The sum of £684 10s. was collected in nursery-registration fees.

The Beekeeping Industry.

The season of 1932–33 varied considerably throughout the principal honey-producing districts in the Dominion. While the honey crop in the Taranaki, Hawke's Bay, Otago, and Southland Districts was a good average one, that in Auckland, Marlborough, Westland, and Canterbury was only light to medium. No improvement is yet noticeable in the marketing conditions for honey, prices still showing a downward tendency. Notwithstanding the unsettled state of the industry, it continues to attract attention. Extensions are being made to established apiaries, and a steady increase in the sale of bee supplies is reported. Valuable assistance has again been rendered by a number of experienced beekeepers in the capacity of honorary Apiary Inspectors, these services being given free of charge to the Department.

Further tests were carried out for the purpose of ascertaining the value of chlorine as a sterilizing agent for combs infected with foul-brood. The experiment in connection with the forwarding of package bees from the North to the South Island was also advanced a further stage during the year.

There was a further reduction in the quantity of honey received at the various grading stores, the total number of cases graded for export being 2,500.

The total number of registered apiaries in the Dominion is now 7,245, comprising 111,910 colonies of bees.

Staff.

With the many and varied activities coming within the scope of the Division, together with the increasing demands for advice and information covering a wide field of operations, a busy year has been experienced. I have to thank the staff as a whole for the loyal and efficient service rendered during the year.

CHEMISTRY SECTION.

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

Mineral Content of Pastures Investigation.

A notable feature of the year's work has been the extension in the use of limonite as a stock-lick to districts bordering on and even remote from those usually recognized as bush sick, in most cases with spectacular results. In many instances the good results appear to be due to the correcting of a deficiency of iron insufficient to cause acute symptoms of disease, but giving rise to a widespread lowering of production, while in other cases the favourable effects probably follow the tonic effects of iron leading to a suppression of intestinal parasites.

Considerations of economy have curtailed the amount of field work that could be undertaken, but by co-operation with officers of other Divisions, notably Veterinarians and Meat Inspectors, a considerable number of samples have been received, especially in connection with the iodine investigation.

Pumice Lands.

Air-deposited rhyolite pumice, which is the type of volcanic ash associated with bush sickness in the North Island, constitutes the chief soil-forming material over an area of about 8,000 square miles, or one-fifth of the total area of the North Island. Bush sickness has so far been found to occur over about half of this area, or more than two and a half million acres. Within the outer boundaries of this proved sick area, however, scattered portions, associated mainly with special topographical features, are relatively healthy. The occurrence of various degrees of pathogenicity is well established, and it is probable that much of the remaining subaerial-pumice country, on large areas of which stock-farming with modern methods has never been attempted, will be found eventually to be affected with bush sickness either in the usual condition or to the extent that treatment with iron licks, such as limonite, will materially increase production.

The use of limonite as a lick for preventing and curing bush sickness has now become standard farming practice in the affected districts, and the distribution of the material has been taken up by various commercial agencies, among those operating on the largest scale being several of the fertilizer companies. As illustrating the improvement that has taken place, the Supervisor of the Dominion Herd Testing Association writes congratulating the Department, pointing out that where despondency was prevalent a few years ago he found optimism as to the future despite the present low prices. The great success of the experiments would definitely assist the herd testing movement.

The Secretary of the Tokoroa Progress League also writes in similar strain, giving instances of the striking results obtained in his district. These include greatly increased cream production as shown by factory returns, the rearing of calves on a large scale, and the deliberate buying-in of sick heifers for curative treatment, thereby securing cheap stock. On one farm the butterfat returns per cow for the same two months of 1931 and 1932 respectively are as follows:—

	1931. No Limonite. Lb. per Cow.	1932. Limonite. Lb. per Cow.
September	.. 17	32
October	.. 24	45

A show is being held in the Tokoroa district this year, a thing unheard of before the introduction of limonite feeding. The output of the Tokoroa cheese-factory, with five less herds supplying milk and with two months and a half still to go, has already eclipsed the previous record.

NEED FOR CARE IN LIMONITE PRODUCTION.

Disappointing results obtained on several farms, as well as in one departmental experiment, were traced to the use of limonite which was found to be of inferior grade. This product was not from the Whangarei deposit, and on changing over to the previously tested material from that source the trouble was quickly rectified. It is thus evident that field trials should precede the general use of limonite from any new source, and that producers should take care that only stone of the highest quality is ground for stock lick. Grittiness in even a good grade may make the limonite distasteful to sheep. The fineness of an excellent sample of Whangarei limonite recently analysed showed that 83 per cent. of material passed a 200-mesh sieve and that gritty particles were practically absent, everything passing a 60-mesh sieve.

SHEEP EXPERIMENTS.

The Atiamuri experiment is being continued by breeding from the ewe-hoggets reared last year on limonite. These hoggets are perfectly grown and in splendid condition. Their fleeces at shearing averaged 11·5 lb. of good-quality wool. The wether hoggets have been sent to the works, and could easily be picked out from other sheep with which they were mingled by their superior size. The original ewes, after rearing their second lot of lambs, are being killed for station consumption, the dressed carcass weights being between 80 lb. and 98 lb.

An experiment with feeding limonite to sheep has been running for about a year in the Kaharoa district, which is representative of the most bush sick of all the pumice country. Ten ewes in lamb were used as controls, while thirty ewes in lamb were fed with limonite, grazing on the same paddocks in rotation. The result to date is that nine out of ten of the control ewes and all their lambs except one have died, the survivor being a miserable specimen. The thirty limonite-fed ewes, which were mostly broken-mouthed and had failed to rear any lambs the previous year without treatment, are in excellent condition, and the 100 per cent. of lambs produced are mostly healthy and well-grown and have only been subject to normal losses. The wether lambs, when sent to the works, averaged, dressed, about 32 lb. The ewe lambs (fourteen) are in splendid condition and are being retained to breed from next year. This experiment has already supplied proof that sheep can be profitably carried on a large area of the most sick country, where they will be a valuable adjunct to dairy-farming in the suppression of weeds, notably ragwort.

LANDS BORDERING THE DISTINCTLY SICK AREAS.

A Putaruru farmer who the previous year out of 3,000 lambs was able to send only 600-odd to the works, while of the remainder several hundred died and the rest were sold as stores for very little, has this year succeeded in quitting all his 3,000-odd lambs as fat. The cost of treatment for the entire flock, ewes and lambs, was under £20.

An officer of the Chemistry Section, after a visit through the Bay of Plenty districts, reports that it is amazing how much limonite is now being used there and with good results. Settlers who were on the point of walking off their farms are now looking forward to the future with confidence. Even on the Rangitaiki Plains beneficial results are being obtained from the feeding of limonite to dairy cows.

In the Gisborne back country excellent results have followed the use of limonite with both sheep and cattle. A fair amount of limonite is being used in the Ngaroma district, but here the results are obscured by the general lack of top-dressing and the state of poverty into which the pastures have been allowed to fall.

MANGAPEEHI AND KOPAKI DISTRICTS, WAITOMO COUNTY.

Analyses have shown the pastures at Mangapeehi to be similar to those of Kopaki, where the occurrence of bush sickness was closely investigated and shown to be correlated with a low iron content. Limonite lick has been given extensive and carefully controlled trials in these areas and has been found an unqualified success. One settler found that the admixture of a small amount of meat-meal with the limonite induced the sheep to take it readily, the meat-meal then being gradually eliminated. Another settler got away 174 fat lambs off 400 limonite-fed ewes and topped the local market with the remaining lambs.

RAGWORT AS AN INTERFERING FACTOR IN BUSH SICKNESS.

In a few cases where inconclusive results attended the use of limonite it was considered that the animals were suffering from ragwort poisoning. The importance of controlling ragwort is therefore even greater in the bush-sick areas than elsewhere, owing to the possibility of confusion of symptoms leading to wrong treatment and incorrect reports of the value of limonite for bush sickness.

The usefulness of sodium chlorate for ragwort destruction is somewhat diminished by the fire hazards attending its use. Trials are therefore being made with other substances to which this objection does not apply, in particular ammonium thiocyanate, which has given promising results in preliminary experiments.

MORTON MAINS DISTRICT, SOUTHLAND.

A considerable amount of work has been done in connection with the disease of lambs occurring in this district. Feeding trials with limonite on several farms have given exceptionally good results. The fat-lamb buyer considered the experimental lambs on one farm to be the healthiest in the district, while on a neighbouring farm where no limonite had been used he was sure they were "gone." Numerous fat lambs have been sold from the various experimental groups, in several cases this being the first occasion for ten years that any lambs have been sold fat. In general no sickness has occurred among the limonite-fed lambs, while farmers not using limonite have had the usual trouble.

Monthly pasture samples have been collected by the local officer in charge from selected farms and analysed in the Laboratory. Although every endeavour has been made to obtain clean samples, the amount of soil contamination has in most cases been so high as to vitiate any conclusions which might be drawn from the iron and manganese figures. The extraordinarily high manganese figures in many cases, even in view of the soil contamination, have led to some attention being paid to manganese dioxide as a possible depressor of iron assimilation, and some small-animal experiments have been commenced to provide evidence on this point. Enclosed plots for sampling have also been established on several farms to enable clean samples of pasture to be collected, and this is now being done.

There is no evidence from the analyses of any deficiency of lime or phosphorus. Iron is low in a few uncontaminated samples. Analyses were also made of the ash of two sick and one healthy lamb. No striking abnormalities were found in the ratios of the mineral elements present. Manganese showed a tendency to increase in amount with decrease of total ash content, being therefore relatively more abundant in the sick and stunted lambs, but the quantities were too small to be of much significance. Copper was present in normal amount, so that the anæmia could not possibly be referred to deficiency of this element.

Mairoa District, Waitomo County.

The new sheep experiments, which were mentioned in the last Annual Report as having been commenced, were wound up in March after running for about a year, owing to the need for economy. The plots and stocking were as follows:—

"40 + 4" (40 cwt. carbonate of lime plus 4 cwt. superphosphate per acre)—30 sheep.
"5 + 2" (5 cwt. carbonate of lime plus 2 cwt. superphosphate per acre)—20 sheep.
"3 + 2" (3 cwt. carbonate of lime plus 2 cwt. superphosphate per acre)—20 sheep.
Control—25 sheep.

The stocking was adjusted to the carrying-capacity of the paddocks, which were subdivided and cleaned up by cattle as required. At the end of the experiment the sheep from the 40 + 4 plot stood out well above the others in appearance, being healthier and stronger. Their average increase in weight over the period was 32 lb. Next in order came the 5 + 2 sheep, which looked well but less thriving, their average increase in weight being 28 lb. The sheep from the 3 + 2 plot and the control plot followed in that order with increases in weight of 21 lb. and 16 lb. respectively. Several sheep in these two groups showed signs of going back, while the remainder did not look well. Several sheep on the 5 + 2, 3 + 2, and control paddocks showed definite signs of "dopiness." It was concluded that both lime and phosphate were necessary to secure increased carrying-capacity, but that a considerable excess of lime was required for maximum healthiness.

Five sheep suffering from "dopiness" were periodically drenched with iron ammonium citrate, and showed on the whole remarkable improvement. The iron treatment may have effected the good result from the tonic effect it has on stock. A similar good result of limonite on calves at Feilding, where no bush sickness could be suspected, has recently been reported.

At the conclusion of the experiment samples of bones from sick and healthy sheep were analysed. The ratio of ash to organic matter was found to be definitely lower in the case of the sick than of the healthy sheep.

Analyses of a number of pasture samples from the enclosed replicated plots have been completed and included in the quarterly reports to the Empire Marketing Board. Treatment with lime alone increased the lime content of the pasture, while a similar increase occurred with superphosphate. With lime and super the increase was greater. Phosphate was increased to a similar extent by both super and lime and super. In most samples iron was low and did not appear to be affected by top-dressing.

Te Popo District, Taranaki.

Analyses of samples of pastures and soils collected during the spring, 1931, and autumn, 1932, were completed. The results indicated that in the unploughed pastures where stock do poorly the calcium and phosphorus contents are low, while they are much higher on the portions of the farms recognized as healthy. It would appear that under the prevailing conditions the unploughed danthonia turf is incapable of responding to the ordinary phosphatic top-dressing.

Bovine Eclampsia, Waikato District.

In view of Sjollema's findings regarding the causes of grass tetany, a number of sodium and potassium estimations were done on pasture samples from the Waikato. It was found that the ratios of potassium to sodium fell within the limits specified by Sjollema as dangerous and it was recommended to experiment with feeding rock salt.

Pampas Grass as Fodder.

Following the publication of analyses of pampas and toetoe grass and comparisons of their feeding value with that of other staple fodders, contact was made with a farmer on the Hauraki Plains who has been experimenting for some years with pampas grass as winter fodder for dairy cows. Although this farmer's herd is a very ordinary one, he is topping his district for butterfat, as shown by the factory returns. Tests have revealed that an increase of 0·3 per cent. butterfat in the milk occurs when the cows are depastured on pampas, and that this drops to normal again on ordinary pasture. The pampas plantations are increased by division of the roots. The best shoots are planted out in spring at a distance of 6 ft. apart each way. These are not fed off until the second year, when the estimated yield of green material is about 50 tons per acre. After grazing off, the stock is removed and the litter of dry leaves fired. A fresh green growth rapidly appears, and grazing may then be regularly practised either in winter or summer. During the past winter 106 head of grown dairy stock have been carried on 2 acres of pampas with 40 acres of run-off. It is considered that 10 acres of pampas will provide enough supplementary feed for the whole 200-acre farm when fully stocked. There appears to be no evidence of digestive troubles. The fibre is short and readily breaks into small pieces. There is evidence that the composition of the fodder varies considerably with the seasons and the soil on which it is grown. This farmer is supplying other farmers with pampas roots at a very low figure.

Officer stationed at Wallaceville Veterinary Laboratory.

Metabolism Experiments with Sheep.—In pursuance of a plan to test the supplementary value of various calcium and phosphorus-containing materials, balance experiments have been conducted on the effect of supplementing a basal diet of poor-quality hay with (1) dipotassium hydrogen phosphate, (2) dried blood, (3) dried blood plus Nauru rock phosphate, (4) dried blood plus Nauru rock phosphate and disodium hydrogen phosphate. The conclusions (published in the *N.Z. Journal of Science and Technology*, XIV, No. 5, 281, 1933) were briefly as follows: Lambs fed a hay of low nutritive value, deficient chiefly in phosphorus and protein, showed positive calcium balances but negative balances of

phosphorus and nitrogen. Supplementary feeding of potassium phosphate decreased the calcium balances to a negative value. Supplements of dried blood enabled the animals to retain nitrogen, and at the same time improved the retention of calcium and phosphorus. The calcium and phosphorus balances were not improved by feeding Nauru rock phosphate as an addition to the hay and dried blood diet. The work, though only preliminary in nature, suggests that sheep feeding on a pasture similar in nature to the hay used—*e.g.*, high country or droughty conditions—will not benefit by supplementary feeding of mineral mixtures to the same extent as they would by improvement of the nitrogen intake.

Analysis of Sheep Milks.—A number of samples of sheep milks from the Wallaceville and Rotorua districts were analysed to provide further data for the study of the calcium and phosphorus metabolism of the sheep.

High Protein Feeding and Reproduction.—Work commenced on rats in 1931 has been continued. The fertility of females fed diets containing 80 per cent. protein was not affected, but the male rats fed such a diet for long periods have become sterile. The investigation is being continued in collaboration with the Officer in Charge.

