1936.
NEW ZEALAND.

DEPARTMENT OF AGRICULTURE.

ANNUAL REPORT FOR 1935-36.

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

Wellington, 13th August, 1936.

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, 1936.

The report continues the record of the extensive and varied operations of the Department in its work of furthering the efficiency and development of rural industries in fullest compatability with the national welfare. It shows that during the first part of the year under review the advisory, research, and regulatory activities have been carried out broadly in the manner and to the extent that have obtained in recent years, and these activities have been productive of quite satisfactory results in that our growing knowledge about the improvement of our farming and the results of research are being reflected in practice. However, it may be questioned whether these are being reflected in practice as completely and as rapidly as is both possible and desirable. This is a question which has been receiving considerable attention since I took office. The work of the Department is now being organized on certain basic conceptions, the application of which, it is considered, will lead to more fruitful exploitation of both our current considerable store of knowledge and of future additions to it. It is realized firstly that complete co-operation and co-ordination within the Department itself is desirable. This arises because of the innate complexity of farming, taken in conjunction with the fact that the farm is the business unit in our rural industries, and advisory work to be fully effective must pay strict attention to this fact. While within the Department there must continue to be much specialized endeavour, the fruit of this endeavour must be welded into a complex but unified whole for use in advisory work. Co-operation of the type that is desirable within the Department is desirable also in respect to the relations of the Department with all organizations concerned in the proper advancement of farming, and this is especially true of those who are most directly concerned—*i.e.*, the farmers themselves and their organizations. In short, co-operated effort is being made a keynote of the policy of the Department. A development that may be expected to follow naturally from the unified thought and co-operative effort that are considered desirable in the work of the Department is a trend towards standardized practice, which, reflecting the best knowledge available, should lead to greater general efficiency, begetting both increased production and improved quality in our farm-products.

From the foregoing it may be deduced that the Department's activity must be based increasingly on instruction instead of on regulation, or, in effect, essential regulation must represent the result of instruction. Hence, the departmental officers must function more and more as instructors rather than as inspectors.

It is realized that an important function of the Department is to keep the farming community fully and promptly acquainted not only with the final results of investigational work, but also with its progress and its trends that may have a bearing on farm practice and planning.

The prior incidental reference to the quality of our produce calls for further mention. In general, New Zealand farming has to face steadily increasing competition from other agricultural countries upon our export markets. One of the most effective means of meeting this competition is improvement not only in the quality of our export products, but in the quality of all those other farm-products upon which the quality of our export products at times depends. There is scope also for improvement in the handling of our products.

An important phase of the agricultural position may be summed up thus: while the efficiency of our farming already is gratifyingly high, there remains scope for substantial progressive improvement, and the task of fostering that improvement in the most economical manner is looked upon as the basic task of the Department of Agriculture.

Two features of the year are worthy of special mention:—

(1) There was a substantial increase, of 38,309 tons, in the deliveries of fertilizers by rail. In the light of departmental investigations and experience relative to the use of fertilizers, this trend augurs well for future farm production.

(2) There was a substantial increase in the killings of pigs for export. At the close of the production year ending September the increase in comparison with the previous year promises to approximate 120,000 carcasses. Further profitable expansion of pig-production is clearly in sight, and the Department is planning to foster such profitable expansion to the fullest possible extent.

I have, &c.,

W. Lee Martin,

His Excellency the Governor-General. Minister of Agriculture.

REPORT OF THE DIRECTOR-GENERAL.

Wellington, 15th July, 1936.

THE HON. THE MINISTER OF AGRICULTURE,—

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

THE AGRICULTURAL AND PASTORAL POSITION.

Despite a markedly abnormal season over wide areas in the Dominion, farm production during the 1935–36 season has been most gratifying in that, in general, there has been a return to the high standard attained in the 1933–34 season. This is reflected in increases in the production of such major lines as butterfat, mutton, cereals, pork and bacon, while lamb-killings for export for the first nine months of the production-year ending 30th September are approximately equal to those of the corresponding period of the previous season. Further, in general the improved market position for the major exportable surpluses of farm-produce has been reflected in appreciated prices, this being especially marked in respect of wool. The joint effect of the maintenance of a highly satisfactory standard of production and of appreciated prices is partly to be seen in the fact that during the first five months of the current calendar year exports of merchandise have exceeded commodity imports in value by £13,583,065, as compared with £9,520,197 during the same months of 1935.

The weather varied greatly throughout the Dominion, and departures from normal conditions influenced production substantially. An outstanding feature in many districts was an unusually wet and consequently backward winter and spring. One result was a decline in dairy production during the early part of the season, the butterfat-production up to the end of November being over 170,000 cwt. less than in the corresponding period of the previous season. Another, and quite general, outstanding feature was the wet summer. One striking result was exceptionally heavy dairy production; the decrease of over 170,000 cwt. at the end of November had been turned into an increase of nearly 140,000 cwt. of butterfat at the end of March in comparison with corresponding periods of the previous season. In short, from December to March the amount of butterfat produced in 1935–36 season was approximately 35,000,000 lb. more than in the 1934–35 season, and as a result the returns of the dairy-farmers were approximately £2,000,000 greater. Incidentally, herein is provided a striking concrete illustration of how materially adequate summer feeding influences production and returns in dairying. The essential difference between the two seasons was in respect to the summer feed-supply, and, as usual, this difference was felt most acutely in February; the 1936 February dairy-produce gradings were greater than those of 1935 by the equivalent of over 90,000 cwt. of butterfat, of a value of roughly £500,000—surely a handsome return for one month for more efficient feeding.

The wet, cold spring followed by a summer of unusually abundant rainfall had a material influence also on fat-lamb production. This is indicated by the fact that while the number of lambs killed for export for the five months ending February, 1936, was almost 600,000 less than the number for the same period of the previous season, yet the corresponding numbers for the nine months ending 30th June are practically equal, being 8,766,757 in 1936 in comparison with 8,782,242 in 1935. Proportionately, the killings of sheep are essentially similar. In those districts which experienced the type of season under consideration, it was difficult to achieve proper control of pasture growth, and for the exceptional conditions obtaining many farms were understocked. Despite the abundance of summer feed, the reserves of hay and silage built up were not at all exceptionally heavy. In the first place, the broken summer weather did not favour successful hay-making, and, further, farmers being faced all along with the possibility, indeed the probability, of a dry spell during which the plentiful supply of pasture growth would be needed, and being unable to foretell the season, played for safety by keeping plenty of feed at hand on the pastures. The unusual abundance of feed in the fall of the year may have after-effects which warrant the consideration of sheep-farmers. In the first place, the conditions favoured the development of parasitic troubles, the control of which calls for special measures to which public attention has been directed by departmental officers; in the second place, because of the abundance of feed, many farmers are anxious about the over-fat condition of their ewes, which often is associated with trouble at lambing.

In the main grain-growing area, the South Island, the season was most variable: while the winter was practically normal, conditions through the growing season were good, and though final figures are not yet available the position is advanced enough to indicate that relatively heavy yields have been produced.

OUTSTANDING FEATURES OF THE YEAR.

Included among the outstanding features of the farming industry for the year are:—

1. An increase of 4·283 per cent. in the production of butterfat for the eleven months ending June, 1936, as compared with the corresponding period of the 1934–35 season, and the probability that the production for the complete season ending 31st July will be only about 0·8 per cent. less than the record production attained in the 1933–34 season. This increase in total production is associated with an increase in the average butterfat-production of all dairy cows, which, in its turn, is correlated with the better feeding, resulting mainly from the more abundant pasture-growth in the latter half of the season.

2. Sales of wool have been record ones in respect of quantity, and have been characterized by solidity of demand and regularity of price, the fluctuations in prices from first to last being small indeed. It is of some moment that the quantity disposed of included a considerable amount of wool carried over—it is estimated that 49,400 bales of wool are being carried over from the 1935–36 season, whereas 186,679 bales were carried over from the 1934–35 season. As a joint result of increased quantity and improved price, the gross value of the wool sold in 1935–36 was £10,083,297, in comparison with £4,486,480 in the 1934–35 season.

3. A substantial increase took place in the number of carcasses of pigs killed for export, 662,754 being killed during the nine months to the 30th June, 1936, in comparison with 566,459 in the corresponding period of the previous season. The increase in the weight of pig-meat for export is greater than the above figures suggest, this being due to the fact that baconers constitute over 70 per cent. of the increase in number.

4. There was an increase in the killings of wether mutton for export from 940,401 in the nine months ended 30th June, 1935, to 1,143,311 in the corresponding period of 1936.

5. A decrease took place in the killings of ewe mutton for export from 1,179,092 in nine months ended 30th June, 1935, to 735,962 in the corresponding period ended 30th June, 1936. These killings confirm impressions obtained from autumn sheep-sales in indicating that the breeding-ewe numbers have been built up by retaining in the flocks ewes that normally in the past would be slaughtered on account of age.

6. A relatively large increase took place in the killings for chilled beef, which, however, continue small in comparison with other quantities of meat exported, the figures being 119,653 quarters for nine months ended 30th June, 1936, compared with 49,297 quarters for the corresponding period of the previous season.

7. An increase occurred in the quantities of apples and pears exported to 1,228,286 cases in the 1936 export season from 1,063,420 cases in the 1935 season.

8. There was a substantial increase in the wheat crop. Up to the end of May 82 per cent. of the total estimated area had been threshed for a total yield of 7,619,126 bushels, this giving an average yield of $38\frac{3}{4}$ bushels an acre, the corresponding figures for the previous season being 5,410,857 bushels and 27 bushels. As a result of flood damage, part of the unthreshed area may reduce the average figures.

9. A substantial increase has been recorded in the oat crop: up to the end of May, 1936, the total threshed was 3,227,525 bushels, giving an average of 47·7 bushels an acre, the corresponding figures of the previous season being 1,847,390 bushels and 38·68 bushels.

10. Increased deliveries of fertilizers by rail were made for the Dominion as well as for each Island separately, the Dominion total being 664,330 tons for the year ended 31st March, 1936, an increase of 38,309 tons in comparison with the previous corresponding year.

11. Record deliveries of lime by rail were made for the Dominion, these, however, involving a decrease of 9,610 tons in North Island deliveries and an increase of 11,130 tons in South Island deliveries for the year ended 31st March, 1936, in comparison with the corresponding previous year.

12. An increase took place in the honey exported to 10,446 cases valued at £34,258 for the year ended 31st March, 1936, in comparison with 5,427 cases valued at £17,844 in the corresponding previous year.

INCREASED EFFICIENCY.

In the reports of the two immediately preceding years certain trends towards increased efficiency which were then evident were noted, and from the foregoing it seems clear that the effects of some of these trends are already reflected in our farming. It is noteworthy also that growing attention continues to be given to some of the major matters bearing on our farming efficiency.

One of these matters is the use of fertilizers. Investigation of the economic role of fertilizers has continued, and has yielded evidence confirming that previously obtained, extending its application and indicating that in many parts of the Dominion there is economic justification for increased use of fertilizers on the basis of current returns and costs in farming. Hence the trend towards increased use of fertilizers as indicated in the increased quantities of fertilizers carried by rail for the year ended 31st March is well warranted and indicative of improved farm practice.

As is so advisable, the development of pig-keeping as an auxiliary to butterfat-production continues to receive increasing attention. The rise, during recent years, of pig-products as an important item in the export trade has been somewhat phenomenal. In 1924 the killings for export numbered slightly fewer than 5,000 carcasses; twelve years later, in nine months of the 1935–36 season, they have exceeded 660,000 carcasses, and seem likely to approximate 710,000 carcasses for the complete producing season ending September, 1936. Assuming export prices of pig-products remain constant at about the current level, further substantial increases in production are economically sound, and seem extremely probable. This may be attributed to the fact that more and more farmers are realizing that it is quite a normal performance to produce 40 lb. of pig-meat (dressed weight) for every 100 lb. of butterfat produced, and that such a production of pig-meat often may be secured without any substantial additional outlay in equipment and material. The possibility of further economic expansion in pig-production gives rise to a pressing need for activity in various directions, and this activity is being undertaken or contemplated by this Department. In the first place, it is important to bear in mind that much profitable expansion could be based simply on freer application of our present knowledge. This points to the need for a more extensive advisory service. In the second place, further expansion probably will make certain current problems of greater moment or create new problems. Hence, there is urgent need for investigation relative to certain matters so as to be the better able to deal with the problems of the future. Among the matters which promise to be prolific of future problems, which are now receiving attention, and which warrant continued and increased attention, are (1) the more effective use of dairy by-products which is likely to develop along the line of increased exploitation of pastures, pasture-equivalents, and grain crops in pig-keeping; (2) the production of carcasses of the weight and type best suited to the needs of the market—this is likely to involve an intensification of the swing-over to the production of baconers, which is already taking place; (3) the prevention in preference to the cure of diseases and disorders, which, judging from the history of live-stock ventures, is likely to become a more acute problem as our pig-population becomes more dense; (4) the evolution of strains of pigs in which good carcass type is associated with economical conversion of feed into flesh under the conditions of feeding and accommodation which it is economic to provide in the Dominion.

In zeal and enthusiasm about the future development of our pig-keeping there seems at times to be an inclination to overlook the outstanding feature of the position—this is, the immense and profitable scope for expansion there is along the line of better exploitation of the foundation material we already possess, both in the better strains of our pigs and in our knowledge, which, though imperfect, in some respects is nevertheless considerable.

Evidence of the trend towards improved farming continues to be provided in the maintenance of a relatively heavy, and in several instances an increasing, use of certified seed. In the 1936 harvest there were record acreages devoted to the production of certified seed of potatoes, wheat, white clover, cocksfoot, and Italian rye-grass, while the perennial rye-grass acreage increased in comparison with that of the previous harvest. The major portion of the certified seed produced is used by the farmers of the Dominion, and from the superior characters inherent in certified seed its use makes possible increased production of crops and pastures.

An endeavour to make better provision of feed is indicated in the fact that the sales of lucerne culture by the Department have been record ones and sufficient to treat the seed required for the sowing of approximately 8,000 acres. After making allowance for the area of previously established lucerne which goes out of production annually on account of its age, &c., the sales of lucerne culture point to an increase in the total Dominion acreage of lucerne. At the same time, the apparent increase at best is only a few thousand acres, and, while welcome as a continuation of the steady increase in the Dominion acreage of lucerne which has been going on for several years, it is much less than the intrinsic merits of the crop justify. Our knowledge of the requirements of lucerne and of its culture under local conditions has become sufficient to enable the failures with the crop that occurred fairly often in the past to be avoided, provided advantage is taken of the conclusions which have been drawn from accumulated field experience and from field trials.

Though there are differences in detail, and though exact data are not available, the position in respect of the role of special crops for feed seems to be essentially the same as last year when evidence of a satisfactory trend was recorded. Facts supporting this are the heavy sales made last spring of seeds of crops providing feed to supplement the pastures, and the frequency of inquiries about such crops.

While the chilled-beef position has not altered materially during the year in comparison with the previous year, the trade in chilled beef, though small, continues to expand, and our knowledge about it grows. For the nine months ended June, 1936, the killings for export provided 119,653 quarters, the corresponding figures for the previous year being 49,297 quarters.

The Dairying Position.

A more buoyant condition has marked dairy affairs generally, and this practically from the opening months of the 1935–36 producing season. The stocks of butter in cold storage in Great Britain have been low. This has been due primarily to reduced production rather than to increased consumption, and the consumption of imported butter by Britain has remained steady. The prices obtained for butter have advanced appreciably.

The year 1935 was marked by a decrease of 14,000 tons in the imports of cheese by the United Kingdom, this being due mainly to substantial falling off in the New Zealand supplies, but the Canadian supplies, which have been declining steadily for several years, continued to decline. Apparently, in the main because of the change in the supply position, the New Zealand returns from cheese advanced.

The figures for eleven months ended June, 1936, of the current dairying season indicate that there is an increase of 4·283 per cent. in butterfat production in comparison with the corresponding period of the 1934–35 season, and the trend in seasonal yield points to a production for the complete season ending July that will be within approximately 0·8 per cent. of the record production of the 1933-34 season.

For the eleven months ended June, 1936, the salted butter graded was 138,054 tons, and the unsalted 6,713 tons, a total of 144,767 tons, compared with 129,007 tons, 4,942 tons, and 133,949 tons respectively for the corresponding period of the previous season; an increase of 8·08 per cent.

The quantity of cheese graded for the eleven months ended June, 1936, were white, 58,041 tons; coloured, 27,156 tons; a total of 85,917 tons, compared with white, 63,300 tons; coloured, 28,953 tons; a total of 92,253 tons for the corresponding period of the previous season; a decrease of 7·65 per cent.

The increase in the production of butterfat proportionately is substantially greater than the increase in the number of dairy cows. Hence, the year was marked by an increase in the average butterfat production of all dairy cows in comparison with the previous year when the the average was 210 lb., but it is estimated, in the absence of definite data, that the average butterfat production of all dairy cows for the 1935–36 season will be approximately 218 lb.: that of 1933–34 was 220·8 lb.

The tendency during recent years has been towards a greater proportion of the dairy production taking place in the early part of the season, and it seems that had the 1935–36 season been a normal one this tendency would have continued. Although the production for the first four months to the end of November was substantially less than that of the corresponding periods of the 1933–34 and 1934–35 seasons, the August production was appreciably higher than in either of the two immediately preceding seasons. Later the adverse spring weather caused a substantial decline which, however, was more than counterbalanced by the abnormally heavy production in the latter part of the summer. The exceptionally wet summer resulted in abundance of feed which gave the unusually heavy summer production of butterfat. In short, feed-supply was the governing factor in the 1935–36 dairy production, a fact which should serve to drive home the importance both of good feeding and the measures entailed in good economic feeding in our dairying economy.

The quality of dairy-produce has been well maintained. An increase in the proportion of cream delivered daily in conjunction with considerable improvement in dairy buildings, both on the farms and at the factories, has contributed towards improving or maintaining quality in the creamery butter. Complaints regarding certain butter-containers have been given attention with a view of remedying the position. In cheese-manufacture several matters, particularly in respect of storage and handling, that affect quality have been receiving close attention, and the average quality of the cheese has approximated that of the previous season. It is realized that there is still scope for improvement in the quality of some of our dairy-produce, and prospective means of bringing about improvement continue to receive consideration. The standards set by the Dairy Division for the grading of cream are being followed fairly closely, and it is considered generally that cream grading in conjunction with increased daily delivery has appreciably lessened the quantity of cream of inferior quality. Likewise in cheese-production the grading of milk with differential payments according to grade is recognized as of assistance in obtaining a better supply of milk.

In the calendar year 1935 there was a marked falling-off in the number of certificates issued in respect of the work of certificate-of-record testing. The number of certificates issued was 723, whereas 892 were issued in the previous year; in 1935 there was a slight decline in the average butterfat production relative to these certificates. In comparison with the previous year there were declines also, both in the number of cows tested under Government official herd-testing and in that under ordinary herd-testing—in the latter the decline amounted to 31,703 cows.