Grass Staggers in Dairy Cows.—Factors causing the upset of magnesium metabolism in this disease are being investigated by preliminary work on rats, which will later be extended to ruminants. The effect of the level of dietary magnesium on the calcium and magnesium contents of bodies, bones, and blood has been determined. The most interesting finding is that the blood magnesium level reflects the magnesium content of the diet, and by feeding extra magnesium as carbonate, sulphate, chloride, or phosphate the magnesium content of the blood has been raised considerably above the normal. This relationship is being tested out on sheep, which are being drenched daily with magnesium salts, and will later be tested on cows supplied with magnesium containing licks or with magnesium salts in their drinking-water. The importance of the work resides in the fact that, since the most marked finding in the blood of cows with grass staggers is a greatly reduced magnesium content, then a practicable method of raising the blood magnesium during the period of susceptibility to the disease might help to mitigate its incidence. Such methods as supplying stock licks containing large proportions of magnesium if these can be made palatable, or the introduction of soluble magnesium salts into drinking-water, might achieve this end. Different strains of rye-grass, which forms a large proportion of the pasture in districts where grass staggers occurs, are being investigated at various stages of growth.

Irregularity in Growth of Wool of Angora Rabbits.—Investigations in collaboration with the Assistant Officer in Charge at Wallaceville indicate that this trouble may be due to a dietetic fault, similar to that produced experimentally in rats (see *N.Z. Journal of Agriculture*, Vol. 44, No. 5, May, 1932, p. 335). This may have a bearing on the growth of wool in the case of sheep.

Hogget Mortality.—Pasture analyses are being undertaken in connection with the investigation at Wallaceville of this trouble.

Contamination Factor in Pasture Analysis.

Despite great care in the collection of relatively clean pasture samples, experience has shown that soil contamination can seldom be disregarded in the interpretation of the ash analysis, particularly in regard to elements occurring in minor proportions such as iron, manganese, and iodine.

In practice the content of alumina has proved the most useful guide to determine the degree of soil contamination, on account of the facts that the higher plants absorb in general only traces of alumina, while in soils aluminium is the most abundant metallic element.

A study has been made of the relationship of the alumina content of grasses and clovers to soil contamination, with conclusions which have been published in an article in *Transactions of N.Z. Institute.*

Iodine Investigation.

This work has been very actively prosecuted during the year. Several thousand thyroid glands comprised in 760 samples have been forwarded by Veterinarians and Meat Inspectors, and analysed for iodine content.

It was thought that " bobby " calves might provide material for a preliminary survey of Taranaki, and with this aim the Veterinarian at New Plymouth examined 1,750 bobby calf thyroids during August and September. He found 4 per cent. enlarged above 15 grammes. Of the 119 glands analysed all were found to have an iodine content above 0·03 per cent., the critical value. The distribution of weight was as follows: Under 4 grammes, 1 gland; over 4 grammes and under 9 grammes, 87 glands; over 9 grammes and under 15 grammes, 16 glands; over 15 grammes, 15 glands. With three exceptions, the enlarged glands came from two definite but unidentified districts. Lack of iodine is evidently not the cause of enlarged glands among bobby calves in Taranaki. Possibly, except in cases of acute deficiency, lack of iodine is not reflected in the new-born young, which is supplied from the body store of the mother, even though the latter may be depleted.

In the Wairarapa district samples of thyroids from sheep varying from three months to six years old showed that the age considerably affected the iodine content, the percentage of iodine increasing with age. On the other hand, forty-three pairs of samples of lambs' thyroids showed no difference between male and female glands, either in size or iodine content. Certain generalizations were drawn from the analyses of the glands, correlating iodine content with the type of country from which they were derived.

The rich limestone constituting the Maungaraki Range and its northerly continuations produced lambs whose thyroids were definitely high in iodine. Of twenty-three samples eighteen were above 0·09 per cent., three between 0·06 and 0·09 per cent., while only two were below 0·06 per cent. on the fresh gland. Thyroids from the greywacke hills of the west and south Wairarapa were considerably lower. Of thirteen samples two were between 0·03 and 0·06 per cent., eight between 0·06 and 0·09 per cent., and three above 0·09 per cent. These were followed by thyroids from the mudstones of the East Coast, where twenty-one samples yielded nine between 0·03 and 0·06 per cent., seven between 0·06 and 0·09 per cent., and five above 0·09 per cent. Samples from the alluvial plains of the Ruamahanga and Wareama River valleys were distinctly low, thirty-eight samples yielding five below 0·03 per cent., nineteen between 0·03 and 0·06 per cent., six between 0·06 and 0·09 per cent., and eight above 0·09 per cent. Of those above 0·09 per cent. four had been supplied with iodized licks and four had come off peaty swamp land. Soil and pasture samples analysed for iodine from the same localities follow the same general order.

A lick-feeding experiment carried out on the Taratahi Plain did not result in any changes in the weights of the animals or their thyroids as against controls, but the iodine content of the glands varied in proportion to the amounts of iodine fed (varying from 3 to 60 oz. potassium iodide per ton of salt).

In the Southland and Otago Districts special attention was paid to the occurrence of goitre, which is found in sheep in some parts of these areas. The occurrence of three variables (weight, per cent. iodine, and per cent. moisture) afforded some means of classification and definition of the term "goitre." The variation of moisture content was from 61·2 per cent. to 87·8 per cent. (average 74 per cent.), and the heaviest glands had not necessarily the greatest percentage of moisture. Glands from sheep were appreciably heavier than those from lambs with the same percentage of iodine, but the number was relatively small. In appearance the glands fell into two distinct classes: (*a*) Small and firm (2–4 grm.); (*b*) soft, slightly heavier (3–6 grm.), apparently with the cells distended with liquid. These latter are associated with the goitrous area. The iodine content of the fresh glands varied from 0·006 to 0·14 per cent. The following table summarizes the position:—

Per Cent. of Iodine.	Number of Samples.							Remarks.
	Clutha River.	Mataura River.	New River.	Waiau and Aparima.	Coast, Palmerston to Oamaru.	Maniototo and Taieri Plains.	Manuherikia and Ida Valley.	
Above 0·08 per cent. ..	..	2	1	..	6	12	2	Good.
0·06 per cent.–0·08 per cent.	1	1	1	..	3	3	1	Fair.
0·04 per cent.–0·06 per cent.	6	7	2	5	4	4	3	Low.
0·02 per cent.–0·04 per cent.	10	11	6	5	3	4	1	Critical value.
Under 0·02 per cent. ..	4	5	2	4	..	1	1	Deficient.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	
Weighing over 3·60 grm.	43	50	33	36	22	25	25	
Below 0·03 per cent. iodine	28	43	67	43	..	11	12	

The average weight of glands containing 0·03 per cent. iodine is 3·57 grm. Accepting this as a provisional standard, about 36 per cent. of the glands in Otago and Southland districts are enlarged above normal, while about 10 per cent. are grossly enlarged—*i.e.*, weigh over 6 grm.—the latter occurring at Mataura Island, Otama, Sterling, Milton, and Awamangu.

Experiments on the efficacy of iodized salt licks as a means of increasing the iodine content of glands are at present being carried out in Southland under the supervision of the District Superintendent, glands from the various groups being forwarded as they become available.

Abrasion of Sheeps' Teeth.

The occurrence of unusually rapid abrasion of sheeps' teeth in the Sanson district has been investigated in collaboration with the Director of the Live-stock Division. It was found that the incisors were badly affected, while the molars were in fair condition. More abrasion was found on limed than on unlimed land. The soil, which is very dry, is derived from an old sea-bottom deposit of river silt, and it is considered that the abrasion is caused by the dusty silt coating the grass. Liming, by increasing the activity of earth-worms in producing worm-casts, caused greater contamination of the pasture and hence more abrasion. The locality was one where the prevailing winds—north-westerlies and south-westerlies—exerted their force undiminished by shelter belts of any kind, a further factor in assisting the distribution of fine silt on to the herbage.

Bone Analyses.

In order to form standards for comparison with pathological specimens a number of samples of bones from healthy lambs and sheep of all ages from North and South Island localities have been analysed, and standards are now in course of preparation.

Soils.

The most extensive investigation was associated with the Napier Harbour Board's scheme for reclaiming areas raised by the Hawke's Bay earthquake. The texture, salt, and carbonate content, hydrogen-ion concentration, and plant food were determined in a large number of soils, and an approximate correlation found between the salt content of the soil and the plant covering. Mechanical analysis revealed a considerable variation in texture, but the predominance of a sandy or silty type indicated more favourable conditions for leaching of the excess of salts than, for example, those encountered in the Zuyder Zee reclamation scheme, where heavy clays were the rule. One of the most significant results of chemical analysis was the high proportion of phosphoric acid soluble in 1-per-cent. citric-acid solution. Several samples of water from the lagoon or from cracks in the newly raised areas were also analysed and found in most cases to be extremely salty, although at the first visit in July, 1932, the whole of the lagoon waters were fresh to the taste, indicating that percolation of sea water takes place at times through the gravel bank between lagoon and ocean.

A proposal by the Public Works Department to drain Lake Waikare (Waikato) led to the examination of representative samples from the bed of the lake. These soils were mostly heavy clays deficient in the sandy fractions, and therefore likely to be difficult to work when drained and exposed to the air. Plant food was not present in exceptional amount, so that the analytical evidence was on the whole against proceeding with the scheme.

In the vicinity of Patutahi, Gisborne, floods left a deposit of silt of varying thickness affecting an area of over 4,000 acres, and representative samples were received for analysis. These soils, which were classified as silt loams, contained an average of 2·5 per cent. of calcium carbonate and were plentifully supplied with total lime, magnesia, and potash. The citric-soluble phosphoric acid was also above the average.

A soil from Hospital Valley, Whangarei, on which vegetation would not thrive, was found to contain an appreciable amount of manganese partly in the active form of manganese dioxide, and only a trace of citric-soluble phosphoric acid, a combination of factors which apparently inhibited plant growth under local conditions.

Some soils from Springvale, Central Otago, which were reported to be infertile were found to be fine sandy silts having a strongly alkaline reaction (pH 9) and containing 0·8 per cent. calcium carbonate, but only small quantities of sodium and magnesium salts. They were micaceous in nature, and it was concluded that the difficulty of growing crops was due to the poor texture and strong alkaline reaction.

An arrangement was made with the Department of Scientific and Industrial Research whereby samples of soil collected by officers of the Geological Survey were analysed for clay content or complete mechanical texture.

Two papers on mechanical analysis were published in the *N.Z. Journal of Science and Technology* for February, 1933, dealing with the treatment of flocculating soils and with a revision of the system of classifying soils according to mechanical composition.

The total number of soil samples dealt with during the year was 175.

Lime and Limestones.

Besides the usual testing of specimens for farmers a considerable number of samples of commercial crushed limestone have been submitted by the Fields Superintendents for report as to their suitability for granting of free railage. In one case where the fineness of grinding was poor approval was not granted until a more finely ground material was produced.

An article was published in the *Journal of Agriculture* for January, 1933, on "Some Factors in the Availability of Ground Limestone as Plant Food," and suggesting tentative standards for fineness.

Fertilizers.

One official and twenty-four unofficial samples have been analysed. In one unofficial sample of basic slag the phosphoric acid fell considerably below the registered analysis, but no action was taken by the purchaser to have an official sample taken.

The following relates to work connected with the registration and inspection of fertilizers for the past year:—

Primary Vendors—

A. Number of registered independent fertilizer firms	108
B. Number of branches of A (excluding head offices)	174
Total of registered firms and branches	282
C. Number of firms (including certain branches) allotted distinct registration numbers in accordance with statements received	147
D. Number of branches not included in C	135
Total of registered firms and branches	282

Secondary Vendors—

E. Number of firms registered as secondary vendors (excluding branches and primary vendors who also act as secondary vendors)	365
F. Number of branches not included in E	50
Total of registered secondary vendors and branches	415

In the case of mixed fertilizers there is a growing tendency to calculate the analyses on the basis of the proportions in which the components occur, no account being taken of subsequent chemical reactions. For example, registration of mixtures guaranteed to contain soluble phosphoric acid has been refused because in the mixture the water-soluble phosphate has reverted to the insoluble form.

The growing sale of fertilizers in bulk (unbagged) makes desirable a more systematic sampling for official analysis, as such material may not be uniform in quality and is rapidly disposed of.

A series of articles on "Commercial Fertilizers and their Basis of Sale," by the Inspector of Fertilizers, in the *N.Z. Journal of Agriculture*, was completed during the year. Reports which have been written include a comprehensive one on a proposal to erect a nitrogen fixation plant in New Zealand, and a review of the world nitrogen situation and the details and costs of fixation of atmospheric nitrogen, also the annual summary of fertilizer importations for 1931–32. Other subjects reported on were (1) Processing of sheep, cow, and fowl manure by artificial dehydration, (2) Seychelles phosphate, (3) erection and costs involved in connection with a proposed fish-meal and fertilizer plant, (4) fermentation of bones, (5) the use of lignite and other carbonaceous materials as fertilizers, (6) the ammoniation of peat, (7) the distinction between dried blood and blood-meal, (8) the manufacture of bone ash, &c.

Miscellaneous.

Samples of limonite from a number of localities, several being in the vicinity of Rotorua, have been examined as to suitability for stock-lick purposes. The majority have been of too low grade, or present in insufficient quantity, to be able to compete with the Whangarei material, the only exception being a very high-grade ore from Okaihau, Bay of Islands.

Solidified molasses has been tried as a vehicle for mineral licks, being roughly powdered and mixed with limonite, bonemeal, &c., and rapidly setting again to a cake on exposure to the air. In this form it is readily licked by cattle out of covered troughs, and should be useful if marketed at a low enough price.

A sample of dried and ground seaweed was submitted for analysis to determine its value as a fertilizer. It was considered that this material would (if found to be palatable and nutritious in feeding experiments) be much more valuable as a stock food, especially for pigs or poultry, than as a fertilizer. So far, however, this suggestion does not appear to have been followed up. There should be scope for much fuller utilization of New Zealand seaweeds than is the case at present.

The kidney of a sheep submitted by the Meat Inspector, Moerewa, Bay of Islands, was found to contain several large calculi consisting of xanthine, this being the first record of this type of calculus among stock in the North Island.

Special reports and advice were prepared and given on the use of superphosphate in drinking-water for dairy cows, the treatment of fish waste for use as fertilizer, the possibility of manufacturing sodium chlorate in New Zealand, precautions to be observed in the use of sodium chlorate (since published as a bulletin), and the use of thallium compounds to induce shedding of wool by sheep in place of shearing.

Two samples of vegetable marrow with an intensely bitter taste were received, one being grown in Wellington and the other imported from Australia. Both were immature and were regarded with apprehension by the purchasers, while vomiting had followed the eating of portion of one sample. The samples were too small for the identification of the bitter principle, which did not give any of the reactions for alkaloids. The family to which the vegetable marrow belongs (*Cucurbitaceæ*) contains many poisonous species closely allied to the marrow, and under certain external conditions it is possible that even the cultivated species may produce poisonous fruits.

Work for the Departmental Divisions.

Live-stock Division.—Periodical analyses of public cattle-dips, analyses of licks, toxicological specimens, drinking-waters, stock licks and medicines, &c.

A solution alleged to be of use in diagnosing mammitis appeared to be merely a very dilute solution of litmus.

Another liquid sold as a cure for mammitis consisted of vinegar, kerosene, and impure fat (probably lard).

A sample of calf food was found to contain a large percentage of inert material, including silica and alumina, as well as a small amount of sulphide, and might be injurious to stock if consumed in quantity.

Some reputed pollard, sold for fowl food, besides having a musty smell due to mites, contained 9 per cent. of fibre, which is nearly double that of average New Zealand pollards.

In a case of suspected poisoning of dairy cows it was found that the ingesta contained tin in solution. Inquiries revealed that the tin had probably been dissolved from tinned vessels rinsed out with boiling caustic soda in the milking shed. The probable cause of death was the drinking of this alkaline wash-water from an open drain. A similar case occurred at an institution near Wellington in 1923, but in this case the ingesta was strongly alkaline, containing sodium carbonate but no tin.

Fields Division.—Soils, limestones, spraying materials, &c., have been analysed. The composition of a series of fertilizers for use in plot experimental work was carefully checked to allow of accurate quantitative application.

REPORT OF THE PLANT RESEARCH STATION, PALMERSTON NORTH.

THE activities of the Plant Research Station have been well maintained during the past year, 1932–33, notwithstanding the prevailing financial restrictions. The appended reports of the several Section heads outline the main features of the work, and afford a good indication of its wide scope.

As previously, the Department of Agriculture has had the co-operation of the Scientific and Industrial Research Department in certain parts of the work.

A. H. COCKAYNE, Director.

AGRONOMY SECTION.

J. W. HADFIELD, Agronomist.

1. SEED CERTIFICATION.

During the seasons 1931–32 and 1932–33 seed certification has continued to increase in volume. The Akaroa strain of cocksfoot, Montgomery red clover, and Kentish Wild White were included for the first time in 1931–32. A schedule of charges for seed-certification services was also inaugurated during that season. It was anticipated that the introduction of charges might restrict activities, but it seems rather to have stimulated interest and to have created a better realization of the value of the services rendered. Fees are paid both by the grower and the merchant, and the amount collected during the first season satisfactorily covered all expenditure in travelling, seals, printing, and stationery.

The certification of perennial rye-grass seed has increased very rapidly. In 1930–31 we sealed and certified 46,000 bushels of machine-dressed seed; in 1931–32 81,000 bushels; and the estimate for the current season of 1932–33 is over 200,000 bushels. This represents about two-thirds of the total New Zealand production of perennial rye-grass seed in pre-certification days.

A slight fall in the acreage of potatoes inspected under certification may be accounted for by the unprecedented low prices offered for the 1930–31 season's crop. There was also a substantial reduction in the area of wheat being offered, although no reduction in the area passed. The reduction in area was due entirely to the raising of our standard in connection with disease infection, which included many crops that would otherwise have been offered. The current season's returns show a doubling of the area offered on the higher standard, which is in every way satisfactory.

White clover had, up to the 1931–32 season, been certified on a basis of age of pasture. Age alone was found to be somewhat misleading, and therefore certification on type was introduced. This resulted in a considerable decrease in the areas eligible for certification. The area available is still unduly small, and every endeavour is being made to locate as many fields as possible carrying the correct type of clover, and every encouragement is given to growers to sow out mother seed for further seed production.

There has been an increase in the production of brown-top seed, although the actual area inspected was less than that of the previous season. This position has arisen as a result of the introduction of per-acre charges. Farmers are now entering only the best areas, whereas formerly they had been in the habit of entering large areas, portions of which could not be harvested with profit. There is no information available respecting the current season's crop.

The certification of beans in connection with bean wilt has been discontinued. It was found impracticable to check, by means of certification, the spread of bean wilt in the Canadian Wonder variety.

The value of New Zealand certified seed is being recognized overseas by the trade, by research workers, and by those who are engaged in agricultural instruction. Certification has certainly given an impetus to the export trade in herbage seeds.

2. GOVERNMENT PURE SEED STATION, LINCOLN.

Satisfactory progress has been maintained in the production and distribution of pure seed stocks.

(a) Wheat.—Pure lines have been raised of all the commercial varieties, and stocks of this seed will be maintained from year to year. There was a ready demand for the produce of the 1931–32 season. The seed harvested during the current season, 1932–33, is of particularly good quality, but it is yet too early to have effected sales. All seed is rendered smut-free, and we are indebted to the Canterbury Seed Co., Christchurch, for undertaking the hot-water treatment of all our stock seed.

Special precautions were taken during the past season to avoid cross-pollination between varieties. All single-plant selections and increase plots are grown in the centre of the main crop of that variety, and a wide belt of rye-corn divides each variety from its neighbour.

(b) Potatoes.—The 1931–32 season was unfortunate in many respects. Frosts in mid-summer following a prolonged drought caused a considerable loss, and a further serious loss, amounting to 50 per cent. of the remaining crop, was occasioned by an attack of eelworm. The demand for seed was far in excess of what we could supply. However, the quality of the 16 tons of seed distributed proved in every way satisfactory, and reports to hand show that the growers were well satisfied. The current season's crop is satisfactory, but the tubers are large, and we anticipate difficulty in filling orders for "seed" size. Only twelve varieties are now being grown for commercial distribution. A further twelve are still under trial, but it is hoped that when these trials are concluded the station will raise and distribute seed of not more than twelve varieties, and these the most suitable for New Zealand.

(c) Peas.—Pure lines of the standard varieties of garden peas have been raised, and stocks will henceforth be maintained at the Station. Merchants who are engaged in contract pea-growing are keen to procure supplies, and the Station has now entered into contracts with these merchants to supply seed from the 1933–34 harvest. It has occupied some years to work up these stock lines, and the measure of success will be better gauged when the merchants come to grow the seed supplied by the Station. If they prove satisfactory, important work will have been achieved. Little is known about the influence of selection and environment on the appearance of rogues in peas. They are a constant source of trouble in commercial seed production, and we hope that the stocks we supply will remain relatively pure over a sufficient number of years to make the work worth while.

Field peas are also under selection. We hope the yield trials this season will give fairly reliable evidence of what progress has been made in selection.

(d) Barley.—Pure and smut-free stocks of malting barley raised at the Station are now replacing existing stocks. Distribution has been effected through the Canterbury Seed Co. A new start will have to be made this coming season, so that we shall have in a few years fresh stocks for distribution to replace any that may have become impure. Meantime selections of the Gisborne barley are undergoing malting trials conducted by the Canterbury Seed Co., and seed should be available for distribution after next season.

(e) Linseed.—The trials of Moose selections have suffered considerably from weed growth, and the results may not be altogether reliable. A number of tall-growing strains of Moose are included in the trials, but we desire to know more of their yielding capabilities before they are introduced into commerce.

3. PLANT RESEARCH STATION, PALMERSTON NORTH.

Work at this Station in the Agronomy Section is confined more or less to investigations bearing directly on problems relating to seed and crop production.

(a) Rapes and Kales.—Trials conducted in 1930–31 had proved that several distinct types of rape were being offered on the New Zealand market. Preliminary trials were therefore devised in 1931–32 to determine yield, chemical analysis, and palatability. During the past season more extensive trials have been carried out, mostly by the Crop Experimentalist in co-operation with the Fields Division. These should give fairly reliable evidence on palatability and fattening quality. Kales and rape kales of various kinds are also under trial.

At the present time the name under which rape is sold is no indication of type. Since each is likely to have its own sphere of adaptability, it would be desirable if merchants could offer rape seed of specified type. Steps are therefore being taken to raise a quantity of pure seed. This may be an inducement to some of our merchants to produce rape seed on contract in New Zealand.

(b) Swedes and Turnips.—Investigation into the nomenclature of swede and turnip varieties has been carried on a further stage. A considerable measure of success has attended the initial efforts at turnip and swede seed production in New Zealand, but merchants are disinclined to handle this seed unless certified by the Department of Agriculture. Probably seed certification will have to be introduced to give the necessary security. Problems relating to the interpollination of rape, turnip, swede, and wild turnip are receiving attention. We are, in fact, gathering together as much information as possible with a view to establishing seed production in New Zealand on a sound basis.

(c) Lucerne.—Seed samples were obtained from overseas and from well-established stands in Marlborough, and several thousand of these seedlings were transplanted 30 in. by 30 in. to permit of individual plant studies. Records were kept of the performance of each plant, and in January, 1932, about 300 of the most promising were selfed. To permit of a further and a more satisfactory study of the selected parents, cuttings were taken prior to selfing, and the clones thus raised have remained under observation till March, 1933.

The L_1 seed resulting from the selfing of the selected mother plants was sown in April—*i.e.*, the autumn immediately following harvest. By September in the following spring the seedlings were large enough to be transplanted to their permanent quarters 30 in. by 30 in. apart. The parent was also transplanted alongside its progeny, and this has proved a very convenient arrangement, permitting a direct comparison between parent and progeny.

We have now growing about 250 parents surrounded by their L_1 families, and in another block the clones raised from the parents of these families. The degree of variation manifest from the single-plant studies indicated a promising field for selection. Moreover, the L_1 progenies have attained a very high degree of uniformity—in fact, many of them appear sufficiently homozygous for practical breeding purposes. The L_2 families, of which we have a few, have attained an even higher degree of uniformity, rendering it very difficult to make any distinction between the individuals in any one family.

Variation in yield, form, and habit between the different families is nearly as great as that exhibited by the parents, and, the possibility of improvement having been demonstrated, more definite objectives now in view are (1) the selection of a superior hay type; (2) the selection of a hay and grazing type for dry conditions. It is intended therefore to self the best plants in the best L_1 families. Present indications are that it will not be necessary to proceed to L_3, and, in any case, the restoration of vigour by the crossing of the best L_2 plants will be undertaken. Meanwhile the clones representative of the parents of the best L_1 families will be seeded during 1933–34 and tested against commercial Marlborough to determine whether any progress has been attained in the initial selection.

Problems, such as pollination, which have a direct bearing on technique in selection and commercial seed production, are being investigated. A somewhat elaborate trial is being undertaken in Marlborough with a view to determining the most practical method of tripping lucerne flowers in the field.

(d) Peas.—The selection of single plants and the growing of their progenies is undertaken at this Station. The produce is then increased at the Pure Seed Station, Lincoln. Peas offer several problems of considerable importance in connection with seed production, and these are being investigated.

(e) Oats.—Despite the rapid fall in oat-growing during recent years, the value of the crop is about equal to that of wheat. An investigation into the oat varieties grown in New Zealand seemed to be warranted and was undertaken last season. Following the line adopted with other crops, it is hoped to first clear away any misunderstanding relating to nomenclature and then to raise pure lines for distribution.

AGROSTOLOGY SECTION.

E. Bruce Levy, Agrostologist.

STRAIN IN PASTURE PLANTS.

Work on strain has commanded most of the time of this Section during the year, and a large amount of work has been accomplished.

Perennial Ryegrass.

Certification Trials.—1931–32 season: In connection with the 1931–32 certified crop, 365 plots were sown. These plots represented chiefly lines of doubtful type as indicated by the screened ultra-violet light. Reports on the majority of these have now been furnished to the Agronomist. 1932–33 season: This autumn 1,012 plots have been sown. A large number of these plots represent South Island lines which are being plot-tested to check up on the screened ultra-violet light method.

Investigational Work: Samples for Trial.—Samples of rye-grass from overseas (chiefly from Australia and England) have been tested. With the exception of one or two Australian lines, the imported lots are all definitely inferior to the New Zealand certified type.

Low Germination of Rye-grass.—Samples of seeds have been harvested from plots sown with seed treated with hot water at varying temperatures to see if the treatment has any beneficial effect on the consequent crop. Seed was also harvested from single plants and plots to see if there is any correlation between plant type and germination.

Elite Strain Work.—Last winter 168 of the best plants from the previous three and a half years' work were selected for further study. This represents slightly over a 99 per cent. culling. Each plant has been split up and put out as a tiller row and six spaced tiller plants. These tiller rows have now been nearly twelve months in their present position, and it should be soon possible to select a few of these for forming the nucleus of a pedigree strain.

During the year was finalized an extensive single-plant study to decide whether or not there is any deterioration in plant type when certified mother seed is once grown. Results indicated that there is a very small and, as far as once growing is concerned, negligible amount of deterioration.

Single plants from fifty-four lines of various origins and having an ultra-violet ray test ranging from 0 per cent. to 8 per cent. were put out with the object of correlating, if possible, the plant type constitution of lines with the ultra-violet ray test. Owing to the very poor soil conditions very little definite information was secured. However, the following facts showed up quite clearly: Certified lines are very even in plant type constitution up to 8 per cent., but lines from other localities and countries are definitely inferior to certified lots, and as the percentage of fluorescence increases up to 8 per cent. so does the plant-type constitution become poorer. Single plants from a Station selection planted adjacent to the above were superior to ordinary certified lines.

In connection with selection work forty controlled mutual pollination crosses were made, largely with the object of becoming conversant with the necessary technique and deciding whether or not the various growth-forms breed true when crossed within themselves or when they are selfed. In most cases a good quantity of seed was secured.

Italian Rye-grass, Western Wolths, and Wimmera Rye-grass.

For some time it has been realized that the type of Italian rye-grass leaves much to be desired. With the object of clearing up this position some seventy-six lots of Italian and Western Wolths were sown last spring as rows, and thirty-one lots were put out as spaced single plants. It was seen that there was a wide variation in plant type from line to line and within each line. The following types of plants occurring in commercial lines have been recognized: (1) Dense leafy type of Italian; (2) open stemmy type—high-producing and quick maturing; (3) various types of false perennial. There is, as far as can be seen at present, no significance in the present commercial use of the name Western Wolths. Trade samples marked Western Wolths vary within the same limits as does ordinary Italian.

Rows of Wimmera rye-grass were grown alongside Italian rye-grass and bad false perennial rye-grass. The Wimmera rye-grass is essentially a quick-maturing grass and dies after one hay-cut, and is consequently of less value for normal New Zealand conditions than even the poorest of our New Zealand false perennials.

Cocksfoot.

Certification Trials.—1931–32 season: Two hundred and fifty plots and rows were sown. Owing to poor soil conditions half of these failed to survive. The remainder have made such poor growth that up to the present time it has not been possible to furnish any reports to the Agronomist. 1932–33 season: Two hundred and fifty-five lots were sown in good soil and have made an excellent strike. Reports should be available next spring.

Broadcast Trials.—One of the most promising lines under test at present is Lincoln College's C. 23 selection. The New Zealand type is still superior, especially in winter growth, to cold-climate strains.

Single Plant Study.—Growth and other characters are in close agreement with plot trial results.

Yorkshire Fog.

From three years' observation of single plants it appears that further work on this grass is not warranted at present, and the trials are being abandoned.

Brown-top.

Certification Trials.—One hundred and seventy-three lines were sown and reported on. The trials show that on the whole New Zealand brown-top is very free from red-top.

Paspalum.

Single Plant Study.—From observations made on single plants raised from commercial Australian and New Zealand samples it would appear that there is very little variation between New Zealand and Australian lines.

Agropyron Species.

During the year a number of inquiries relative to the above have been received. Eleven lines of various species have been planted out as spaced single plants and these are being tested for their suitability for New Zealand conditions. The following species have been recognized: (1) *A. cristatum*, (2) *A. tenerum*, (3) *A. Smithii*, (4) *A. divergens*. *A. Smithii* may be regarded as a possible danger on account of its strong rhizomatous growth and its coarse foliage; it has nothing to commend it. The remaining species, while not dangerous, cannot yet be regarded as promising fodder or lawn grasses. Broadcast trials under dry, arid conditions are necessary before these species can be viewed as worthy of much consideration.

White Clover.

Certification Trials.—Four hundred and fifty-seven lines sown in the spring of 1931 have been finally reported on; 550 plots were sown in the spring of 1932 on the Station area. Within eight months of sowing definite and final reports have been issued on all except forty-three of these last-mentioned plots. This autumn a further thirty-five plots have been sown.

Original Broadcast Trials.—After three years of close study this experiment has been finalized. Throughout the whole term of the trial the New Zealand certified types were outstanding.

Single Plants.—Of the original 4,000 plants planted out in November, 1929, the ten best have been kept and used to build up a selected line now being multiplied. This original single-plant study has now been finalized. From the 3,460 single plants from superior lines previously tested seventy-one plants have been selected and planted out under the tiller row and single-plant system. A total of eighty-nine plants, all exceptionally good, has been put under this system of testing. Eight hundred and twenty individual white-clover plants were studied through the seedling stages to determine how soon type could be identified from the seedling stage onward.

Elite Strain Production.—Four separate elite lines have been seeded. Plots from these lines are proving superior to ordinary mother-seed lines, the best of these being 45 per cent. better than a standard certified mother-seed line. This selection has yielded a very good seed crop, which will be sown out, for further seed production, at the Pure Seed Station, Lincoln.