During the year the organization of group herd-testing was remodelled. The previous control by a voluntary non-statutory body was discontinued, and the Dairy Board was given power to control group herd-testing and associated work. During the year herd-testing was assisted by a Government subsidy of £4,000.

While the position in the dairy industry as a whole is particularly satisfactory, especially when one takes into account the recent progress and improvement that has taken place in a period of difficult conditions, during which production and quality have been maintained and considerable building for the future has taken place in both pastures and stock, there is, nevertheless, need to mention two matters in regard to which there is considerable call for improvement—the quality of dairy-produce and better control of the diseases of dairy stock.

As in the past the Department continues to give much attention to measures the object of which is improvement of the quality of dairy-produce—the system of farm-dairy instruction warrants specific mention in this regard. During the year thirty-nine dairy-farm instructors were employed by eighty-nine dairy companies, receiving supplies from 36,098 farmers of a total of 70,258 suppliers to dairy factories for the whole of the Dominion. Hence, 34,166 suppliers to dairy factories did not receive direct advice regarding the quality of their produce.

In common with the dairying of other countries, New Zealand dairying suffers grave annual losses because of the diseases of dairy stock. In respect of this one can obtain but little if any consolation from the fact that some of the major diseases, such as mastitis and contagious abortion, seem to be more burdensome at times overseas than in New Zealand, and this in countries which have devoted more funds and ability to research relative to the control of the diseases than could be provided by such a small country as New Zealand. As is indicated by the appended report of the Director of the Live-stock Division, the work of investigating these diseases continues to be prosecuted vigorously in New Zealand, and at the same time New Zealand veterinarians and associated workers take pains to keep themselves acquainted with the results of cognate research overseas.

The Sheep-farming Position.

The somewhat unsatisfactory condition of sheep-farming in 1935 was replaced in 1936 by a remarkably buoyant one, comparable to that of 1934. The change was due largely to the great change in the wool position. The wool sold reached a record quantity, and the prices obtained in 1935-36 showed a marked improvement in comparison with those of the previous year. The following information taken from the annual review of Messrs. Dalgety and Co., Ltd., sums up the position:—

"The following table gives a comparison of the results of the Dominion wool sales for the last two seasons:—

	1934–35.	1935–36.
"Bales sold	479,797	756,833
"Net weight, lb.	164,618,251	264,947,142
"Weight per bale, lb.	343	350
"Gross value	£4,486,480	£10,083,297
"Average per bale	£9 7s.	£13 6s. 5d.
"Average per lb.	6·54d.	9·13d.

"The above table shows the following increases for the 1935–36 season: Bales, 277,036; weight, 100,328,891 lb.; gross value, £5,595,817; value per bale, £3 19s. 5d.; value per pound, 2·59d.; weight per bale, 7 lb.

"The following figures show the bales sold and the average prices realized for North and South Islands respectively:—

Island.	Bales sold.	Average per Bale.	Average per Lb.	Weight per Bale.
		£ s. d.	d.	lb.
North	453,727	12 10 5	8·30	362
South	303,106	14 10 6	10·48	332
New Zealand	756,833	13 6 5	9·13	350

"The production of wool in the 1935–36 season has been computed as—greasy wool, 625,240 bales; slipe, 91,992 bales: a total of 717,232 bales."

The end of the season found a very small carry-over in the stores, the estimated total being 49,400 bales as compared with a carry-over of 186,679 bales at the end of the 1934-35 season. A feature of the 1935-36 wool season was the constant demand for all classes offered, and the relative uniformity in prices from the beginning to the end of the selling season. The destination for the year ended June, 1936, of only approximately 35 per cent. of the number of bales sold was the United Kingdom, whereas, during the year ended September, 1934, over 56 per cent. of New Zealand wool, and in the year ended September, 1935, over 58 per cent., was exported to the United Kingdom.

As was the case a year ago the world wool position seems distinctly satisfactory from the viewpoint of New Zealand producers, but, of course, unexpected developments later may affect the market. Recent decreases in the world's sheep population, which in the case of some countries are quite substantial, have been recorded. France's sheep population, for instance, has dropped from 14 millions in 1914 to 9·8 millions in 1933. On the other hand stocks of crossbred wool at consuming centres were at March of this year brought down for the first time for many years to a normal figure, and the maintenance of the current consumption might lead to higher prices. Taken in conjunction with the present demand for wool it seems of some significance that the estimated world's annual production of raw wool, which has been declining steadily, was approximately two hundred million pounds less in 1934–35 than it was in 1928–29. Recently—*i.e.*, April, 1936—the Imperial Economic Committee stated: "Factors contributing to the present healthy statistical position of wool have been the fashion trend in the East, particularly Japan and China, where wool tissues enjoy a growing popularity and the consequent industrial development in those countries (more particularly in Japan)."

The estimated average lambing percentage in 1935 was 86·31; this is substantially less than that of 1934, which was 89·24, and indeed less than that of any year since 1930. However, because of the increase in the number of breeding-ewes in 1935, the total number of lambs estimated for 1935 did not fall as much as the decreased lambing percentage would at first sight suggest; the estimated number of lambs for 1935 was 15,373,642, while for 1934 it was 15,680,393 estimated and 15,689,492 actually tailed. The lowered lambing percentage is considered to be due partly to the existence of facial eczema in some ewes when the rams were put out and partly to the fact that the season was not a good one for lambing in certain districts.

The interim return of sheep as at 30th April, 1936, gives a total of over 30,000,000, which is an increase of nearly 1,000,000 on the previous year's total and which is the second highest total recorded—the peak year was 1930 when 30,841,000 sheep were in the Dominion on 30th April. To some extent the sheep population as at 30th April, while of customary accuracy as a return, does not represent the true position in the sheep industry. This is because the figures relative to 30th April reflect the late killing-season. Since 30th April slaughtering of wethers and lambs has proceeded much more freely than is usual at this season—approximately 160,000 more sheep were slaughtered during May and June, 1936, than in the same months of 1935 and, of course, the increase of 1,000,000 in sheep population is reduced by this number at the end of June. For the nine months ending 30th June the killings for export were: Lambs, 8,766,757 carcasses in 1935–36 and 8,782,242 carcasses in 1934–35; wethers, 1,143,311 carcasses in 1935–36 and 940,401 in 1934–35; ewes, 735,962 carcasses in 1935–36 and 1,179,092 carcasses in 1934–35. The sharp decline of 443,000 in the killings of ewes points to the strengthening of the number of breeding-ewes by including a larger proportion of old ewes. Some interest attaches to the fact that the killings of breeding-ewes were high last year and again in 1931–32—both years in which wool prices were abnormally low.

Apart from an increase of 112,000 in the freight carcasses of boneless beef for export, the available returns do not point to any material change in the beef-production. Probably any substantial future change in that respect will be correlated with developments in chilled-beef production.

While the normal high quality of New Zealand meat has been well maintained, it seems to behove us to ask whether this suffices in view of developments in the world's meat trade. It probably may be said with truth that quality is of more value in meat-marketing now than it ever was before. Some of our competitors in the world's meat-markets assiduously have been increasing, not only their output but the quality of that output. In regard to lamb, for instance, the point may have been reached where there is danger that our supremacy in regard to quality—a supremacy which is so valuable to us—may be challenged. The New Zealand sheep industry cannot face such a possibility with equanimity. Fortunately there is no clear reason why its previous valuable eminence in respect to quality of lamb and mutton cannot be maintained.

Fruitgrowing.

The area in commercial orchards in the Dominion remains practically stationary at about 27,000 acres, of which 11,700 are in the North Island and 15,400 in the South Island; any planting of new areas is largely offset by other established areas becoming unprofitable and going out of production.

The conditions prevailing generally in the 1935–36 season were not at all favourable for orcharding. Considerable damage was done by gales in February, and, further, largely because of weather conditions, the amount of disease and of russetting was greater than usual. Despite the unfavourable conditions the quantity of fruit exported was greater than in the previous season, being 1,228,286 cases—1,115,320 cases of apples and 112,966 cases of pears—in comparison with 1,063,420 cases in the previous year, in which the quantity was the lowest since 1929. The total quantities in cases of apples and pears exported during the previous four years were: 1932, 1,596,058; 1933, 1,430,513; 1934, 1,574,912; 1935, 1,063,420. Throughout the season the fruit exported was in excellent condition. In general the handling of the fruit at the ship's side was as satisfactory as can be expected under the conditions obtaining. The local carriers of fruit—the shipping company and the Railway Department—gave good service. Although some modern vessels have been engaged upon the export fruit-trade, the majority of the ships used were of an old type in which improved equipment for fruit carriage would be of value. Of the 1936 exports 818,973 cases went to London, 191,736 cases to the West Coast of Britain, 61,659 cases to Southampton, 55,624 cases to Halifax, 30,000 cases to South America, 62,000 cases to the Continent of Europe, and 7,790 cases to the East. The Government assists in the export of fruit; its liability does not exceed £12,500 for each year, and Government assistance is to cease with the 1937 payment.

Citrus culture is making satisfactory headway, especially in the northern districts which are suitable for the production of citrus fruits. The total area now planted in citrus fruit-trees is 1,884 acres, consisting of 1,300 acres of lemons and 584 acres of oranges; 112 acres were planted during the year. Good, seasonable crops of lemons were secured. While appreciable improvement in the grade and keeping-quality of the fruit took place there remains room for further improvement. Growers are showing a keen interest in this and a desire to improve their knowledge. Regulations relative to the grading and packing of citrus fruit were brought into force in December, 1935, and growers are satisfactorily endeavouring to meet the position. The New Zealand grape-fruit (Poorman orange) is coming into favour rapidly as a breakfast fruit, and plantings are being made to meet the demand. Various phases of citrus growing have been investigated and further investigation is contemplated. The co-operative grading and packing shed at Kerikeri is nearing completion, and this should be of great value to citrus growers in that district, where the citrus industry is of considerable size.