Genetical.—During the late spring and early summer thirty-three pairs of plants were caged, a pair to each cage, at flowering time, and reciprocal crossing was carried out by introducing humble bees. Eight of these crosses consisted of pairs of plants superior in performance and alike in growth form. These crosses are intended to test the breeding abilities of the parent plants. Seven crosses were carried out with pairs of plants of similar type and similar HCN value in order to study the inheritance of HCN content in the plants resulting from the crosses. Four types of crosses have been made—namely, (1) good type plants high in HCN content, (2) good type plants low in HCN content, (3) poor type plants relatively high in HCN content, (4) poor type plants relatively low in HCN content. The remaining eighteen crosses completed consisted of crossing each of our ten best plants with one of three other plants. Owing to differences in flowering times, and insufficient cages, it was not possible to complete the thirty crosses as originally planned. The seed resulting from the successful crosses has now been sown out in boxes under glass frames, and later the seedlings will be planted out as single plants for further study and selection.

Red Clover.

Certification Trials.—Seventy-five lines of red clover have been sown. The majority of these lines are imported Montgomery lines or once-grown Montgomery lines which have come in under test for certification purposes. Reports have been issued on most of these lines which were sown in the spring.

Single Plants.—In September 1,600 seedlings were planted out as spaced plants. These represent three lines—two Station-selected lines and a good commercial line. These have been put out as a possible source of superior plants suitable for later strain building. At the same time a further 900 plants were put out. These consisted of 100 plants of nine different lines. Three of these were mother-seed lines, and the other six consisted of two first-harvest lines grown in New Zealand from one or other of the three mother-seed lines. The mother-seed line has been planted between its respective first-harvest lines so as to aid the comparison of the mother-seed lines with their first-harvest progeny. A note on the types of growth forms occurring in these lines has been taken. In August the best 109 plants of the extra later-flowering type in the 2,200 single plants put out in May, 1930, were picked out and replanted on the Station area.

Elite Strain Work.—The seed harvested from the seventy plants selected and planted in a block on the Station area has been sown broadcast and as single plants. A heavy seed crop has been harvested from the spaced single plants, and this will be available for field plot work. The plots of this line under trial are proving to be very dense, more leafy, and better producers than the average commercial mother-seed Montgomery lines. After seeding, some of the seventy plants died, so the remainder were blocked together, and to these were added the 109 plants selected from the 1930 plantings. This block was allowed to seed this year, and this crop will be tried out further as an elite strain.

Genetical.—Four exceptionally good plants have been crossed in pairs, in each possible combination of pairs. The seed harvested will be sown, and the progeny will be closely studied.

Subterranean Clover.

The block of fifty plants of each of twenty lines planted out last year was seriously spoilt by flooding, so this block has been discarded and a fresh series has been planted out under better conditions. Three more lines have been included in this single-plant trial. The trials so far have shown the existence of important strain differences. A small block of single plants of a dense leafy line was grown for seed, and a very good crop has been harvested. This will give a good supply of seed for further trials.

Lotus Major.

One thousand six hundred lotus major single plants have established well. During the growing season notes have been taken on these plants, and a classification into different types is being worked out. There are wide strain differences occurring amongst the plants of the lines under study.

A supply of seed from a good commercial line has been obtained by planting out a small block of single plants and harvesting the seed produced. This seed will be useful for further trials and comparisons with other lines tested or built up by selection.

Seed-production Experiments.

In order to test the best time for closing up pedigree strains for seed-production purposes the Station white clover selection block was shut up at varying dates from 13th October to 22nd December. Shutting up towards the middle of December gave the best yield of seed, with much less bulk to handle compared with the earlier shut up lots.

Two blocks, each ⅛ acre, have been sown down with dual crop, the one being a selected rye-grass plus a selected white clover, and the other a selected rye-grass plus a selected Montgomery Red. It is hoped by using the larger blocks to control the bottom growth by sheep, to take a rye-grass crop the first year, and in subsequent years a dual crop. The problem is to combine a grass and a clover in the same field to enhance the value of the area for grazing during the period of the year when a seed crop is not being produced.

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

Three additional areas have been sown, and reports on all trials have been submitted regularly by the instructional staff of the Fields Division.

SUPPRESSION OF ANNUALS IN HAWKE'S BAY AND POVERTY BAY PASTURES.

These trials have now been finalized, but little really satisfactory evidence one way or another was secured. In a dry district like Hawke's Bay it would appear that manuring through stock is more effective than direct applications of artificial manures, particularly in small plots, the effect of the dressings on these being largely masked by the superimposed animal manures wherever stock concentration is sufficiently high to liquid-manure the entire area. Manuring whole paddocks in order to increase production is sound, and the reflex of the added stock carried is in a marked betterment of the sward as a result of the urine and droppings from stock.

REGRASSING SECONDARY-GROWTH COUNTRY.

No new work has been attempted, but the areas sown have been kept under observation.

ECOLOGICAL WORK.

Detailed botanical analytical work in connection with field trials at Marton and at the Research Station have been made from time to time.

GREEN-KEEPING RESEARCH.

This scheme of work, which is undertaken on behalf of the New Zealand Golf Association, and which is primarily an inquiry into the establishment and maintenance of greens, has progressed steadily during the year. Included in its aims and objects is a definite study of lawn grasses viewed specifically from the world trade requirements in lawn seeds. The first annual report has been prepared and presented to the Council.

ALTERNATE MOWING AND GRAZING TRIALS AT MARTON AND GORE.

The measurement of performance in strain is of paramount importance when it comes to impress overseas countries with exact yield data in regard to world strains. Also when it comes to pedigree plant production some measure or other than eye is essential to gauge the relative values of these compared with the best commercial strains available. Sowings of the major strains in rye-grass, white clover, red clover, and cocksfoot, including New Zealand and overseas strains, have been made at Marton and Gore. Yields are being kept, the plots being sown in twelve replicates and measured under the "Hudson" system of alternate mowing and grazing. Owing to the lack of finance, yield-data work on the Gore series has not yet commenced.

LAND REQUIREMENT AND GLASSHOUSE ACCOMMODATION.

The urgent land requirement of the Section has been met largely by a close collaboration with the mycological work on the original Station area. Land which it is desired to rest from plant disease investigational work is utilized for the grass and clover work. The need for glasshouses is urgent in order to commence building pedigree strains of rye-grass, white clover, red clover, Italian rye-grass, and cocksfoot. Means to control pollination in the early stages in the building-up of a pedigree strain is essential, and at Palmerston North the only practical means is within glasshouses.

FIELD EXPERIMENTS SECTION.

A. W. Hudson, Crop Experimentalist.

The total number of experiments in existence is 568, compared with 586 for the corresponding date in 1932. While the number of experiments with annual crops has been well maintained, there has been a slight reduction in the number of pasture top-dressing experiments.

A feature of the more recently inaugurated experiments has been the close collaboration with other specialist officers, and the carrying-out of co-operative trials on farms to form a connecting link between the research work at the Plant Research Station or the Wheat Research Institute and the extension work of the Fields Division. The active co-operation of the Director of the Fields Division and his staff, in spite of considerable demands on their services from other directions, has been the chief factor in enabling this policy to be pursued.

During the year fourteen reports on experiments, or reports containing reference to results from experiments, have been published in the *N.Z. Journal of Agriculture*.

A. RESEARCH INTO FUNDAMENTAL GRASSLAND PROBLEMS.

(1) Marton Experimental Farm.

Nine trials are now being carried out under the "alternate mowing and grazing" technique. Four of the experiments outlined in the previous annual report have been finalized. Two of the investigations are being continued.

During the past year seven new investigations have been instituted. Three of these deal with the following aspects of manuring: (*a*) Heavy infrequent versus lighter and more frequent applications of ground limestone, (*b*) comparison of different forms of nitrogenous fertilizers and methods of applying in relation to the dressings of minerals, (*c*) comparison of different phosphatic fertilizers in conjunction with and without liming.

Soil studies and chemical investigations of the pasture herbage are being carried out on all the manuring trials by the Analytical Chemist.

The alternate mowing and grazing technique is also being applied in four experiments to the determination of the following on behalf of and in collaboration with the Agrostologist: (*a*) Comparison of rye-grass strains, (*b*) comparison of clover strains, (*c*) comparison of cocksfoot and red clover strains, (*d*) comparison of seeds mixtures.

The tethering of sheep technique as practised at the Plant Breeding Station at Aberystwyth, Wales, was given a trial as a means of comparing production as influenced by manuring. It was found to be too laborious a method for adoption at the present stage of the work.

(2) Ruakura Farm of Instruction.

This trial has been continued, and the results are being published as Part V of Bulletin 31, Department of Scientific and Industrial Research.

(3) Gore Experimental Area.

A series of trials on strains of rye-grass, clovers, and cocksfoots, and a seeds-mixture trial, similar to those being carried out at Marton, were sown at the Gore Experimental Area, in addition to an area for investigation of fertilizer problems. Unfortunately, the financial position has prevented these trials being put under measurement as yet. The importance of having a series of similar trials to those being conducted at Marton carried out under different soil and climatic conditions is obvious.

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

(1) Grazing Trials on Dairy Farms to determine the Effects of Nitrogen.

Only four of these trials are being carried on during the present season, and these, with one exception, are on experimental farms or subsidized demonstration areas. In the 1931–32 season, which was the fourth of this series of trials, the average increase per hundredweight of nitrogenous fertilizer applied was considerably below that obtained in any of the three previous seasons. The results obtained are being summarized and will be submitted for publication, together with a summary of the results of the 1930–31 season.

(2) Grazing Trials to determine the relative Merits of Hawke's Bay Certified Perennial Rye-grass and Typical Canterbury "Perennial Rye-grass."

Reports on the six trials that are being carried out indicate that the Canterbury rye-grass is being largely displaced by cocksfoot and white clover, which, under favourable spring conditions, maintained production on these fields fairly well. The Hawke's Bay rye-grass fields, however, continue to provide a larger amount of grazing, and up to date have given an average increase of 30 per cent. over the production of the Canterbury rye-grass fields. The margin of superiority of the Hawke's Bay fields has therefore not been widened during the past year, due mainly to the reasons stated above.

(3) Observational Top-dressing Experiments.

The response-to-manure survey of New Zealand by means of observational top-dressing experiments is being continued and extended as far as the limited facilities will allow. These trials continue to show the marked effect of potash, in combination with phosphate, on production in parts of Taranaki and in certain districts of the Auckland Province. Very appreciable lime responses have also been indicated in many trials, particularly so in parts of Auckland Province. Some of these latter tend to indicate that lime is the major limiting factor to production in certain districts.

Such responses in the districts cited were, up to a short time ago, unsuspected, and it seems desirable to increase the number of trials in these districts as rapidly as possible, so as to define the limits of the lime or potash deficient areas. With this object in view, and in order to obtain a wider distribution of experiments generally, many of the older observational trials will be finalized in the near future, to be replaced by further trials in districts not hitherto served.

About three hundred and ninety observational experiments on pasture are in existence at the present time, and it is considered that about two hundred of these have been laid down sufficiently long to indicate any responses due to fertilizers which can be observed, and these will be discontinued. The results from many of these experiments have been summarized and published.

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

Although the superiority of the better types of pasture species over the inferior types has been fairly well established, a total of twenty-three strain trials, which combine demonstration with investigation, have been laid down. It is considered that actual demonstration will do more than anything else to impress farmers with the importance of sowing species of the correct strain. Six of these are being carried out in conjunction with the grazing trials mentioned under (2) above. In addition to those mentioned, a few of the older strain trials are still in existence, but the purposes of these have now been served and they will be abandoned in the near future.

(5) Legume Inoculation Trials (in Collaboration with the Mycologist).

Following the success which has attended the inoculation of lucerne in most districts, arrangements are being made to lay down a number of experiments to determine the effect of inoculating other leguminous species such as red clover, white clover, and lupins, with the appropriate bacterial culture. These are being carried out in arable districts chiefly, where a period of several years elapses between the ploughing-up of one leguminous crop and the sowing of another on the same ground. The comparative failure of white clover as an associate pasture species under dry conditions is generally attributed to the dryness. The question of inoculation has never been seriously considered, and to what extent it may constitute a limiting factor is worthy of determination. The importance of the legume on soil fertility, and, in the case of white clover in particular, its influence on pasture production and utilization, cannot be emphasized too strongly.

(6) Seed Production (in Collaboration with Agrostologist and Seed Analyst).

Trials have been laid down at Gore Experimental Area to investigate factors affecting the germination of rye-grass and Chewings fescue seed respectively. Three trials have been laid down on Banks Peninsula to observe the effect of fertilizers on cocksfoot seed production. A trial on the effect of fertilizers on the production of rye-grass seed is being arranged in Central Otago.

C. EXPERIMENTS ON ANNUAL CROPS CARRIED OUT BY OFFICERS OF THE FIELDS DIVISION.

(1) Wheat.

(*a*) manuring.

During the year nineteen trials were laid down in the Canterbury District and four in the Otago District.

With the exception of three experiments laid down in districts where the effect of superphosphate was in doubt, "no-manure" plots were excluded from experiments during the 1932–33 season. The advantages of using 1 cwt. super per acre with wheat have been repeatedly demonstrated by experimental results in the past. The average increase due to the use of 1 cwt. super in 113 experiments which have been conducted to date, including the three mentioned above, has been 4·3 bushels per acre.

The main line of investigation was centred on the use of nitrogen, and all experiments laid down involved the use of different forms, chiefly sulphate of ammonia and nitrate of soda, and different times of application.

Conditions for the growth of the wheat crops were distinctly favourable as compared with the two preceding seasons, yet the results from nitrogen applications were not encouraging. The average increase from 1 cwt. of sulphate of ammonia top-dressed in August was 2·2 bushels per acre, and nitrate of soda at 1 cwt. to 149 lb., applied in September, gave an average increase of 2 bushels per acre. Applications of sulphate of ammonia with the seed in some cases resulted in delayed germination, while in one or two instances germination and yield were adversely affected, with the result that the average increase from this treatment was only 0·9 bushels per acre.

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

Two trials were carried out in which the rate of seeding varied from 60 lb. to 120 lb. per acre. The results confirm those of 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 occur. In addition to being of importance in connection with variety trials, the information to date suggests that a little more rather than less seed should be used in common practice.

(*c*) wheat variety trials.

Nine variety trials were carried out in collaboration with and on behalf of the Wheat Research Institute. In five of these, crosses of White Fife and Solid Straw Tuscan supplied by the Wheat Research Institute were tried out against Solid Straw Tuscan. With the exception of one experiment, the latter was higher in yield than the crossbred wheats, although three of these showed much promise in view of their high milling and baking qualities. The average increase of Solid Straw Tuscan over these three crossbred lines was 1·4, 1·6, and 2·1 bushels per acre respectively. In the remaining variety trials Solid Straw Tuscan was in all cases much superior in yield to the standard varieties with which it was compared.

(2) Barley.

Manuring.—Three experiments were carried out, one in Canterbury and two in Central Otago. The increases resulting from the use of 1 cwt. superphosphate were 5·6, 7·5, and 2 bushels per acre respectively. In the Canterbury trial sulphate of ammonia, 1 cwt., applied with the seed, depressed the yield by 2·9 bushels, but the addition of ½ cwt. sulphate of potash to super increased the yield by 1·3 bushels over that of super alone. In the Central Otago experiments nitrate of soda at 1 cwt. was top-dressed, and this gave increases of 5·9 and 3·9 bushels per acre respectively. In both these trials sulphate of potash at 1 cwt. per acre slightly depressed the yields when used with super, but gave slight increases when used with super plus nitrate of soda.

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

(3) Potatoes.

(*a*) manuring.

Early Potatoes, Pukekohe District.—Three experiments were laid down in 1932, the full programme of work contemplated not being possible owing to other duties engaging the attention of the Instructor concerned.

South Island Manuring Experiments on Main Crop Potatoes.—Seven experiments were laid down in 1932, and these are progressing favourably. The results of the 1931–32 season's experiments were published in the *Journal of Agriculture* for February, 1933.

(*b*) SOURCE OF ORIGIN OF SEED-POTATOES EXPERIMENTS.