Passion-fruit culture which received considerable attention a few years ago has not made any progress during the past year. There is evidence of increasing demand for New Zealand wines and of expansion in vineyards. The season was unsatisfactory because of the weather generally, and particularly the February storm, and it is considered the season's wine-production will not exceed 100,000 gallons in comparison with 148,000 gallons in the previous season.

Many demands have been made upon the Department for advice regarding orcharding, and as a means of ensuring that such demands for advice will be met in a fully satisfactory manner in the future, a considerable amount of investigational work is being undertaken; trials carried out during the year numbered seventy-five. An important series of the trials relates to the use of fertilizers and lime. The investigational work relates also to root-stocks, spraying, grafting, variety-tests, and fruit cold-storage. Especial attention has been given to cold storage, because of its importance in orcharding, and the work has included experiments carried out in conjunction with the Department of Scientific and Industrial Research. A portion of the work is now reaching finality and it is clear that some very useful information is being obtained. The work ranges over a wide field and deals with the influence of locality and soil types on the keeping-quality of apples, the influence of maturity on the incidence of bitter pit in Cox's Orange Pippin, the use of oil wraps in the control of scald, the influence of storage temperatures on internal breakdown, and the influence of methods of handling on overseas transport.

Other Branches of Primary Industry.

The markedly satisfactory status of the major sections of primary industry in respect to the quality and quantity of production is repeated in certain other branches of primary industry which, though not of particularly great current importance, in our national economy are, nevertheless, very useful parts of it or promise to become of major importance.

PIG-KEEPING.

Previous reference has been made in this report to the welcome evidence that dairy-farmers not only are obtaining a more thorough knowledge of the valuable potentialities in pig-keeping as a companion venture to butterfat production, but also are applying this knowledge in their farm practice, the concrete result of this being the striking increase in pig-meat production that is in progress. During the year under review, as in recent years, this Department has carried out a considerable amount of investigational work relative to pig-keeping. Various diverse methods of pasture utilization by pigs have been the subject of formal investigation and of observation in the field, and the Department is now able to indicate which of the methods considered have been attended with most success and are most suitable in practice. The growing on the farms for use by pigs of grain crops and of crops which may serve as alternatives to pastures has also been studied, and while much valuable information about the economic use of such crops has been obtained further investigation is desirable. Diseases of pigs have been the subject of considerable investigation, which already has yielded valuable information, though further work in certain directions is desirable. In this work field officers of the Live-stock Division have at times co-operated with the Wallaceville Laboratory of that Division. Some detailed information about the work is given in the appended report of the Director of the Live-stock Division, and that of the Officer in Charge of the Wallaceville Laboratory. An interesting phase of the work is that relative to tuberculosis in pigs. The justification for expenditure on such work is clear from the fact that tuberculosis was recorded in over 16 per cent. of the pigs that came under inspection. Another interesting phase is that relative to the infections which are responsible for a large proportion of the cases of pleurisy and pneumonia in pigs—disorders which field experience shows to be associated with bad feeding and housing. It is recognized that to enable the results of the current investigational work to be fully exploited it is advisable to supplement this work by farm-management studies designed to determine the economic scope and nature of pig-keeping on dairy-farms, having due regard to such matters as the size of the farms, soil types, labour utilization, cropping possibilities, &c. In short, it is necessary to consider the farm as a unit, which is what the farmer himself does, and to determine how butterfat production and pig-meat production may be combined into a farming unit with best economic effect.

POULTRY-KEEPING.

In general the poultry industry had a satisfactory year except for the fact that disease has been more in evidence than usual—*e.g.*, an outbreak of fowl-pox which occurred at Auckland was fairly widespread and serious in its effects. During the past season, 11,915 cases (357,450 dozen) of eggs were exported to the United Kingdom in comparison with 11,527 cases (345,600 dozen) in the previous season.

The industry, through the Poultry Board, is characterized by energetic endeavour designed to bring about improved business conditions and practices within the industry, and in this direction the Poultry Board and the Department of Agriculture have been in consultation about such matters as Government subsidy or guarantee; chick-sexing in respect to which examinations are conducted by the Department—restrictions on uncertified persons undertaking chick-sexing are suggested; Stock-foods Bill; chilled egg (marketing) regulations; and research relative to poultry diseases. Considerable research relative to poultry diseases has been carried out, and expansion of this work is contemplated. Some detailed information about current investigation of poultry diseases is given in the appended reports of the Director of the Live-stock Division and of the Officer in Charge of the Wallaceville Veterinary Laboratory.

Fifteen candidates presented themselves at the first chick-sexing examination in this country which was conducted at Wallaceville Poultry Station during the year, and three second-class certificates were granted.

Wallaceville Poultry Station continues to discharge several distinctly useful functions: it demonstrates the best known methods of poultry-management, and during the year it conducted experiments relative to various aspects of poultry-culture, including feeding-practice. The results of two trials were recorded in the *Journal of Agriculture*.

BEEKEEPING.

Apiary registrations were fairly numerous during the year, and approximately 8,500 apiaries are now registered. The honey exported for the year ended 31st March, 1936, was 10,446 cwt., valued at £34,258; the corresponding figures for the previous year were 5,427 cwt., valued at £17,844. Grading of honey for export was carried out along lines fixed two years ago by the Honey Control Board. The grading system, which is working smoothly, eliminates the export of honey of low grade, which endangered the high overseas status of New Zealand honey.

The organization of the honey industry, particularly in regard to marketing both locally and overseas, has been the subject of adverse criticism, and possible improvement in this respect is receiving both private and official consideration.

The wet and unsettled weather conditions during the summer and the exceptional storms in February militated against the optimum results. As far as possible with the funds available close attention has been give to inspection of apiaries in respect to disease, relative to which much valuable assistance has been received from those beekeepers who act as honorary apiary inspectors.

TOBACCO.

In comparison with the previous year the number of persons afforded employment from tobacco-growing has increased; 2,651 acres of tobacco was grown in 1935–36 in comparison with approximately 1,800 acres in the previous year. A prospective record crop in the Motueka district, where 2,300 acres were planted, was severely damaged by hail. A trial consignment of Nelson-grown leaf sent to London under the supervision of the Department's Tobacco Instructor arrived in good condition and realized a satisfactory price. Consideration is being given to the further exploring of the market.

Diseases which have developed in the crop have been investigated and useful information has resulted. Use of the experimental area near Auckland is being made in the production of seed of the Virginian type.

HEMP.

For the year ended 31st March, 1936, 26,162 bales of hemp were graded, an increase of 7,348 bales in comparison with the previous year. The corresponding figures for tow were 4,848 and 3,510 bales. A comprehensive examination of the whole hemp-industry position was made by the Department during the year, and it is considered that some steps to improve the milling of the fibre seem possible. At present too high a proportion is of low grade, which hampers the export trade.

SEED-GROWING.

In the year under review, the official certification of seed was extended to include *Phalaris tuberosa*. Irrespective of the area devoted to brown-top, which is not available, there has been a substantial increase in the area inspected in respect to the production of certified seed. The production of certified pedigree seed is an innovation of the year, and the limited supply of this seed was sold readily through trade channels. Contracts for future production of pedigree seed have been made. Further information about the year's results in respect to the official system of seed certification is given in the appended report of the Certification Officer.

For the year ended December, 1935, 15,309 samples of seed were received for testing by the Seed-testing Laboratory of the Department. As formerly, much the greater portion of the work was for the seed-trade. About two hundred samples were examined for the private information of farmers, and the remaining samples related to departmental activities, mainly investigational.

A possible result of official work relative to seed-growing is the replacement of certain seeds now imported by locally-grown seeds of superior characteristics. The appended report of the Seed Analyst contains information about valuable investigational work, including studies of the germination of Algerian oats, the causes of the low germination of perennial rye-grass under certain circumstances, and the laboratory determination of strain characters in white clover.

The Use of Artificial Fertilizers and Lime.

The artificial fertilizers carried by rail for the twelve months ended 31st March, 1936, were 38,309 tons more than in the previous twelve months. The Dominion figures in tons for the years specified are: 1929–30, 691,604; 1930–31, 568,491; 1931–32, 570,144; 1932–33, 613,450; 1933–34, 552,223; 1934–35, 626,021; 1935–36, 664,330.

The figures for the North and South Islands in recent years are—

	North Island. Tons.	South Island. Tons.
1931–32	435,237	134,907
1932–33	463,603	149,847
1933–34	394,156	158,077
1934–35	471,876	154,145
1935–36	493,222	171,108

The agricultural lime carried by rail during the year ended the 31st March, 1936, was 1,520 tons greater than in the previous year—the smallest annual increase recorded in recent years. The quantities, in tons, of agricultural lime carried annually by rail since 1st March, 1930, are—

	North Island.	South Island.	Total for Dominion.
1930–31	72,678	83,168	155,846
1931–32	70,570	69,766	140,336
1932–33	94,701	79,713	177,117
1933–34	99,919	94,068	193,987
1934–35	116,482	128,256	244,738
1935–36	106,872	139,386	246,258

The extent of the fertilizer investigations carried out by the Fields Division may be gauged partly by the fact that at 31st March, 1936, 510 fertilizer trials were in progress. These comprised 466 devoted to pastures and 44 devoted to lucerne and annual crops, and included 160 which were laid down in the year under review.

The survey of the response of grassland to fertilizers which has been continued from previous years, and which is to be continued in the future, accounts for half of all the fertilizer trials. A main objective is to ascertain the role of potash and lime in association with phosphates, and latterly trials have been laid down for the purpose of throwing light on the relative merits of various phosphatic fertilizers, including "Heskett" slag.

The trials show that, generally, attractive results are obtainable from phosphates, and that at times lime alone, at other times potash alone, and at still other times both lime and potash, may advantageously be used in association with phosphates. From such evidence it seems likely that some farmers err by not spending money on lime, while others err by spending money on lime, and that a parallel position obtains in regard to the use of potash. It seems also from the experimental work under review that fertilizer practice should be based mainly on the information resulting from trials and observation in the field, instead of on generalized or traditional considerations such as may arise from attaching undue weight to what has happened under different circumstances or what has been taught in other times or places. Some of the views expressed at times about lime and also about superphosphate well exemplify the need of adjusting views to current knowledge relative to local circumstances.

There is much gratifying evidence that the results of fertilizer trials carried out by the Fields Division over a period are widely influencing farm practice—the manuring of pastures and cereals are striking instances—but, at the same time, there is some evidence that at times fertilizer practice so fails to accord with the best available knowledge that the farmer's purse suffers gravely.

Stock-disease.

A continuation of general freedom from contagious diseases in horses has again been recorded in the year under review—an exception is provided in some cases of strangles. The position relative to diseases of cattle is far from being so satisfactory, although the year has been a normal one. Of the 478,963 cattle (exclusive of calves) examined at abattoirs and slaughterhouses, 6·52 per cent. were affected with tuberculosis in varying degrees, an increase of 0·98 per cent. of infection in comparison with the previous year. Of 14,423 cattle subjected to the tuberculin test, 7·9 per cent. reacted. While blackleg remained at a satisfactory level, there was evidence of increase in the number of cases of Johne's disease. Work designed to assist in the control of this disease is in progress. Though the Johnin test cannot be described as completely reliable, it is most helpful in control. There was practically no change in the incidence of mammitis and contagious abortion. The curative value of vaccination not being established, hygienic control of mammitis is available as a protective measure, about which there is increasing confidence as the result of observations in herds in which hygienic methods have been adopted. Controlling the spread of the trouble rather than curing it continues to be the farmer's only protection against contagious abortion. Temporary sterility was not so much in evidence as in preceding years; investigations in regard to it are in progress, and the advisability of continuing these investigations is clear. Cattle-tick is not now looked upon as a serious parasite of stock under conditions in New Zealand, and its incidence is governed by the attention given to control measures which are well known. Paspalum staggers in cattle, not previously noted in the Auckland Province, occurred during the year, and was the subject of much study both in the field and at Wallaceville Veterinary Laboratory. Investigation showed that in all cases affected animals had been grazing paspalum attacked not only by ergot, but also by another fungus. No mortality occurred, but the milk-production decreased

and the affected animals lost condition. Bloat in cows was further investigated, one result being that acidulation of the drinking-water was reported as being of no value in prevention. The possibility of correlation between bloat and lime deficiency is being investigated. Internal animal parasites continue to be the cause of considerable losses in young cattle. The value of good feeding in combating such parasitic troubles often is ignored in practice; drenching without good feeding is apt to give unsatisfactory results.

In the North Island generally the wet summer favoured the development of parasitic troubles in sheep, and considerable attention has been given to the task of bringing under the notice of farmers the danger of losses in the absence of proper control measures. As anticipated, some losses have already occurred. No serious outbreak from facial eczema took place. The conditions associated with facial eczema did not prevail, but ewes affected in the previous season wintered badly, and in many instances had little milk after lambing. In the South Island facial eczema occurred in Mackenzie Country, and, relative to this, investigational work is planned.

The incidence of pulpy kidney in Otago tended to increase. The possibility of control of pulpy kidney by means of vaccination of the ewes was investigated during the year with most promising results. Briefly, on two farms the results were: of 812 vaccinated ewes, the number of lambs lost because of pulpy kidney was 2—*i.e.*, 0·24 per cent.—whereas of 840 unvaccinated ewes receiving the same treatment apart from vaccination the number of lambs lost because of pulpy kidney was 59—*i.e.*, 7·02 per cent. These initial trials well warrant continuation of the investigation. The year yielded no evidence of a lessened need for attention to lymphadenitis, which necessitates the rejection for export of carcasses in which it occurs. Practical control consists of giving attention at shearing-time to the precautions recommended. Sheep blow-fly has been fairly prevalent in most sheep districts, and considerable advice about methods of control has been necessary. Measures of control employed overseas have been under trial, and require further trial before reliable conclusions can be formed. Increased attention has been given to lice and ticks by the inspection staff.

The continued substantial expansion in pig-keeping intensifies the advisability of paying greater attention to those management-factors which are known to affect greatly the incidence of disease. The final results of current investigations should provide information of value in evolving methods of eliminating the present heavy losses from tuberculosis. But improvement in the present disease-position is not dependent on obtaining additional information from research; a great deal could be done towards minimizing the present heavy losses from disease simply by reasonable efficiency in applying the knowledge now available. It is known that feeding, hygienic conditions, and housing of the kind being recommended as the result of past experience would serve to bring about a sharp decline in the incidence of such serious troubles as tuberculosis, pleurisy, and necrotic ulceration of the skin.

The Rabbit Nuisance.

Despite the prevalence in the spring and summer of conditions unsuitable for effective poisoning operations, improvement is shown in the control of rabbits, much of which is now carried out by Rabbit Boards. Recently in districts in which Boards do not function local committees operated under the Employment Board's scheme, which provided for subsidizing labour for the purpose of rabbit suppression. When these committees were suitably organized they obtained valuable results. Board control is being generally favoured, because the various Boards have operated successfully. During the year several new Boards have been formed under the Act.

Control of Noxious Weeds.

On the whole, noxious weeds have been reasonably well controlled. However, the control of ragwort is giving much concern in some districts, and especially in the Auckland Province. Fortunately, a definite improvement is reported, this being attributable to the increasing use of sodium chlorate and the grazing of sheep. A proprietary preparation known as "Atlacide" has been compared in field trials with sodium chlorate, with which it has been found comparable in its efficiency in the destruction of ragwort. The practical interest attaching to this lies in the fact that Atlacide is safer than sodium chlorate on account of its inert matter nullifying the explosive properties of the sodium chlorate which it contains—sodium chlorate alone is dangerous when handled carelessly, but relatively safe when used with reasonable caution. As yet, completely satisfactory economic control of ragwort has not been evolved in regard to central portions of the North Island, but the Department plans to take special measures for the control of ragwort during next season in some of the districts most seriously invaded.

Variegated thistle in parts of the North Island and sweet briar in parts of the South Island have been spreading, and special attention is to be given to their control. The apathy of certain landholders has necessitated considerable attention to other important weeds such as blackberry, gorse, and Californian thistle. To date fifteen counties have assumed control of the administration of the Noxious Weeds Act within their areas.

Ruakura State Farm and Farm Training College.

At Ruakura State Farm the winter was fairly mild and rain not excessive, but the spring was very late, and when grass-growth ultimately commenced it was exceptionally rapid. It was a difficult season in which to harvest surplus growth on pastures, but 86 acres of hay of moderate quality was stacked and an area of 50 acres of grass growth was ensiled. As has been the case in recent years, no annual sale of pedigree stock was held at Ruakura, but surplus stock was sold at the Combined Breeders' sale at Hamilton in September, when thirty-four yearling bulls averaged £15 17s. 6d., and when the demand for Shorthorns and Ayrshires was keen and that for Jerseys was relatively poor. There was a much keener market than for some time past for Ruakura Berkshires; Tamworths sold fairly well, but there was but a poor demand for Large Whites. On the whole, Ruakura Farm of Instruction has had a successful year.

The attendance at the Ruakura Farm Training College has been somewhat disappointing in respect to numbers, but a good type of student has been enrolled. The possibility that a course shorter than the present one of eighteen months would prove more popular is being given consideration.

At Ruakura, and at six other smaller areas which are to varying extents under the control of the Fields Division, valuable experimental and demonstrational work is being carried on. Such areas are of definite value for investigational work which is too difficult or too intricate to be carried out in co-operation with farmers in the manner in which it proves possible to organize a considerable amount of valuable investigational field-work.

Te Kauwhata Horticultural Station.

At the Te Kauwhata Horticultural Station, in the lower Waikato, the usual farming-operations were carried out. The grape crop suffered from the severe February storm. It is estimated that the wine produced in the year will not exceed 12,000 gallons, which is about 2,500 gallons less that was produced in the previous year. During the year 12,606 gallons of wine were sold. A considerable demand for wines, principally table varieties, from all parts of the Dominion has been met. The receipts exceeded expenditure by about £1,700.

The Plant Research Station.