Investigations into the effect on yield and incidence of virus in a line of seed potatoes grown at nine different centres in the South Island have been in progress over the past two years. When these lines of seed were brought together in a yield trial in the 1931–32 season striking differences in the amount of disease in the various lines were exhibited, and whereas the percentage of disease shown by some lines of seed had been doubled from that in the previous year, other lines, particularly those grown in colder districts, tend to show a decrease in the percentage of disease present. There was also high correlation between the total amount of virus and the yields from seed from the various centres. Arrangements have been made to continue this investigation with another variety—Dakota—which is relatively more immune to mosaic and less immune to leaf-roll than the Arran Chief variety used in previous trials.

(*c*) POTATO VARIETY TRIALS.

On account of the high percentage of virus in some of the varieties under trial, these experiments were not continued in the 1932–33 season.

(4) SWEDES AND TURNIPS.

Manuring.—Commercial basic super and mixtures of super and slaked lime were tried out against a mixture of equal parts super and carbonate of lime. Eight experiments in which these treatments are included have been laid down in the 1932–33 season. Up to the present the use of super plus carbonate of lime in equal parts has provided the best means of overcoming serious germination injury accompanying the use of super alone, and has resulted in increased yields. Trials at the Plant Research Station have indicated, however, that the effect of lime in overcoming germination injury caused by super depends to a large extent on the kind of limestone used, and further trials will be carried out next season with carbonate of lime from the principal sources of supply.

Effect of Liming and Manuring on Club-root.—Five trials to determine the effect of liming and manuring on club-root, carried out in collaboration with the Mycologist, are being continued.

Varieties in Relation to Club-root.—A number of varieties of swedes and turnips are under trial at the Gore Experimental Area to determine their resistance to club-root.

(5) RAPE AND RELATED CROPS.

Feeding Value of different Types (in Collaboration with the Agronomist).—Sixteen experiments to determine the feeding value or relative palatability of the three different main types of rape, and different types of kale and chou moellier, have been laid down. In some of these records are being taken of the carrying capacity of the areas sown and the increases in weight of the lambs carried.

D. MISCELLANEOUS EXPERIMENTS.

Other experiments being conducted include the following: Lucerne manuring; maize manuring; maize varieties; methods of pasture establishment.

MYCOLOGY SECTION.

G. H. CUNNINGHAM, Mycologist.

This report covers briefly the more important investigations undertaken during the year ending March, 1932–33, by officers permanently or temporarily attached to the Mycological Laboratory. Details of the work outlined will be found in papers published during the year by members of the staff, or in the quarterly progress reports.

(1) DISEASES OF SWEDES, TURNIPS, AND RAPE.

The following diseases are the limiting factors in the successful culture of brassicas. Consequently work has been concentrated upon the development of methods whereby dry-rot and club-root may be economically combated. Results secured during the past season have shown that if dry-rot free, club-root resistant seed is used, not only will clean crops be secured, but several successive crops may be grown upon the same land.

DRY-ROT (*Phoma lingam*).

As past work has demonstrated that this disease is seed-borne, and that it may be combated by the use of clean seed, work has been concentrated upon improvements in methods for producing clean seed.

To test the efficacy of the method of disinfection of seed by the hot-water process introduced by this Laboratory, and to demonstrate to farmers that use of clean seed results in a dry-rot free crop, eleven farm crops, totalling 300 acres, were sown in several localities. For the purpose naturally infected seed was selected, disinfected, and sown on land which had not been in brassicas the previous season. The crops remained dry-rot free throughout the season, thus demonstrating both the efficacy of the disinfection treatment and the fact that this affords a practicable method of combating this serious disease.

Advantage is being taken of the facilities afforded under the Small Farm Plan to grow for commercial distribution quantities of dry-rot-free swede seed. The objects of this are twofold, for it enables us to demonstrate that brassica seed may be grown readily within the Dominion, and to supply in bulk a high germinating line of seed absolutely free from the disease. Seedlings are being raised at the Tiritea area, sufficient being grown to plant out 10 acres (on selected small farms) for seed production. At this initial stage only one variety, Herning, is being employed, since this is both free from dry-rot and resistant to club-root. Consequently those using the resultant seed will be able to secure satisfactory crops even on club-root infected soil, provided certain additional precautions are taken.

Club-root (*Plasmodiophora brassicae*).

Work during the year has been concentrated upon the production of resistant swedes, turnips, and rape, and in improving methods of increasing resistance by the use of lime. Resistant strains under test are several selections of swedes, as Station Herning, Superlative, and Canadian selections of Herning; of turnips the variety Bruce (a Scottish selection); and of rape, three Station selections. Of these the Station selections of Herning have proved to be the most resistant of all brassicas tested, being more resistant than the mother line (of European origin) from which they were selected; the Canadian selections, too, have proved most satisfactory; the Station Superlative proved highly resistant in the preliminary tests, but gave indifferent results when tested on a field scale. The turnip Bruce has proved moderately resistant in the South, but owing to the difficulty of growing the Aberdeen type in the North it has not been possible to test it against the resistant swedes at the Tiritea Area. The resistant strains of rape have proved promising, but work has not yet proceeded beyond preliminary trials at the Area. Further selections are being undertaken with a view to improving the resistance of the most promising strains, selections being planted with a view to seeding this coming season. The most resistant Herning selection is being used in connection with bulk seed production in connection with the Small Farm Plan as discussed in the preceding section.

On land in which the spore load is reasonably low (as where moderate infection had occurred the previous season) a practical control is now possible when 33 cwt. of burnt lime is applied three months in advance of sowing the crop, and when seed is drilled with basic slag or a mixture of equal weights of superphosphate and slaked lime. Investigations have shown that spores may remain in the soil in a viable condition for three seasons at least, and that certain weeds, as Shepherd's Purse, may act as carry-over hosts for the pathogen.

(2) CEREAL DISEASES.

Cereal Smuts.

During the year recently introduced dusts were tested against the standard hot-water treatment for control of smuts of wheat and barley. In the course of these investigations it was found that the variety Jumbuck, which has proved to be a suitable wheat for the North Island, was most susceptible to seed injury resulting from treatment; consequently further work was carried out with a view to improving the process necessary for disinfection without injury to germination.

Further work has been commenced on a series of comparative field trials with the various copper carbonate and organic mercury dusts. Dusting is being conducted at monthly intervals from harvest to sowing, to ascertain whether the time of dusting has any relation to efficacy in controlling smuts.

Cereal Rusts.

An attempt is being made to ascertain the biotypes of the cereal rusts present in the Dominion, both of cereals and grasses, as a preliminary to work on production of resistant varieties. As these fungi cannot be combated on a field scale by chemical treatment, the only means of reducing the heavy annual losses they induce lies in the production of cereals and grasses resistant or immune to attack.

(3) POTATO DISEASES.

Wilt Diseases.

Work on the wilts has now been completed, and the results of the past four seasons' experiments will shortly be published. During the course of this work some fifty fungi were isolated; but of these very few proved to be responsible for wilting of the haulms. The presence of vascular discoloration in the tubers was found to have no value as an indicator, since most wilted plants were secured from tubers in which this condition was absent.

Internal Brown-fleck (Cause unknown).

The past season's work confirmed that of the previous year, to the effect that infected tubers were more likely to produce a diseased crop than when healthy tubers were used. Certain varieties proved highly susceptible, notably Northern Star and Arran Victory.

Virus Diseases.

About 7 cwt. of virus-free seed, of four varieties, is now available; this being the product of those lines grown during the year at the isolation area at Tangimoana. These lines will be bulked in new land at 1,200 ft. altitude, on the foothills of the Tararuas, with a view to ultimate commercial distribution.

(4) DISEASES OF PEAS, BEANS, LUPINS, ETC.

Sore-shin of Lupins (Cause unknown).

Despite numerous experiments it has not been possible to work out a field method of control of this disease. Negative results were secured in plots which were heavily limed, treated with chemical disinfectants, or different manurial applications. Numerous fungi have been isolated from infected plants, but all inoculations have proved negative; consequently the cause is at present unknown. This work is being continued.

Collar-rot of Peas (*Ascochyta* spp.).

A small quantity of pea seed free from this disease has been secured from lines grown at Tangimoana. This will be bulked on one of the small farms with a view to commercial distribution. Clean seed, sown on land previously in an infected crop, produced peas free from collar-rot; thus demonstrating that (*a*) the disease is seed-borne; (*b*) it does not persist in the soil for more than a limited period; (*c*) use of clean seed affords a practical method of control.

Bean Wilt (*Bacterium medicaginis f. phaselicola*).

Small quantities of wilt-free bean seed, of several varieties, have been produced at the Area and Tangimoana. These lines will be bulked for commercial distribution on one of the small farms. Although promising results have been secured with a method of seed treatment, further work is necessary as complete disinfection has not yet been obtained.

Virus Diseases of Peas, Beans, etc.

Transmission of mosaic from clover to healthy peas has been demonstrated, the vector being *Aphis rumicis*. Attempts are being made to ascertain whether pea mosaic is transmitted with the seed. Attempts to transmit pea mosaic to French beans were unsuccessful.

Lucerne Nodule Organism.

During the year cultures of the lucerne organism have been distributed in quantity sufficient to inoculate 69,500 lb. of seed, showing an increase of 80 per cent. over the previous season. These were forwarded to 1,037 farmers, an increase of upwards of 40 per cent. over last season.

Clover Nodule Organism.

Experiments are being carried out with a view to ascertaining whether improvement in establishment of red and white clovers can be secured by inoculation of the seed with strains secured from nodules present on the different clovers.

(5) CHEESE AND BUTTER MOULDS.

Inoculations of pat butter with various moulds (reported as contaminants of butter in store) gave negative results; save in the case of an *Aspergillus*, which produced a distinct taint.

Colloidal sulphur was proved to be ineffective in preventing mould growth on cheese bandages. Thirty-two small cheeses were made and inoculated with various moulds, to ascertain whether fungi were responsible for the various discolorations present in occasional cheeses. This work is not yet completed, but results have so far shown that the fungi used are in no way responsible.

An officer of the Laboratory, Mr. W. D. Reid, was loaned to the Dairy Research Institute for two months to assist in work connected with the effects of bacteria on cheese discoloration.

(6) FOREST TREE DISEASES.

During the year a detailed disease survey was conducted through the exotic plantations of the State Forest Service in both the North and South Islands. As a result, it was ascertained that the following major diseases were present:—

Phomopsis strobi was found in all regions on *Pinus radiata* where this was grown in regions subjected to severe winter conditions. It has been proved experimentally that the fungus is able to attack trees only through injuries induced by frost or snow, but that once established it may become actively parasitic and kill outright trees under ten years of age. Precocity of growth appears to be a contributary factor.

Diplodia pinea was found to be responsible for serious losses in seedling *Pinus ponderosa* (and other species to a less extent) in nursery beds, and a moderate loss in areas recently planted when unfavourable conditions were experienced following planting. The fungus was also responsible for the production of a "red-top" condition on *P. ponderosa*, *P. Laricio*, and *P. austriaca* in certain regions where unseasonable frosts were experienced, killing the topmost whorls and leaders.

Stag-heading was found to be prevalent in regions where soil conditions were unfavourable, as in the poorer pumice soils of the North, clay soils of Moutere, light gravels of Canterbury, and above a certain altitude in Otago.

Root-rot, due to a fungus at present unidentified, was found on several species of pines in plantations set out in areas previously under native forest.

Phomopsis juniperivora was found to be responsible for a serious loss in nursery stock of *Cupressus macrocarpa* and *C. lawsoniana*, and under certain conditions to produce gummosis and death in established trees of these species in the field.

(7) FRUIT-TREE DISEASES.

Orchard Sprays.

During the year three papers on orchard sprays were published in the *N.Z. Journal of Agriculture*. These dealt with units of measurement, preparation and use of (*a*) sulphurs, (*b*) lime-sulphur, and (*c*) copper sprays. In consequence of the publication of these papers, orchard spray practices have been profoundly modified, many of the materials formerly in use being discarded by the orchardist as being of little value.

Disease-control Experiments.

Some five hundred experiments were conducted during the year with a view to improving disease control and reducing the costs of application. This is the third and final season for most of these experiments. Results have been incorporated in orchard practice wherever possible, and have led to very material improvement in disease and pest control, certain diseases—formerly serious problems—being controlled to such an extent that they are almost ignored by the orchardist.

Canker-producing Fungi.

A study has been made of certain obscure cankers found in the orchards, the fungi responsible isolated, and their pathogenicity established. In this way it has been ascertained that *Gloeosporium perennans* and *Neofabraea malicorticis*, two fungi responsible for apple branch cankers in North America, are present in the Dominion.

Fungous Wastage in Cool Store.

Investigations covering three seasons have now been completed, and the fungi responsible for decay of fruits in store isolated and identified. In most cases the cool-storage factors responsible for the onset of these organisms have been ascertained, for it is hoped that a knowledge of these may aid in reducing losses of this nature.

(8) SMALL-FRUIT DISEASES.

Strawberry Virus Disease.

Inoculations have demonstrated that a serious strawberry disease prevalent throughout New Zealand is due to a virus, and attempts are being made to procure virus-free plants for commercial distribution.

Tomato Diseases.

An intensive study is being conducted with a view to ascertaining the tomato diseases present in the Dominion, and possible methods of control. To date this work has covered diseases caused by leaf-mould, sclerotium disease, the virus diseases black-stripe and mosaic, and blossom-end rot (non-pathogenic).

(9) SILAGE INVESTIGATIONS.

With a view to improving the quality, process of manufacture, and palatability of silage a series of investigations has been undertaken covering the following points: (*a*) Influence of bacterial cultures on preservation of silage; (*b*) effect of age of grass and its degree of wilt; (*c*) effects of molasses; (*d*) use of Virtanen process in silage production.

So far it has been ascertained that a sweet and green silage can be made when cultures of certain bacteria are used; that molasses alone improves the product; and that by use of the Virtanen process (application of certain acids in dilute solutions) a good-quality silage may be produced. The cost of acid in New Zealand is, however, so great that the last-mentioned process is too costly to introduce into farm practice.

(10) VEGETABLE AND FLOWER DISEASES.

Celery Leaf-spot (*Septoria apii*).

This, a seed-borne disease, has been effectively combated at the Station by a hot-water treatment evolved during the year.

Pelargonium Rust (*Puccinia pelargonii-zonalis*).

A method for combating this disease, troublesome in cultivated "geraniums," has been evolved, the process consisting of dusting or spraying plants at intervals with certain sulphur compounds.

Bulb Diseases.

Investigations are under way with a view to combating decay of flower bulbs carried by various fungi.

(11) TOBACCO DISEASES.

The virus diseases of tobacco, which cause considerable losses throughout the Dominion, have been made the subject of investigation. From the data secured during the past season, practical methods of combating these diseases have been evolved, and will be utilized in reducing losses this season.

(12) GRASS AND CLOVER DISEASES.

Defective Germination of Perennial Rye-grass.

Experiments are under way to determine whether defective germination of certain lines is due to fungi associated with the seed-heads. For the purpose certain treatments have been worked out, and the treated seed sown for test. Promising results have been secured with certain lines of low vigour. From infected seed four fungi have been isolated, and their pathogenicity is being tested.

Rusts of Perennial Rye-grass.

As striking differences have been noted in clonal lines of perennial rye-grass under test by the Agrostologist at the Tiritea Area, work is being undertaken to ascertain whether it is possible to select lines resistant to both rusts (*Puccinia graminis* and *P. coronata*) from these.

Clover Virus Diseases.

In conjunction with virus diseases of other legumes, those present on clovers in New Zealand are being investigated. Up to the present it has been found that the virus present on red clover may be transmitted to garden peas, and that the virus reduces the herbage by about 50 per cent. Further work on transmission in the field is under way.

ENTOMOLOGY SECTION.

J. Muggeridge, Entomologist.

The past year has been a particularly busy one in regard to the amount of both routine and research work. The routine work involved a good deal of correspondence dealing with the identification of insects and their control, the preparation of reports, and the care and attention of the entomological collection.