As in previous years, the Plant Research Station has operated in substantial co-operation with the Department of Scientific and Industrial Research. At Palmerston North and at Marton extensive work on pastures, much of which was previously in progress, has been continued. Strain-testing of grass and clover species has been a major feature of the agrostological work, while by plant-breeding towards a "pedigree" standard, which has been contined, it is expected to raise the standard of ordinary certified seed. This work has involved close and valuable co-operation with the Fields Division. In an investigation relative to "feed" flavours in dairy-produce different phases of the question have been receiving the attention of dairy companies, farmers, the Dairy Division, the Dairy Research Institute, the Fields Division, as well as the Plant Research Station, and already information which promises to yield guidance of value is in sight. The Agrostology Section has initiated a pasture-survey in Hawke's Bay as part of the land-utilization survey of Hawke's Bay, which recently has been commenced. Arrangements between the Agrostology Section and the New Zealand Golf Council provide for the continuation of research and advisory work relative to green-keeping. In collaboration with the Fields Division an extensive series of trials regarding pasture-seed mixtures is in progress. Many arable crops, including wheat, oats, peas, potatoes, lucerne, rape, tomatoes, soya beans, onions, and maize, have been the subject of investigation at the Plant Research Station, Palmerston North, at the Pure Seed Station, Lincoln, and, in collaboration with the Fields Division, at various other points throughout the Dominion. The fungi and bacteria that have a bearing on farm-products have been the subject of considerable research. Previous work on dry rot of swedes, which has been continued, has given particular attention to disease-resistance of strains or varieties. Considerable attention has been given to club-root control, but so far no strain which satisfactorily resists attack on badly-infested ground has been found. Brown-heart of swedes, turnip mosaic, rusts and smuts of cereals, virus diseases of potatoes, internal brown-fleck

of potatoes are among the diseases of crops of major importance which have been investigated. Turnip mosaic, which has become of serious proportions at the Plant Research Station, Palmerston North, reduces the yield of rape by one-quarter. A survey of its economic importance in the main turnip-growing districts is planned. A discovery of much practical moment is that Aucklander Short Top is a carrier of masked potato virus, which causes grave losses when transmitted to other varieties. A considerable amount of work relative to horticulture has also been done, diseases of peas, beans, tomatoes, tobacco, strawberries, hops, and marrows being included. Investigation has yielded useful information about moulds which damage foodstuffs, textiles, &c. Supplies of lucerne-inoculum sufficient to treat 122,000 lb. of seed were sold, and the use of similar inoculum for other leguminous crops such as clovers, lupins, peas, soya beans continues to be investigated with, as yet, such varying results that no definite findings can be advanced. In seed-testing, determinations of purity and germination-capacity called for 23,960 tests; 1,525 samples of perennial rye-grass were subjected to ultra-violet-light examination; samples of imported Australian cereals were examined for the presence of skeleton weed, from which they were free; as the result of recent research a satisfactory method of testing new season's Algerian oats has been evolved. Work during the year has provided further evidence of the reliability of the picric-acid test of white clover. During the year 79,000 parasites of the white butterfly were liberated, mainly in the principal South Island districts and in the Auckland Province. In the latter part of the season in some districts the parasitic control of the white butterfly was not as thorough as it was earlier in the season. The cause of this was investigated, and it seems likely that suitable measures to maintain satisfactory control will be found practicable. Much work relative to diamond-back-moth control is in progress both in the Dominion and in England, but control measures have not as yet been defined. Much work of horticultural interest has been in progress, including the use of winter oils in spraying, the use of insecticides for controlling the white butterfly in cabbage, and the control of red scale on lemons. The Systematic Botanist collaborated with the Live-stock Division relative to the incidence of facial dermatitis, and further work in this respect is in progress. Preliminary botanical observations have been made on ragwort-infested areas, and trials regarding fruit-tree stocks have been continued, while hazelnuts, walnuts, and apple varieties have received attention. The work of the chemical section was along the lines of previous years, and included the investigation of the chemical composition of herbage and the analysis of soils for plant nutrients. A considerable amount of further information about the work is contained in the appended report of the Director of the Plant Research Station.

Wallaceville Veterinary Laboratory.

The diagnostic and investigational work carried out at Wallaceville Veterinary Laboratory involved dealing with 9,030 specimens, analyses, and samples, while 42,615 samples relative to mastitis and contagious abortion were dealt with at the subsidiary laboratory at Hamilton. The specimens examined relative to Johne's disease indicated that ten new farms were definitely affected, and the need for control of this disease has been demonstrated. Because of the large numbers of pigs suffering from tuberculosis, whey samples were tested biologically—in one of seventy-seven samples infection with tubercle bacillus developed in guinea-pigs inoculated from the whey. Skim-milk from farms where much tuberculosis occurs in pigs is also being tested biologically. Over 40,000 samples relative to mammitis were dealt with, and the great majority of these samples were in respect to the mammitis-control scheme—some evidence that farmers recognize the value of the scheme. Treatment of cows with Azamine Entozon and chlorine has been fairly successful, and it seems advisable to encourage local treatment of the udder with suitable drugs. Two phases of sterility in cattle that have been the subject of considerable research are sperm morphology and dietary protein, while studies of sterility in sheep have indicated that coincident with a flush of feed in the autumn the effective fertility of many rams was unduly low. Investigation has shown that paspalum staggers, seen in New Zealand for the first time in April, 1936, may be set up by feeding ergotized seed-heads to cattle. Various phases of photosensitivity in sheep, embracing the so-called facial eczema, were the subject of considerable investigation while the use of rabbits proved valuable for the diagnosis of mycotic dermatitis which has been recorded over wide areas, but only in small numbers of sheep and especially in Merinos. It was shown that by putting material from the joints of affected animals on the cut end of the tail at docking time, lambs could be given arthritis, and in another experiment, a correlation between the greater incidence of antepartum paralysis and poor late-winter feeding was indicated. Good results sufficient to justify further work were obtained from vaccination of ewes, for the control of pulpy kidney in lambs. There was an increase in the

number of cases noted of pneumonia in sheep, but so far, casual organisms have not been identified. Arthritis and pleurisy in pigs were the subject of extensive investigations, while fowl-pox, coccidiosis, and leukaemia in poultry, have received further attention. Other matters dealt with during the year include grass staggers in dairy cows, magnesium metabolism, toxicity of common smuts, vitamins, and mineral deficiency.

The Chemical Laboratory.

As usual, a wide range of work of economic value has been carried out by the Chemistry Section. Several aspects of the control of bush-sickness have been investigated. Previous work in regard to the composition and the propagation of pampas grass has been extended. In regard to the iodine investigation progress has been made with the analysis of many glands already in hand. In general, in the North Island the supply of iodine is not below the critical point on any extensive areas, but some of the alluvial and river-bed soils, especially in the Wellington Province, are inclined to be low in iodine. In the absence of evidence of iodine deficiency, the use of iodized licks is not advisable, as iodine in excess of requirements is considered of no advantage, and may be injurious. A wide range of samples of soil, many being in respect to reclamation projects, was analysed. Most interesting results of distinct prospective practical value were obtained in an investigation in which disorders and mortality in pigs were correlated with the use of galvanized-iron piping for the transport of skim-milk to piggeries. In the meantime, pending further investigation, caution is recommended in the use of long lines of galvanized-iron pipes in the above connection. Included in the 994 samples received for examination during the year were soils, liming materials, fertilizers, pastures, weed-killers, dips, toxicological specimens, thyroids, and bloods. The Fertilizers Act was administered as formerly, the number of brands registered was 924, the number for the previous year being 851. The chemical control of weeds, especially ragwort was investigated.

Farm-management Survey.

In last year's report reference was made to the growing need for the study of farm-management which is distinct from both stock-management and crop-management, and which takes into account the farmer himself in relation to such matters as his finances, his supply of labour, his transport, and his markets, present and prospective. During the year, a farm-management survey of Hawke's Bay was initiated. This survey is being conducted as part of the land-utilization investigation being sponsored by the inter-departmental Land Utilization Committee. The Hawke's Bay farm-management survey is still in its early stages, during which the final results cannot be forecast reliably, but the work already done suggests that information of direct value will be obtained and that greater farm-population and greater farm-production in Hawke's Bay will be indicated as economic. The urban and rural communities of Hawke's Bay are interested in and assisting with the work.

Irrigation in Canterbury.

Because of the present and prospective development of irrigation farming in Canterbury, a special advisory service designed to provide the best available information about irrigation under Canterbury conditions has been inaugurated. If the best economic results are to be obtained from irrigation such information must be reflected in practice, and so it is intended that the service will keep in very close touch with the irrigators, and it is expected that as the area under irrigation is increased there will be a correspondingly increased demand for advice—a demand which will call for a strengthening of the service.

Advisory and Instructional Work.

The extensive manner in which the advisory and instructional services of the Department continue to be utilized reflect to some extent the ever-changing problems and difficulties that confront farming. It may be said with safety that the demands upon the Department are now more extensive, more varied, and more exacting than formerly, and this trend may be expected to continue if the increase in farm-production, which seems in prospect, takes place. Whether an increase in our present farm-production becomes a permanent feature of our national economy is dependent largely upon whether it is economic. Whether it is economic depends in its turn, to some extent at least, upon the standard of efficiency attained in farm-practices, and farm-management. Hence, it is of some moment that increased production, correlated with increased efficiency, and lowered cost of production, is often obtainable in several spheres of farming in New Zealand merely by better application of knowledge we have at hand. However, the translation of knowledge into practice sometimes takes place quite slowly, and this seems to be

particularly true of farming knowledge. Possibly an explanation of this has been the difficulty of disseminating knowledge among the farmers. Fortunately, however, this difficulty is being minimized by the influence of better facilities for social contact—*e.g.*, motor-cars, better roads, and radio. Hence, in the future, the translation of knowledge into practice, which it is a task of the Department of Agriculture to foster and facilitate, may bring about increases in farm-production more quickly than the rate of development in production of the past would lead one to expect.

Young Farmers' Clubs.