The following exotic insect pests were recorded as being present in New Zealand:—

Haplothrips niger Osborn, on *Trifolium pratense* (first record from Southern Hemisphere).—This insect, which is now well distributed in New Zealand, is a serious menace to the production of clover seed.

Listroderes costirostris. Gyll. (*Desiantha nociva;* Lea).—A South American species now established in Australia and South Africa.

Psila rosae F.—The common carrot fly of Britain, also referred to as the "carrot-rust fly," owing to the characteristic rusty marks which the larvae leave in the carrot root.

Ceroplastes rusci.—This scale has a wide distribution and attacks, among other things, pear and citrus fruits.

Ceroplastes rubens.—Like the scale *C. rusci*, *C. rubens* has a wide distribution and a very wide host-range. It is reported as attacking ninety-two plants representing forty different families.

RESEARCH.

Pieris rapae (White Butterfly).

The past season has been very favourable for the multiplication and spread of the white butterfly. It is now found in practically the whole of the North Island as far as Auckland, and has been found at Picton, Leefield, Ward, and Christchurch, as well as Timaru, in the South Island. It was most prevalent in the Hawke's Bay district; and near Hastings, where its depredations were under observation, it proved a serious menace to chou moellier and rape crops.

To combat the butterfly menace large numbers of its natural enemies were imported from the Farnham Royal establishment of the Imperial Institute of Entomology, London. Two species of natural enemies were imported—namely, *Apanteles glomeratus*, a parasite which attacks the butterfly larva in its early stages, and *Pteromalus puparum*, a pupal parasite which lays its eggs and develops at the expense of the butterfly pupa. One hundred thousand cocoons of *A. glomeratus* were imported, from which adults were reared under insectary conditions for liberation in the field. From the 100,000 cocoons 43,330 parasites emerged, and 1,543 hyperparasites. Of these, 37,682 of the parasites were sent into the field, while all of the hyperparasites were destroyed. There were two consignments of the *P. puparum* parasites; the first lot, which arrived on 5th January last, consisted of 706 parasitized puparia, while the second batch, which arrived on 27th January, consisted of 1,046 parasitized puparia.

From both of these consignments 12,386 parasites were reared, and of this number 10,812 were sent into the field. All of both species of parasites were liberated in the vicinity of Maraekakaho, near Hastings, the object in concentrating the material in this fashion being to ensure, as far as possible, the establishment of the parasites.

From observations made in the field it has been found that both species of parasites are at work, but a comparatively long period must yet elapse before the full effects of their presence will be felt; meanwhile, it is hoped that further money will be made available for an intensive prosecution of this work along the lines already started.

Plutella maculipennis (Diamond-back Moth).

During the past season the diamond-back moth was extremely prevalent, and most of the injury caused by this insect was, by popular opinion, attributed to the white butterfly. Particularly was this statement true in the Manawatu district, where comparatively few of the butterflies occurred and yet the injury to cruciferous crops was considerable. In the Hawke's Bay district, however, especially in chou moellier crops, the butterfly was a greater menace than the moth. It is patent that the combined attacks of the above two insects are likely to prove disastrous to cruciferous crops in New Zealand, and to avoid such a happening it will be necessary to concentrate on the biological control of the moth as well as on that of the butterfly.

Trialeurodes vaporariorum (Greenhouse White Fly).

During the past summer colonies of the white fly were established in the glasshouse and insectary in preparation of the receipt of its natural enemies from the Imperial Institute of Entomology. From the consignment of parasites, which arrived on 5th January last, only a few were observed to emerge, and unfortunately they did not become established. We hope to continue the importation of these parasites until a colony is established.

Thrips.

With the assistance of the Horticulture Division a survey of the *Thysanoptera fauna* in orchards is being made, and up to the present three previously unrecorded species have been found. These are *Isoneurothrips australis*, *Isoneurothrips* sp., and *Taeniothrips vulgatissimus*.

Oil Spray Experiments on Red Mite Eggs.

Numerous tests on the ovicidal effect of sprays on red mite eggs were carried out during last winter. The experiments indicate that 90 per cent. of the winter eggs of the mites are susceptible to oil treatment when the oil is applied at a concentration of 1–10.

Eucoslaspis brunneus (Bronze Beetle).

Work on this subject has been carried out now for two successive seasons. The purpose of these experiments was to ascertain qualitatively the factors which operate against a successful control, since it is a common belief that arsenate of lead is ineffective against the bronze beetle. All work was carried out in the laboratory.

Results in 1931–32 showed that complete protection of the fruit and a complete kill of the beetle could be obtained by securing a complete cover of arsenate of lead or oil. The results then at hand showed that it was possible that the pest had been repelled by the spray and that the kill may have been secured by starvation. Results of the 1932–33 experiments show definitely, however, in the case of lead arsenate at any rate, that this is not the case, and that the effect is a poisoning one. Results may be summarized as follows: (1) Lead arsenate (2 lb. in 100 gallons water) can effectively poison the bronze beetle; (2) a complete coverage of the surface to be protected is absolutely necessary for control; (3) there is a minimum effective amount of arsenate deposit required for control; (4) oils, if applied so as to produce a complete cover, will protect the fruit; (5) lead arsenate plus oils in suitable proportions will protect the fruit.

Cydia pomonella (Codlin Moth).

The information secured on this subject by the use of bait traps of fermenting molasses shows that for two successive seasons there has been only one generation of the moth per season in Palmerston North. It can also be shown that the calyx spray is not as important as some authors state.

Biology of Red Mite (Paratetranychus pilosus).

Material for a complete statement of the biology of the red mite in New Zealand is almost secured. On an examination of the data secured up to June, 1932, it was decided that additional information on the overwintering of egg-laying habits of the mite should be secured before the results of the investigation were presented. This work is now almost finished. The known host list of the European red mite in New Zealand comprises apple, pear, peach, and plum. The life history of P. pilosus is as follows:—

(1) Winter egg hatching: Period over which this occurs is mid-September to early in November.
(2) Length of period from hatching to adult: Approximately twelve days.
(3) Number of eggs laid by one female: Varies from fifteen to thirty.
(4) Incubation period of summer eggs: Ten to twelve days.
(5) Winter egg laying: This may take place as early as the end of January and continue on to mid-April. The egg-laying period thus may spread over a period of three months at least. In late January and in February, when leaves are assuming the brown colour, due to mite attack, winter egg laying is going on. After having started this egg-laying the mites disappear from the trees in a comparatively short time.

Four natural enemies of *P. pilosus* have been found—namely, (1) A ladybird predator, *Scymnus* sp., (2) a predacious midge larva, (3) and (4) two species of predacious mites. Only one of these enemies is important—*Scymnus* sp.—judging by observations up to date.

Odontria zealandica (Grass Grub).

During the 1931–32 and 1932–33 seasons experiments were made with Orach or Canadian spinach, a plant which was said to be very attractive to the beetle. This was planted at intervals during the two seasons stated, and, when suitable, sprayed in November and December with arsenate of lead. Observations show that the plant is freely eaten by the beetle, but it was impossible to judge how many were actually killed by the poison. Some of the plants were stripped almost bare of leaves. It had been claimed that hundreds of beetles could be found dead beneath the sprayed rows. This did not prove to be so in the experiment, so that as far as killing the beetle is concerned the tests were inconclusive.

In 1932 further experiments were conducted with the arsenate of lead treatment on turf against the larvæ. This work showed that the broadcasting of arsenate of lead powder at the rate of 5 lb. per 1,000 sq. ft. of surface is successful in eradicating the grub. On a poor turf such a treatment tends to discolour the grass after a time, but this can probably be obviated by suitable manuring. Further experiments have been conducted on the use of carbon disulphide. This work has shown that various amounts of the chemical are required for different types of soil. The application in the emulsion form is more economical than when the raw material is injected into the ground. Experiments were also conducted by making surface application and injection of naphthalene and paradichlorobenzene, but over a period of three to four weeks these treatments had no apparent effect on the grub. The experiments, however, were not very conclusive. Experiments have been laid down in 1933 to corroborate those of 1932.

BOTANY SECTION.

H. H. Allan, Systematic Botanist.

Routine Work.

This work has followed the lines of previous years. Identification of and advice on specimens sent in has reached considerable dimensions, and has occupied a good deal of time. This service is evidently increasingly valued and taken advantage of. It is pleasing to note the interest awakened in various schools, both in the indigenous and the introduced flora. Various papers have been written to assist the work of the Junior Red Cross League in furthering the study of grassland by its members.

A number of new records of introduced plants have been made, some of considerable importance. Officers of the Department of Agriculture are evidently watching the incoming of aliens with increasing care, so that early advice may be secured concerning them.

To facilitate this work, as well as to assist special investigations, exchange of herbarium material with stations abroad has been continued, so that this Station now possesses a valuable herbarium of foreign species identical with or allied to those introduced into this country. Exchange of publications has also resulted in valuable accessions to the library, to which has also been added further contributions from Dr. L. Cockayne, C.M.G., F.R.S.

Research Work.

As indicated previously, the major investigations undertaken have been the revision of the systematics of the grasses of New Zealand and of the alien flora. The manuscript of the books dealing with these researches has been brought near to finalization. In addition an introductory book on the grasses of New Zealand, for which there is evidently a demand, has been prepared and is almost ready for submitting for publication. In the work on grasses my assistant, Mr. V. Zotov, has given a remarkable amount of assistance and has prepared a complete set of illustrations.

Special attention has been paid to the supposed poisonous plants, many specimens considered to have caused mortality in stock having been sent in during the year. A series of articles is in progress dealing with the more important aliens recently observed.

The more technical aspects of the work on systematics are being published in appropriate journals, including an important paper on hybridism prepared in collaboration with Dr. L. Cockayne.

Mr. C. Woodhead has conducted an investigation on Northern Spy apple root-stocks, and has isolated nine types for further study. These have been propagated this year. A full report on this work has been prepared, and a general account is being published in the *New Zealand Journal of Agriculture*.

SEED TESTING SECTION.

N. R. Foy, Seed Analyst.

During the twelve months ending December, 1932, 13,917 seed samples were received for testing purposes, the total representing an increase of 2,151 on the number received for the previous year. Of this total, 12,050 samples were tested for purity and germination, and 1,867 were germinated for examination under ultra-violet light.

The distribution of the 12,050 samples for purity and germination was as follows: Seed trade, 9,165; Department of Agriculture, 2,469; other Government Departments, 33; Massey Agricultural College, 143.

For the quarter ending March, 1933, 4,546 samples have been received, which represents an increase of 20 per cent. on the number for the same period in 1932.

Purity Inspection of Certified Perennial Rye-grass.

In 1932, 392 machine-dressed samples of certified rye-grass mother seed were passed on purity for sealing and tagging, of which 8, or 2 per cent., were rejected. For the 1933 season, all certified rye-grass samples inspected, and for the quarter ending March, 688 had been examined, of which 17, or less than 3 per cent., were rejected.

Government Seed Purchases.

During the year 1932, recommendations on a relative-value basis have been made to the Stores Purchasing Officer for all State purchases of grass, clover, and other forage seeds. A total of 594 purity and germination tests have been made on samples drawn from bulk deliveries and the results reported to the Stores Purchasing Officer with any commentary based on a comparison of purchase specification and delivery quality as might appear necessary.

Deterioration of Grass Seed during Shipment from New Zealand.

During the year several trial shipments of predried Chewings fescue were made in co-operation with seed-houses in New Zealand, England, United States of America, and the Seed Testing Stations at Cambridge and Washington. An additional parcel was shipped in cool storage by the steamer in which 500 sacks suffered almost complete deterioration during the previous voyage. In all predried lots the seed was landed with only a slight loss in germination capacity, this loss being approximately equal to that sustained by control samples held at this Station. The germination of seed shipped as ordinary cargo dropped from 25 per cent. to 40 per cent. more than the dried seed. It was observed that some lines carried better than others, even when predried, and that the same lines showed a marked tendency to deteriorate more quickly than others, under dry storage in New Zealand. It would seem, therefore, that the efficacy of predrying is relative to seed vitality, and that the harmful results of high temperature are offset by a low humidity, and what may be termed the normal rate of deterioration is not retarded.

Laboratory studies with seed of different contents of moisture held for various periods at specific temperatures showed not only the harmful effect of combined high temperatures and degrees of humidity, but also that seed of normal moisture content could be held for long periods at low temperatures. The idea of shipping seed in cool storage is by no means new, but trouble has always arisen in the provision of suitable steamer storage.

During a recent visit by the writer to the Southern districts the questions of predrying and cool storage were fully discussed with representatives of the seed-exporting houses, all of whom, after perusal of the evidence produced, were impressed with the possibilities of special treatment or storage. In view of the depressed state of the market and the high landed costs of drying equipment, the idea of cool storage specially appealed to the majority. Immediately negotiations were commenced with the shipping companies, and as a result limited cool-storage space was made available. To date, approximately 500 sacks of 1933 seed have been shipped at low temperatures, and for some of the lines the shippers have arranged for control samples to be drawn prior to shipment and on delivery, and placed at the disposal of this Station. Facilities offered by the Cambridge and Washington Seed Testing Stations have been taken advantage of in this respect, and we anticipate that shortly we will be in possession of full data concerning the condition of the seed on arrival overseas.

In order to test the effect of cultural treatment on seed vitality, the produce of plots sown, top-dressed with various combinations of phosphate, nitrogen, and potash, and harvested at different stages of ripeness, under the direction of the Fields Superintendent, Dunedin, and the Crop Experimentalist, is about to be dressed here, and will be shipped, probably to England, part predried and part in cool storage. The effect of the various treatments and combinations of same should provide very valuable data.

In conjunction with the drying work various types of sack linings are being tested, one of which shows considerable promise as a moisture-proof container.

The results obtained from the work with Chewings fescue will be used as a basis for trial shipments of other grass seeds, for which deterioration is a limiting factor in an export trade.

Low Germination of Perennial Rye-grass.

Much evidence in confirmation of the findings of Mr. E. O. C. Hyde, as published last year, has been obtained during the past season. Specially selected material has been submitted to the Mycologist, who reports that he has now been successful in obtaining fungus fructification. Identification of the fungus considered to be responsible for the destruction of the germination of the non-viable seeds has proved difficult, and cultures have been forwarded abroad for confirmatory identification.

With a drier season in the Manawatu and Sandon districts, many of the lines have given reasonably high germination percentages, but there is a large proportion of the 1933 season's crops which is quite without commercial value.

Some hundreds of Southern-grown samples, representative of various plant types and various origin, have been received from the Gore Experimental Area, where they were grown under the direction of the Crop Experimentalist in co-operation with the Agrostologist at this Station. In addition, the produce of plots sown with hot-water-treated seed has been submitted. On one series of plots sheaves were cut and forwarded weekly from the time of flowering up to the seed-fall stage. Incidentally, the material for culture was obtained from seed in the dough stage, from early-cut sheaves.

The whole of these samples are being tested for germination as quickly as facilities will permit, and examinations made of caryopses of specimens from every plot. It is yet too early to form definite opinions, but from the examinations made it would appear that the degree and amount of infection is relative to the perenniality of the line, and that in consequence the very inferior forms of false perennial are completely uninfected. Hot-water treatment appears to have had little or no effect in reducing infection.

The success from a germination point of view of perennial rye-grass production in the Southern districts would appear to depend upon the isolation of strains resistant to the fungus infection; but to date there has been no consistency in lots which have appeared to be resistant.

Cyanogenetic Reaction of White Clover.

This work is being continued, using picrate paper as an indicator of the amount of HCN liberated from the seedlings. An improved technique permits of the test being completed in eight days. The indications are that the test results will prove of great assistance in strain diagnosis, particularly when used in conjunction with preliminary data obtained from field trials of white clover.

New Zealand Paspalum Seed.

Samples collected by the Field's Division officer at Whangarei, following various harvesting treatments, are being specially worked with a view to recommending a practical harvesting and dressing procedure, so that New Zealand seed could be produced to compare favourably on a purity and germination basis with Australian seed.

General.