There is much evidence that an agency of much value to the Department in its advisory and instructional work is available in the Young Farmers' Clubs, the work of which has greatly extended since the initial clubs were founded in Otago in 1932. At the end of the year under review there were thirty clubs in the North Island and fifty-six clubs in the South Island, with a total membership of approximately 2,000, and the clubs are so rapidly growing in popularity that the time seems not far distant when there will be a chain of clubs throughout the Dominion located at most farming centres of sufficient population to have the social activities of typical up-to-date small rural communities. The Department proposes to stimulate the work of clubs by arranging for officers of the Fields Division to act as organizers and for departmental officers generally to assist the clubs as far as possible in respect to lectures, field days, &c. The clubs, which are self-supporting and which open their membership to those between sixteen and twenty-five years of age, hold monthly meetings regularly, and engage in a wide range of social and educational activities. They are receiving considerable enthusiastic support of adult business and farming communities.

Publications and Publicity.

The *New Zealand Journal of Agriculture* served usefully as the official medium for recording the investigational work of the Department of Agriculture and of kindred organizations which undertake the task of increasing the store of knowledge about means of improving farming. The *Journal of Agriculture* also fulfilled a purely advisory service in disseminating information not necessarily original, based on our accumulated store of knowledge, about farming practice. Hence the *Journal of Agriculture* generally has been composed of a blend of articles of technical and popular subject-matter.

As occasion arose, bulletins and other publications or statements were issued as in the past to supplement the *Journal*. The national series of weekly radio lecturettes from Station 2 YA Wellington was discontinued, but radio addresses by departmental officers were given at other centres.

Miscellaneous.

As usual, the Department has undertaken a good deal of work resulting from governmental measures connected with farming. The arrangement made in 1931 whereby the Fields Division purchased seeds and manures required by Government Departments has been continued and operated usefully during the year. For the year purchases of seed of the value of £21,745 were authorized. Many hundreds of individual lines were considered on the basis of purity, germination, and estimated unit values, and 1,656 lines representing 350 tons of seed were purchased. There is no doubt that the basing of purchases on a comparison of known values in this way has been advantageous. Other matters relative to which the Department has carried out work are the railage subsidies on lime and fertilizers, concessions on railway transport of primary produce, the arrangements with the manufacturers of superphosphate, the relief of producers subjected to abnormal storm-damage, and the financing of improved facilities in dairying. The Department has been in close touch with the Executive Commission of Agriculture, the Dairy Board, and the Meat Board relative to various matters affecting farming.

Conclusion.

I desire to record my appreciation of the assistance I have had from the Secretary, the Directors of the Divisions, the officers in charge of other units, together with members of the staff generally who, during the year, have endeavoured to the full extent of their ability, to have the responsibilities of the Department met as efficiently as possible. On the 1st May, 1936, Dr. C. J. Reakes relinquished his duties as Director-General, a position he had held since 1918. All members of the staff join with me in recording our very deep appreciation of the manifold services he has rendered his department.

A. H. Cockayne, Director-General.

NAURU AND OCEAN ISLANDS PHOSPHATE.

REPORT OF A. F. ELLIS, C.M.G., NEW ZEALAND COMMISSIONER, BRITISH PHOSPHATE COMMISSION.

DETAILS are supplied herewith regarding the sixteenth year of operations at Nauru and Ocean Islands under Government ownership. The year terminated on 30th June last, and the shipments compare with the previous years as follows:—

	1933–34. Tons.	1934–35. Tons.	1935–36. Tons.
Nauru	379,100	457,900	506,600
Ocean	177,489	237,982	319,779
Total	556,589	695,882	826,379

A substantial increase of 130,497 tons over the previous highest total will be noted, and, in view of the expanding demand for phosphatic fertilizers, an increase in output from the two Islands is again being aimed at for the current year. To permit of this, further plant is being installed at the Islands. Distribution of the output was as follows: United Kingdom, 6,000 tons; Australia, 561,200 tons; New Zealand, 192,879 tons; other countries, 66,300 tons.

The proportion of output which came to New Zealand was 23·34 per cent., as compared with 26·76 per cent. for 1933–34 and 30·84 per cent. for 1934–35.

Importations to New Zealand compared with the two previous years are: 1933–34, 149,805 tons; 1934–35, 201,665 tons; 1935–36, 199,237 tons.

During the period under review the weather conditions at the Islands have been favourable, and the health of the staff and labourers has been good, with the exception of an epidemic of influenza at Ocean Island last year. The loading arrangements at both Islands have continued to give satisfactory results, and rapid discharging of cargoes at New Zealand ports has been maintained.

The Commission's m.v. "Triaster" and s.s. "Triona" are making fast trips between Australia and New Zealand and the Islands, the former having now delivered a total of twelve cargoes and the latter fifty-one in the two countries, besides carrying out any necessary mooring work.

LIVE-STOCK DIVISION.

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

The functions of the Live-stock Division cover a varied and extensive field. Primarily the Division is concerned with the protection and maintenance of the animal health of the Dominion. This is established through the agency of its field staff, which, in addition to the administration of the Stock Act, performs a supervisory control by means of which the occurrence of any unusual disease of live-stock can be readily determined. Research and investigation into animal disease is conducted by the staff of the Wallaceville Veterinary Laboratory working in collaboration with the field veterinarians. Advisory and instructional service to the farmer is maintained on all aspects of control and prevention of disease amongst stock, including animal husbandry instruction in its relationship to the hygiene, feeding, and management of live-stock. Quarantine and inspection of imported stock, together with the administration of those regulations having a bearing on the introduction of animal disease, is an important item in maintaining our live-stock free from the more serious animal diseases present in overseas countries.

In the administration of the Slaughtering and Inspection Act the Live-stock Division carries out the important duty of inspection and certification for export of all meat and animal by-products.

From the public health aspect, the Division controls the inspection of meat slaughtered for consumption in the Dominion, and also performs the very important work of dairy inspection in relation to the public milk-supply.

Amongst the activities of the Live-stock Division is included the administration of the Noxious Weeds Act and Rabbit Nuisance Act.

Health of Live-stock.

HORSES.

In so far as contagious disease is concerned, a continuance of freedom from such has again to be recorded in our horse population, a rather enviable position which the Dominion consistently maintains. With the exception of the occurrence of some cases of strangles, no contagious diseases of horses were reported.

With regard to the breeding of horses, it is pleasing to report that the increased activity in the direction of breeding of draught horses, commented upon last year, continues, and has developed even to a greater extent during the past year. High prices have been realized for good types of draught horses, and consequently breeding would appear to be sound economically. The breeding of Clydesdale horses has always occupied a very high position in New Zealand, and in this connection the introduction of legislation by which the soundness of Clydesdale stallions is ensured by compulsory veterinary examination, as is done in other countries, is well worthy of serious consideration.

Of the lighter class of horses, the hack and hunter types would appear to be engaging somewhat more attention than of recent years. Also the presence of riding schools in some centres is an indication of a tendency towards a return to horse-riding exercise. The breeding of horses suitable for remount purposes is, however, much neglected.

CATTLE.

Tuberculosis.—In the administration of the Stock Act 6,527 cattle were condemned during the year as a result of clinical examination and the application of the tuberculin test, compensation being paid in accordance with the Act. In the administration of the Slaughtering and Inspection Act 478,963 cattle (exclusive of calves) were examined at the various abattoirs and meat-export slaughterhouses. Of these, 31,244, or 6·52 per cent., were found to be affected with tuberculosis in varying degrees. This indicates an increase of 0·98 per cent. infection amongst cattle slaughtered in those premises. During the year the tuberculin test was applied to 14,423 cattle, of which number 1,141 reacted (7·9 per cent.).

Actinomycosis.—The number of animals condemned for this disease and for which compensation was paid totalled 828.

Malignant Growths.—The number of animals condemned and for which compensation was paid was 353.

Blackleg.—The incidence of this disease remained at a satisfactory level during the year. In the Whangarei district an increased number of outbreaks was recorded. The total number of calves vaccinated in the blackleg areas of Taranaki and Auckland during the year was 20,491. An amendment to the Blackleg Regulations, extending the period of time allowed for the removal of calves from the area after inoculation, was made during the year, this period being extended to ninety days.

Anthrax.—The Dominion continues to remain free from this disease.

Johne's Disease.—Further evidence of the increase of this disease came to light during the year in Taranaki and the Waikato, and it can be surmized that the infection exists on many other farms which, on account of the owners not suspecting the nature of the condition, remain unreported to the Department. Johne's disease can be briefly described as a chronic bacterial enteritis of cattle, due to the entrance of a specific germ known as Johne's bacillus. The characteristic symptoms produced are chronic and severe scouring, accompanied by progressive emaciation, until the animal is reduced to the condition of a "piner" or "waster." The germ is taken into the animal's system in food or water, and there is evidence to support the belief that it can live in the soil for considerable periods of time, particularly in wet, badly-drained pastures. The disease can have a very lengthy incubative period, and an animal may carry the infection for years before typical symptoms are shown. This fact creates one of the greatest difficulties in the control of spread of the disease.

Owing to its insidious nature and the economic loss which it is capable of producing, more especially when it occurs in pedigree herds, the control of Johne's disease is causing the Division considerable anxiety. Since the introduction, a few years back, by overseas workers on the disease, of the diagnostic agent known as Johnin, this has been extensively used by the Department in the detection of the disease. Although the Johnin test cannot be said to be absolutely reliable, yet it affords the only method of detection known at present, and is undoubtedly most helpful in methods of control.