During the period under review the demand upon the Station's services has been a very heavy one, and, notwithstanding recent additions to staff and equipment, the demand is still beyond the Station's capacity. It has been, and still is, necessary that the staff be asked to work longer hours, and it is desired to record appreciation of their assistance in this respect.

CHEMICAL SECTION.

B. W. DOAK, Chemist.

MARTON MOWING TRIALS.

The chemical work on certain of the mowing trials at the Marton Experimental Area has been completed, and no further work on these particular trials is being carried out. Work has been started on three new trials—both soil and herbage analyses being carried out. Soil samples were taken from the various plots to be treated before the first application of fertilizer was applied. The points being investigated are as follows:—

(1) The effect of heavy infrequent against light frequent applications of lime on the chemical composition of the herbage, and on the lime and phosphate status of the soil.

(2) The effect of various nitrogenous fertilizers, when applied at the same time as superphosphate, compared with the effect of these same fertilizers applied so that the date of application of the nitrogenous fertilizer is some months different from the date of application of the superphosphate, on the chemical composition of the herbage, and their effect on the soil.

(3) The effect on the chemical composition of the herbage and on the phosphate status of the soil of superphosphate, basic slag, and North African phosphates, when applied with lime and without.

CHEMICAL METHOD OF DETERMINING TYPE IN WHITE CLOVER.

Some five hundred odd samples of white clover herbage have been analysed for potential hydrocyanic acid content. The percentages of HCN of these have been examined with reference to the type note of the Agrostologist. It has been found that an excellent correlation exists, and tentative standards for HCN content have been set to correspond with the standards set for the eye determination of type. It is considered that this determination, when used in conjunction with the eye determinations, will render the determination of type more easy.

GENERAL WORK.

A number of samples of linseed selections were analysed for oil content for the Agronomist, and an investigation into the chemical composition of various rape types as affected by sampling at different stages of growth is also being carried out for that officer.

WALLACEVILLE VETERINARY LABORATORY.

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

In reviewing the work of the past year it may be noted in comparison with the preceding period that in the main Laboratory fewer samples have been examined. This however does not mean that there has been a slackening-off of work, but rather that the work has been more thorough and research activities greater.

The Laboratory was fortunate in getting Dr. I. J. Cunningham, M.Sc., Ph.D., attached during this year as a Nutrition Research Officer. Dr. Cunningham has had singular opportunities for becoming proficient in nutrition work, and had brought back to New Zealand a colony of white rats from the Rowett Institute. This rat colony was also transferred to Wallaceville and is proving with Dr. Cunningham a most valuable adjunct to experimental work, more particularly in the study of sterility and grass staggers in dairy cows and mineral deficiencies of stock generally.

The work of Messrs. Blake and Webster, including particularly that on sterility and mastitis, is of particular value to the Department, while the long and arduous work of Messrs. Kidd and Bryant in examination of milk samples is to be thoroughly commended. Both these officers have furnished good reports.

Specimens and Samples received for Diagnosis during the Year.

	Wallaceville.	Hamilton.	New Plymouth.
Milk, mastitis	4,884	31,900	7,047
Milk, mastitis cultural work	2,000 approx.	..	1,622
Milk, tuberculosis	521	..	(leucocyte counts 101)
Milk, culture *B. abortus*	400	..	28
Whey agglutination for *B. abortus*	..	..	27
Blood agglutination for *B. abortus*	2,204	323	204
Sterility specimens—			
Semen samples	42	500	42
Cervical swabs	..	..	117
Cattle specimens	374	..	121
Sheep	122	..	(thyroids) 7 (lamb femurs)
Swine	99	..	..
Horses	23	..	..
Poultry	51	..	..
Dog	6	..	..
Disinfectants	24	..	..
Miscellaneous	6	..	34
Biochemical samples, blood, urine, &c.	743	..	..
Totals	11,499	32,723	9,350

CATTLE DISEASES.

Contagious Abortion.

Of 2,204 blood samples examined at Wallaceville 1,467 were negative. In 496 of the composite town milk-supply samples examined biologically 154 guinea-pigs gave a positive reaction to the agglutination test for contagious abortion = 31 per cent. 106 guinea-pigs showed definite lesions = 21 per cent. 17 guinea-pigs gave abortus lesions without agglutination reaction in serum. 17 only of the milk samples gave a growth of *Br. abortus*. A small number of herds (about 9) have been regularly tested in order to keep them free from contagious abortion.

Sterility in Dairy Cows.

The main work for the year on cattle was carried out by Mr. Blake, in the Waikato, where some five hundred different seminal fluids were examined for motility, duration of life in the pipette, and morphology. Mr. Webster's work in the Taranaki area was curtailed because of lack of material. The following table has been prepared by Mr. Blake, and represents the position as he finds it in the Waikato:—

Classification.	Number of Bulls.	Average Percentage of Successful First Services.	Average Number of Cows served.
Good and fairly good	39	73	36
Fair	36	58	34
Poor	38	42	35
Bad	40	35	30
Sterile	7	0	17

There have been a few discrepancies in this work, but on the whole it is very satisfactory. Mr. Blake reports that several bulls have been entered into herds showing a poor average of successful services, and in such cases the good bulls have been able to put the cows in calf. Some of these unsuccessful services may have been due to faults in the cows, but work on the lines adopted by Mr. Blake is well worth following up.

It is noteworthy that Mr. Blake has noticed one family of bulls in particular which either become sterile or are poor breeders from youth. Daughter heifers from one of these bulls were also sterile.

Observations made in Taranaki indicate a tendency for bulls to become infected with streptococci and to carry infection to cows which, after service, suffer from cevicitis. This is not so evident in the Waikato, for good bulls placed in a herd following bad bulls, put cows in calf. That being so there would appear to be two forms of sterility—one infectious, the other physiological or possibly dietetic.

At Wallaceville work is in progress with rats to see whether protein feeding above a 20-per-cent. level is harmful to the testes. It has already been noted that 80 per cent. protein tends to render rats sterile. Feeding is also in progress with certain potash salts. It is noteworthy that the Waikato pastures tend to be richer in protein than the Taranaki pastures. During the past few years there has been a succession of bulls on the main Laboratory farm which become practically sterile after three seasons in use, and it is doubtful whether these bulls are showing streptococcic infection.

The main work requiring to be done in herd sterility is bacteriological examination of the quantity of material procured by Mr. Blake, and, already in progress, steady work on the question of diet in relation to damage of the testes.

Mastitis.

The work commenced last year on control of mastitis by grouping of cows for milking purposes has been continued and expanded, as far as staff will permit, in the Taranaki and Waikato districts. At the end of this year a questionnaire was issued to those dairy-farmers who had been in the scheme over two seasons, and of fifty replies only one was dissatisfied with the results. They stressed several points in their replies:—

(1) That cows were in decidedly better condition as regards visible mastitis now than at the commencement of the examination of their herds. Culling had been practised and accounted for this to some extent, but there was also the fact that heifers were much cleaner under the scheme at the end of their first milking season than had been the case in previous years.

(2) There was a reduction in the number of dry quarters.

(3) No noticeable hereditary bias could be ascertained.

(4) The abortion rate did not appear to govern the amount of mastitis in any way.

(5) Cow pox and teat lesions generally were much reduced as a result of the care taken to disinfect the teats after milking.

These results are distinctly encouraging.

At Wallaceville and New Plymouth a considerable amount of cultural work has been performed on herds either in the scheme or lent for experimental purposes, and there is no doubt but that bacterial flora in quantity and virulence follows closely on the gravity cream leucocyte count. The lower assessment figures (see previous annual report) contain from no bacteria up to moderate numbers of harmless types such as diphtheroids, and harmless micrococci; the intermediate figures show greater growth of the less virulent type of micrococci and hæmolytic staphylococci while the high counts give streptococci or staphylococci almost invariably.

A table provided by Mr. Webster gives a very clear summary of his Taranaki findings.

Leucocyte Reading.	Number examined.	Percentage under Ten Colonies per Plate.	—
0	644	73·9	92·8 per cent. under 100 colonies per plate.
1	186	47·9	91·9 ,, 250 ,,
2	250	23·2	92·8 ,, 750 ,,
3	186	9·1	93·5 ,, 2,000 ,,
4	112	4·4	76·7 ,, 2,000 ,,
5	63	3·2	73·0 ,, 2,000 ,,
6	90	2·2	43·3 ,, 2,000 ,,
	1,531		

Several cases of streptococcic or staphylococcic mastitis following cow-pox lesions have been seen during the year, and from the fact that staphylococci or streptococci are almost equally prevalent in acute mastitis in many herds, some such factor lending itself to easy infection through the teat must, in my opinion, be implicated in the spread of the disease.

That the scheme itself is beneficial in the majority of herds is shown by Mr. Blake's observations.

The hereditary factor in predisposition to mastitis has been given attention by Mr. Blake, but has not as yet suggested any definite results.

Trials with chlorine gas, Entozon, and Rivanol have been watched or actually carried out as curative agents, but results have not been particularly satisfactory, though in some cases they were temporarily helpful.

Experimental work on technique has shown the serious changes which take place in staining, &c., if too much formalin is added to the milk sample. One drop is sufficient for preserving an ounce bottle sample. Also the quantity of milk used from each quarter is a big factor in correct assessment values.

To summarize the position, the mammitis-control scheme is proving beneficial to farmers employing it. The reason is three-fold—better hygiene in the shed, elimination or milking last of cows with bad quarters, and a much healthier state of teats which previously suffered from cow pox or other teat lesions. Very considerable work has been put into this scheme to prove or disprove it, but we can, under ordinary conditions, advise its use.

Anthrax.

One outbreak of anthrax was diagnosed, material having been forwarded from cattle dying on the affected farm.

Grass Tetany or Grass Staggers.

Considerable attention was given this disease by field officers in the Waikato and by the laboratory staff at Wallaceville. A trial of magnesium injections with and without calcium failed to raise the blood magnesium to such an extent that affected animals would show any beneficial effect. The magnesium treatment will, however, be further tried in an altered form. The work carried out is being published in the *Veterinary Record*. Blood analyses tend to show a low Ca. and Mg. with a higher than normal phosphorus content. Pasture analyses of the district show a high phosphorus content of fodder, with a tendency towards a low calcium content, and it is at present suggested that it is this harmful balance which binds the magnesium and gives the symptoms now so well known.

Further inter-seasonal work on grass staggers is being performed by Dr. Cunningham with his rat colony in an effort to find what dietetic condition will reduce blood magnesium. He has already shown that feeding of magnesium is conducive to a rise in blood magnesium, and an experiment is in progress to see if this effect is produced in sheep and in cattle.

Biological Test for Tubercle Bacilli in Town Milk-supplies.

Five hundred and twenty-one guinea-pigs were inoculated with centrifuged milk samples from different districts in New Zealand during the year. In the case of nine samples only was a positive result obtained. The affected herds were dealt with by the field staff, and the diseased cows were eliminated. Samples were taken with the addition of boric acid and the method of sampling has been satisfactory. 1,410 cc. of crude tuberculin has been issued to field officers for testing purposes.

Blackleg.

Some 42,800 doses of formalinized culture of B. chauvoei have been issued to field officers for blackleg control. The vaccine has been found particularly useful, and in only one case was blackleg known to occur after vaccination. In that case the animal died before immunity had been produced. Thirty-seven portions of muscle were forwarded for guinea-pig inoculation test. Thirty-one were positive for B. chauvoei, while six showed Vibrion septique infection.

Jöhne's Disease.

This has again been in evidence, twenty-one specimens of gut having been received for diagnosis, eighteen of them being positive. The specimens came chiefly from two main centres in Taranaki.

Nasal Catarrh.

A form of nasal catarrh is present in several dairying districts, particularly Taranaki and Waikato, in which cattle show a very ulcerated condition of the nasal mucosa and acute catarrh. The condition gave the impression that it was infectious in the herds in which it originated, but pus placed in the nasal passages of cattle at Wallaceville from affected animals did not infect the experimental animals. A gram negative streptococcal bacillus has been isolated on several occasions from affected animals, and, although it is viewed with suspicion, it has not yet been able to produce the disease experimentally.

Iodine Deficiency in Taranaki.

The work of Mr. Webster in examining thyroid glands from five-day-old calves killed at the meat-works is worthy of note. He found in 2,300 calves 10 per cent. abnormal-sized thyroids. One hundred and sixty glands were sent to the Chief Chemist for examination. Results of analyses indicate that certain districts show a greater degree of incipient goitre than do others, a fact already noted by medical authorities in school-children in the same districts.

SHEEP DISEASES.

Caseous Lymphadenitis.

More station-owners have been induced during the year to try the palpation method of dealing with this disease. The actual figures obtained from palpation have been a little difficult to get, but the report of Mr. Dayus is illuminating where the reduction in numbers of ewes affected was from 9·34 per cent. to 1·85 per cent. over a two-year period.

An effort was made to find whether a medicated oil could be utilized to kill the Preisz Nocard organism on blades contaminated with pus from open abscesses. Trikresol, carbolic acid, and Thymol were all tried, but without success.

Ante-partum Paralysis.

In continuation of the work of the past two years on this disease, six ewes in an advanced stage of pregnancy were placed in the shed and given hay alone as a source of food. In seven days they dropped on the average 23 lb. each in weight. The ewes were fat when chosen, but were in good health and had the appearance of producing twins. The two sheep to drop least in weight were the two which survived the experiment, one having a single lamb only and the other producing dead twins on the tenth day. A wether in very fat condition was placed in with the ewes, but it kept its condition and was not in any way detrimentally affected by the poor diet. Three of the ewes had a full mineral supplement given them daily, so that there could be no suggestion that the reason for their decline was an insufficiency of minerals in the ration. Of those receiving mineral one ewe died, but all six lambs died or were born dead, while of those receiving no mineral two ewes died, one having a single and the other twin lambs which died. The third ewe had one small single lamb and did not become sick. The ewes became dull, and commenced breathing heavily from four to eight days after being placed in the shed.

Analyses of blood and urine were kept going during the experiment and gave results as follows:—

Blood: Calcium, magnesium, potassium normal throughout. Tendency for phosphate to rise towards lambing time and markedly rise just before death. Slight drop in sugar until lambing. T.N.P.N. varied considerably, depending on the function of the kidneys. Cholesterol rose following the closing of sheep in the shed and drop in weight. CO_2 varied considerably. NaCl varied but did not show any great abnormality.

Urine: Acid. Albumen present or not present, depending on state of kidneys. Sugar invariably absent, as was urobilin. Acetone present in varying degree in all cases. Diacetic acid usually present in all experimental sheep, whether they lived or died. Phosphate in the urine varied more than other products of excretion. The increase appeared coincident with dullness. It might be looked upon as a diagnostic sign. Phosphate dropped at once following lambing. Inoculation of mice was performed with blood, and with urine from affected sheep and lambs, but without any trace of toxicity being demonstrated.

The season's work once again strongly suggested that the condition is one due to a ketosis due to increase in fat content of the liver from fat depots. The result of a snowstorm in the Wairarapa district just previous to lambing time also showed that sudden starvation was a very great factor in production of the disease in those ewes carrying twin lambs and considerable condition.

Enzootic Icterus.

A serious outbreak of jaundice, with death of many sheep, occurred on a farm in the Waikato. An investigation strongly suggested previous ragwort feeding as being conducive. Consequently three sheep were fed at the Laboratory on a little hay and much ragwort over a period of a month during which time over *400 lb. of young green ragwort* was eaten. The sheep were kept in the shed on hay for a further six weeks, and then let out on green grass to find whether the damaged liver might let some deleterious product of young grass metabolism enter the blood stream, and so cause a breakdown of the red blood corpuscles. However, the sheep appear perfectly healthy still.

A sheep running on the Laboratory farm, but which had never had access to ragwort, was found dead with similar post-mortem appearances to the enzootic icterus cases seen in the North. This effectively rules out ragwort as a specific precursor of hæmatogenous jaundice.

Tuberculosis in Sheep.

Two more cases have been seen this year of tuberculosis in sheep. The specimens were noticed by Meat Inspectors in meat-export slaughterhouses.

Mortality in Hoggets.

As it was considered that the autumn would probably be a damp one with abundant feed, an experiment was commenced with twelve hoggets to find what elements were lacking when conditions were conducive to a mortality; whether parasites were a primary or secondary factor, and whether mineral deficiency played a role, or whether the decline of the animal was mainly physiological starvation. To that end analyses of pasture by Dr. Cunningham, of blood by Mr. Josland, and examination of fæces by myself, have been carried out over a period of three months, but without as yet being successful. Unfortunately for our purpose, the weather turned fine, and the pastures have not been luscious since the experiment commenced; so it is hoped to repeat the experiment later. This experiment is being continued throughout the winter.

Pulpy Kidney Disease of Lambs.

The work of Mr. D. A. Gill of demonstrating that the immediate cause of death in this disease is the absorption from the small intestine of a bacterial toxin has now been concluded. Since the last report the organism which was then mentioned as the probable cause has been successfully identified by toxin-antitoxin trials, &c., as a species of *B. ovitoxicus* (Bennetts). Lambs have been inoculated with doses of toxin prepared artificially from cultures of this organism and have died as a result, their kidneys rapidly becoming pulpy after death.

Field work on the disease during last spring consisted mainly of testing out a vaccine and an antitoxin as a means of preventing the disease. The vaccine used was an anaculture (formalinized in the usual manner) and the antitoxin was prepared by inoculating a horse with increasing doses of toxin until its blood serum contained large amounts of antitoxin. This involved a considerable amount of work, but eventually yielded an antitoxin of such strength that $\frac{1}{10000}$ of a cubic centimetre of the horse's serum would protect a mouse against more than one certain lethal dose of the toxin.

The field trials of vaccine and antitoxin were rather spoilt by the fact that the disease did not occur extensively this season in the experimental flocks. Over 700 lambs received the vaccine and some 550 in the same mobs were left as controls, but the difference in the slight death-rate which occurred was not sufficient to justify any faith in that method of vaccination as a preventive. With the antitoxin, however, much more hopeful results were obtained. Over 1,000 lambs were inoculated with it and the same number were left as controls. Only three inoculated lambs died, two of the deaths being probably due to causes other than pulpy kidney, whereas twenty controls died, of which all but one were certainly affected with the disease. This does not actually give a true picture of the results, however. The experiments with antitoxin were carried out in nine flocks. In eight of them the results were: Inoculated lambs, deaths 3 (2 doubtful); control lambs, deaths 6 (1 doubtful). The ninth farm was the only one on which a well-marked death-rate was occurring at the time the inoculations with antitoxin were carried out, and in this instance out of 192 inoculated lambs none died, whereas 13 died of the disease among the 139 lambs in the same mob which were left as controls (0 per cent. as against 9·35 per cent.).

The value of this work lies in the fact that success of antitoxin as a preventive still further proves the part played by the toxin in the causation of the disease; and, secondly, it would seem that in the antitoxin we have a means by which a severe death-rate among valuable lambs (studs) could be stopped. It is not anticipated that antitoxin inoculations could be used as a wholesale measure to prevent pulpy kidney losses—the expense would be more than its complete success would warrant. It is hoped that still further study of the factors which predispose lambs to the disease may enable us to evolve satisfactory measures of controlling the disease through the method of farming and sheep management.

A full report of the research work that has been carried out since the investigation was commenced in 1926 has now been prepared for publication as a special research report.

Circling Disease of Sheep.

Mr. Gill has also been giving further attention to this trouble. When the last annual report was made it was stated that an organism had been isolated from the brain of an affected sheep which there was reason to suppose was concerned in causing the disease. During the past year several similar cases have been dealt with, and it was found that with the proper technique this organism could be obtained from all of them. As the cases have been received from the Wairarapa, Hawke's Bay, Southern Taranaki, and the Waikato, and in all but two instances the organism was obtained in pure culture, its connection with the disease is quite apparent. Bacteria-free filtrates of brain emulsions from three cases have been prepared and tested on normal sheep by intracerebral inoculation without inducing any harmful effects, thus going far to rule out the possibility that the organism was functioning as a secondary invader in the wake of a filterable virus. Further experiments on sheep with the organism itself demonstrated that when small doses are inoculated into the carotid artery typical "circling disease" is induced, and that the lesions in the brain are on a par with those of naturally occurring cases. It was also found that sheep could be affected by pouring doses of culture into the nostril. In these experiments the brain became affected, but the organism also set up a pneumonia. Considerable attention is being paid to the possibility that the natural path of infection by which sheep contract the disease is the nose, and also that the first stage larvæ of the sheep nostril fly (*Oestrus ovis*) may injure the nasal mucous membrane, thus providing the organism with a means of penetrating the tissues and eventually reaching the brain. The disease occurs almost invariably during the period when this fly is active, and in two recent cases (one dealt with by Mr. A. L. Thompson near Wanganui, and the other sheep being sent to Wallaceville from the Te Kuiti district) these young larvæ have been found in the nasal cavities.

The Sheep Tape-worm.

With a view to discovering the infective stage in the common sheep tape-worm (*Moniezia expansa*) Mr. Peddie has carried out a series of feeding experiments, using ripe proglottides (obtained from the meat-works), some in a moist and others in a dried state. Several experiments were carried out with both the moist and dried proglottides, which were cut up and fed in the form of a drench. Controls were used in all experiments, to rule out any possible infestation being introduced by means of the grass and hay used for feeding. All experiments carried out with moist proglottides were negative.

The detailed results of these experiments all agreed with similar experiments carried out in South Africa, but more particularly with those of Seddon in Australia, with the exception that *no immunity* was found to occur in lambs after repeated drenching with ripe proglottides, such lambs subsequently becoming infected when placed on naturally infested ground.

Other experiments were carried out with ripe proglottides, which were allowed to dry for varying periods and later moistened and fed as a drench. From one such experiment a positive result was obtained, that in which the proglottides had been dried for three weeks, the control remaining negative.

SWINE DISEASES.

No particular diseases have been noted in pigs. Quite a number of specimens were examined for scabies and for pasteurellosis. The thorn headed worm, *Macracanthorynchus hirudinaceus*, was found in the North Auckland district in one batch of pigs. This is the first indication of its presence for some thirty years. (N.B.—An outbreak of swine fever near Wellington occurred after the date of this report.)

POULTRY DISEASES.

Coccidiosis has been diagnosed in pullets on several farms again this year, and it would seem from histories that day-old chicks may have been responsible for bringing in the disease to one plant. Some study of this disease will shortly have to be undertaken to protect the industry.

A bone condition resembling Paget's disease of human beings has again been seen in two breeders' establishments. The cause is as yet obscure.

QUARANTINE STATION.

Twelve dogs and eight bitches passed through the quarantine station at Wallaceville over the twelve months. One bitch whelped and lost three of her six puppies. Eczema has on several occasions been troublesome, but otherwise the animals have been healthy.

PUBLISHED ARTICLES, 1932-33.

Control of Caseous Lymph-adenitis in Sheep; Dayus and Hopkirk. *Jour. of Agric.*, July, 1932.

Method of Control of Mastitis in Dairy Herd in New Zealand: Hopkirk. Presented to Science Congress, Sydney, August, 1932. Published *Aus. Vet. Jour.*, June, 1933.

Boric Acid as Preservative for Milk in Bacteriological Examination: Gill. *Veterinary Jour.*, July, 1932.

Bovine Sterility in New Zealand: Webster. Presented to Science Congress, Sydney, August, 1932. Published *Aus. Vet. Jour.*, April, 1933.

Pulpy Kidney Disease of Lambs: Gill. *N.Z. Jour. of Agric.*, May and December, 1932.

Circling Disease—A meningo-encephalitis of Sheep in N.Z.: Gill. *Vet. Jour.*, June, 1933.

Circling Disease: Gill. *N.Z. Jour. of Agric.*, May, 1933.

Grass Tetany of Dairy Cows: Hopkirk, Marshall, and Blake. *Vet. Record*, 1933.

Br. Abortus in Town Milk Supplies: Hopkirk and Gill. *Vet. Rec.*, April 1, 1933.

Principal Diseases of Stock in New Zealand: Hopkirk. Presented to Pan Pacific Conference in Canada, May, 1933.

Effect of Br. Abortus on Udder of a Normal Cow: Gill. *Vet. Jour.*, April, 1933.

Milk Sample in Seven-months Heifer: Hopkirk, *Aus. Vet. Jour.*, April, 1933.

Some Observations on Calcium and Phosphorus Metabolism of the Sheep: Cunningham. *N.Z. Jour. of Science and Tech.*, XIV, No. 5, 1933.

A Study of the Blood of Healthy Sheep and Cattle in New Zealand: Josland. *N.Z. Jour. of Science and Tech.*, XIV, No. 5, 1933.

BIOCHEMICAL WORK PERFORMED BY MR. S. W. JOSLAND.

Mr. Josland supplies the following sub-report:—

Sodium.—The micro determination of sodium in blood is now being introduced in the routine examinations carried out. Values of 300–400 mgm. per 100 c.c. have been obtained in sheep serum.

Magnesium.—With the co-operation of Dr. I. J. Cunningham, experiments have been conducted with a view to improving the accuracy of the method for the colorimetric determination of magnesium in serum.

Fat in Liver.—The fatty acid content of the livers of several healthy ewes has been determined. Values for purified fatty acids varied from 3–10 per cent. on moist weight, with corresponding iodine values of 130–96.

When time is available work is being performed on the normal value of the blood of fowls. The following variations have been observed in the blood of non-laying pullets: Calcium, 12–15 mgm. per 100 c.c.; inorganic phosphorus, 5·6–7·0 mgm. per 100 c.c.; magnesium, 1·4–3·3 mgm. per 100 c.c.; sugar, 120–152 mgm. per 100 c.c.; non-protein nitrogen, 38–45 per mgm. per 100 c.c.; sodium chloride, 480–600 mgm. per 100 c.c.; haemoglobin, 8·0–9·5 grm. per 100 c.c.

From the histological aspect the blood of fowls and birds presents some difficulty in that the red cells, leucocytes, and thrombocytes are all nucleated. Thus the ordinary enumeration methods are unsuitable. After investigating several special methods, that of A. F. Bernard Shaw (*Journ. Path. and Bact.*, 1930, Vol. 33, No. 3, p. 833) was adopted. This method, which necessitates the use of neutral red and crystal violet, gives differential staining between leucocytes and thrombocytes, while preserving the red cells. The following variations were obtained: Red cells, $1·8–3·3 \times 10^6$ per c.mm. Leucocytes, 2,100–2,500 per c.mm. Differential leucocyte count: Polymorphs, 21–27 per cent.; Lymphocytes, 65–73 per cent.; Monocytes, 0–2 per cent.; Eosinophils, 2–8 per cent.; Basophils, 0–1 per cent.

Mammitis.—In a large number of milk samples catalase and chloride determinations and microscopic cell counts were made. The conclusion reached was that neither catalase nor chloride determinations were as valuable as the microscopic cell counts in the diagnosis of mammitis.

Specimens examined.—Sheep blood, 286; cattle blood, 120; rat blood, 43; fowl blood, 30; urine samples, 102; milk samples, 81; cerebro spinal fluid, 11; liver (fat content), 8; blood films, 47; miscellaneous, 15: total, 743.

NUTRITION RESEARCH WORK PERFORMED BY DR. I. J. CUNNINGHAM.

The following sub-report is by Dr. Cunningham:—

As explained by the Officer in Charge, the writer was enabled to commence experimental work on animal nutrition at Wallaceville in June, 1932. The work has been greatly facilitated by the transfer of the colony of Wistar rats (Glaxo strain) from the Chemistry Section in October. Several different lines of investigation are in progress, and these are dealt with under the following headings:—

Metabolism Experiments with Sheep.—A plan of work has been drawn up to test the supplementary value of various calcium- and phosphorus-containing materials—*e.g.*, steamed bone flour, rock phosphates, &c.—for sheep on diets of varying calcium, phosphorus, and protein content. The main work is at present in abeyance owing to the difficulty in procuring a carbohydrate sufficiently low in both Ca. and P. and yet palatable to the sheep. Some progress has, however, been made, using as basal diet a hay of low nutritive value deficient in phosphate and nitrogen. Balance experiments were conducted; in the first experiment the effect of a supplement of $K_2H\ PO_4$ was determined, and in the second those of (1) dried blood, (2) dried blood plus Nauru rock phosphate and (3) dried blood plus Nauru rock phosphate and Na_2HPO_4.

Briefly, the conclusions were as follows: Lambs fed a hay of low nutritive value, deficient chiefly in phosphorus and protein, showed positive calcium balances but negative balances of phosphorus and nitrogen. Supplementary feeding of potassium phosphate decreased the calcium balances to a negative value. Supplements of dried blood enabled the animals to retain nitrogen and at the same time improved the retention of calcium and phosphorus. The calcium and phosphorus balances were not improved by feeding Nauru rock phosphate as an addition to the hay and dried blood diet.

The work, though only preliminary in nature, suggests that sheep feeding on a pasture similar in nature to the hay used—*e.g.*, high country or droughty conditions—will not benefit by supplementary feeding of mineral mixtures to the same extent as they would by improvement of the nitrogen intake.

Analyses of Sheeps' Milks.—As another aspect of the study of Ca. and P. metabolism of the sheep, thirty-four samples of sheep's milk have been analysed for ash, calcium oxide, phosphoric acid, and nitrogen, while fifteen were further analysed for iron. Eighteen of the samples were taken from the Wallaceville Farm, and sixteen were sent in from Rotorua by Mr. C. R. Taylor. The mean results are given as grammes/100 m.l. of milk, except in the case of iron, where the results are expressed as mgm./100 ml. milk.

	Ash.	CaO.	P_2O_5.	N_2.	Fe.
Wallaceville, mean of 18	0·963	0·291	0·378	0·842	..
Rotorua, mean of 16	0·975	0·324	0·375	0·941	0·036

High Protein Feeding and Reproduction.—Experiments commenced in November, 1931, have been continued The fertility of females fed diets containing 80 per cent. of protein was not affected, but the male rats fed such a diet for long periods have become sterile. The number and motility of the sperms is considerably reduced, and serious degeneration of the seminiferous tubules takes place. The work is being continued in view of the similarity between the lesions in rats' testes and the testes of bulls considered to be temporarily sterile.

Grass Staggers in Dairy Cows.—Investigations of this disease are being made with the particular view of ascertaining the factors bringing about the upset of magnesium metabolism. Preliminary experiments are being made on the rat and positive findings will later be tested out on ruminants.

The effect of the level of dietary magnesium on the calcium and magnesium contents of bodies, bones, and blood has been determined. The most interesting finding is that the blood magnesium level reflects the magnesium content of the diet, and by feeding extra magnesium as carbonate sulphate chloride or phosphate the magnesium content of the blood has been raised considerably above the normal. This relationship is being tested out on sheep, which are being drenched daily with magnesium salts and will later be tested on cows supplied with magnesium-containing licks or with magnesium salts in their drinking-water. The importance of the work resides in the fact that, since the most marked finding in the blood of cows with grass staggers is a greatly reduced magnesium content, then a practicable method of raising the blood magnesium during the period of susceptibility to the disease might help to mitigate its incidence. Such methods as supplying stock licks containing large proportions of magnesium, if these can be made palatable, or the introduction of soluble magnesium salts into drinking-water, might achieve this end.

Other work connected with grass staggers involves the investigation of different types of rye-grass at different stages of growth. This grass forms a large proportion of the pasture in districts where grass staggers occurs. Plots of five varieties of rye which have been laid down from seed supplied by Mr. E. B. Levy, of the Plant Research Station, Palmerston North, are being cut at intervals.

Irregularity in Growth of Wool of Angora Rabbits.—The incidence of this trouble has been reported and is being investigated in collaboration with Mr. D. A. Gill. From the appearance of the lesions and the histories of the animals, it seems possible that the condition is due to a dietetic fault and similar to that produced experimentally in rats.

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