It is recognized that drastic control measures designed to prevent the movement of stock from known affected farms must necessarily inflict severe hardship on the owners; nevertheless, this becomes necessary on farms on which the disease has reached heavy proportions. In other cases in which the infection on the farm is slight, it is hoped that by the institution of periodical Johnin-testing the disease on such farms will be controlled. In this connection, Mr. Gill, District Superintendent of the Wellington District, has organized an attempt at eradication in two grade herds in Taranaki. Semi-annual testing is being carried out, with slaughter of reacting animals. Some time must necessarily elapse before an opinion can be formed, but the trial will prove highly valuable in determining the success or otherwise of such means of effecting eradication of the disease.

The intradermal testing of cattle for Johne's disease has been carried out in Taranaki by Mr. Stephens, Veterinarian, Stratford, and in the Waikato by Mr. Marshall, Veterinarian, Hamilton, both officers displaying keen interest in what must be recognized to be arduous work.

Mammitis.—Speaking generally, the incidence of this disease has not increased during the year. Evidence of increasing confidence in the adoption of hygienic methods of control in the milking-shed is observed amongst dairy-farmers. The number of farmers who continue to avail themselves of the service provided by the Wallaceville Laboratory and the subsidiary laboratory at Hamilton, in the regular examination of milk-samples in the mammitis-control scheme, is an indication of appreciation of its application. The present day outlook on this disease is more reassuring for those who take the trouble to adopt definite control practice. In the absence of any recognized curative properties in vaccination, hygienic control methods must be looked upon as affording a large degree of protection. The disease, however, is one which fully justifies intensive research.

Contagious Abortion.—The incidence of this disease remains somewhat as in previous years. In some instances abortion "storms" in herds have been reported, but this occurrence cannot be said to be as common as in past years, due no doubt to the result of intensive dissemination of the infection amongst dairy herds. In this disease, also, measures of control offer the only means of protection available to the farmer. Information in this direction has been largely given by field officers, and the use of the agglutination (blood) test for the disease, which is done free of charge by the Wallaceville Laboratory, continues to serve a useful purpose in indicating infected animals, and enabling control methods to be employed.

Temporary Sterility.—The occurrence of delayed conception in dairy herds was not reported to the same extent as in preceding years. Limitation of staff at Wallaceville prevented any extension of inquiry into this seasonal herd trouble. Investigational work with reference to the bull as a factor in the condition has, however, been continued by Mr. Blake, Veterinarian, Hamilton, his observations indicating the high percentage of bulls whose semen showed poor sperm morphology, associated with definitely bad results from the point of view of service. The necessity for continued research involving the aspects of bull, cow, and nutritional factors is indicated.

Cattle-tick.—The incidence of cattle-tick (*Haemaphysalis bispinosa*) in the infested areas is to a large extent governed by seasonal climatic conditions. Protection of clean areas is attempted by regulatory control, but, giving consideration to the varied means by which cattle-tick can be spread from one district to another without the agency of cattle, it is obvious that such control cannot prevent the spread of tick. As stated last year, cattle-tick must not be regarded as a serious parasite of stock, and it is again reiterated that limitation of the occurrence of ticks on any particular farm can be accomplished by individual effort on the part of the owner if attention is paid to the methods of tick destruction, which should now be well known.

Paspalum Staggers in Cows.—This condition, not previously observed in the Auckland Province, occurred during the autumn. In commenting on the condition Mr. Collins, District Superintendent, Auckland, reports: "Last autumn some rather alarming reports were received about cattle being affected with 'staggers.' In some cases the majority of the herd was affected, whilst in others only a few animals were showing symptoms. The trouble did not last long, however, as most cases started about the middle of April and by the first or second week in May had practically disappeared. Many districts were affected, cases being reported from the Bay of Plenty, Waikato, and North Auckland. Investigation showed that in all cases the animals had been grazing on paspalum which was affected with a fungus as well as with ergot. No mortality occurred, and although some farmers reported a diminution in the milk-supply and some slight loss of condition in the affected cattle, others stated that the animals, although they staggered when moved along, did not appear to be affected as far as general health was concerned." Experimental feeding carried out at Wallaceville showed the ergotized seed-head of paspalum to be toxic, and capable of producing the nervous symptoms.

Tympanitis (Bloat) in Cattle.—This seasonal trouble was not so much in evidence last spring. Further inquiry into the condition was maintained by Mr. Marshall, Veterinarian, Hamilton, who had an opportunity of observing the effect of acidulation of the drinking-water as a preventive. This was reported upon as having no beneficial effect in preventing the occurrence of bloat. A suggestion that the trouble might be associated with lime deficiency has been made, and this viewpoint is being tested in the Bay of Plenty district.

Grass Staggers in Cows (Grass Tetany).—This disease which affects cows at varying periods after calving was reported to be more prevalent than in the previous two seasons. Its occurrence is mainly in the Waikato, although a few cases were reported in the Gisborne and Wanganui

districts. It is now believed to be a magnesium blood deficiency, and the use of magnesium sulphate hypodermically is regarded as most useful in subacute cases. Various methods of supplying magnesium in the diet to cattle are being tried.

"Foul-foot" in Cattle.—Advice regarding methods of preventing the occurrence of this condition in dairy herds has been disseminated. It is almost invariably associated with dirty and muddy conditions surrounding holding-yards, and removal of these conditions by more extensive use of concrete usually brings about improved results as far as the foot trouble is concerned. Investigation into this condition from the bacteriological aspect is desirable, with a view to establishing the most common causal organism.

Chronic Bovine Hæmaturia.—No special mention is made of this condition by field officers during the year.

Ergotism and "Fescue Poisoning."—Mr. McIlwaine, Veterinarian, Palmerston North, records having seen a number of cases with typically affected feet. This results from the practice of feeding cattle on the roadside during the winter months, where tall fescue is prevalent. Mr. McIlwaine remarks that in some instances apart from any foot lesions, cattle present a haggard appearance, with a dry, long coat which persists throughout the summer. These cases are known as "fescued" animals, and could be mistaken for tuberculous cattle.

Parasitic Disease in Young Cattle.—As mentioned in previous reports, this condition is responsible for considerable loss in young cattle. Many calves die or have their constitutions undermined by the action of internal parasites. In combating the trouble, the importance of the provision of extra nutritious feed in assisting the young animal to overcome the effects of the parasites cannot be overestimated. In this respect chaff, oats, and good hay, will do far more good than drenching with worm medicine.

SHEEP.

With much improved prices for wool and fat sheep, the sheep-farmer must be regarded as having had a satisfactory year. From the health viewpoint the seasonal conditions were unfavourable for sheep in the North Island generally. The percentage of lambs on many farms was considerably lower than usual, this being in many instances attributed to the existence of facial eczema amongst the ewes when the rams were put out. The season was not a good one for early fat lambs, and the numbers coming forward to the freezing-works in the early summer were much below the average. With an abnormal rainfall from January onwards, and prolific growth of pastures, conditions very favourable to parasitic development, it was only to be expected that losses would occur in lambs from this cause. Such losses have occurred in many districts, and the outlook for hoggets in the winter period is not too encouraging in this respect. The year under review has, however, not been marked by any very extensive outbreak of sheep disease.

Photosensitization (Facial Eczema).—No serious occurrence of this disease took place during the year. In the light of past experience its development was not expected, as the growth of feed maintained throughout the summer and into the autumn period, with not excessive temperatures, were conditions inimical to the occurrence of facial eczema. It was, however, noticed that ewes affected in the previous year's outbreak wintered badly, and in many instances had no milk when they lambed. Another point which is brought to light is the resultant liver damage in sheep which have survived an attack of facial eczema, this disturbance leading up to an unthrifty condition of the animal.

In the South Island the occurrence of facial eczema was again noticed in the Mackenzie Country. A botanical survey of the pastures showed the presence of species of hypericum, which it is considered may have some influence in the production of the disease in tussock country. Further experimental work has been arranged in this connection.

Parasitic Disease.—As stated in last year's report, the losses occasioned to sheep-farmers through parasitism of their flocks is greater than from any other cause. Seasonal conditions exert a marked contributory factor in this connection, and the high rainfall, and resulting growth of pastures, with absence of hot drying weather, of the past summer and autumn provided ideal conditions for development of parasitic larvæ. At the same time the unsuitable nature of the feed for lambs reduced their nutritional level, with the result that the lambs quickly succumb to the effects of the parasites. Mortality has already occurred, and it is probable that considerable loss of hoggets will take place during the winter months. The Live-stock Division has, by articles in the press and other means, advised sheepowners of the urgent necessity of early action in order to avoid heavy mortalities later. In attacking the problem of internal parasites of sheep, too much reliance must not be placed on the specific action of any anthelminthic agent, whilst neglecting the maintenance of the lamb's strength by the provision of extra suitable supplementary feed. In this respect the feeding of chaff, oats, and good hay will be found to produce results. The difficulty which is said to be experienced in getting hoggets to eat hay in the early winter might be overcome by educating them earlier to take it, and this has even been practised by some sheep-farmers before the lambs are weaned. The benefits of such practice are indicated in seasons when through abnormal conditions the pasture is luxuriant, and cannot be maintained in that short condition which provides the best sheep feed.

Infectious Entero-toxæmia of Lambs (Pulpy Kidney).—Reports indicate that in the Otago District the losses of lambs were rather above the average. An interesting development in connection with pulpy kidney disease of lambs has to be recorded. Trials were undertaken in Central Otago during the year, in which pregnant ewes were vaccinated with a formalinized enterotoxæmia vaccine, with the idea of a transference of immunity to the lamb through the medium of the ewe's colostrum, or first milk. The vaccine was prepared at the Wallaceville Laboratory; two doses of vaccine were given to the ewes, the first at approximately six weeks before lambing, and the second a week or ten days before lambing. In the trials a number of unvaccinated ewes were left as controls. Briefly the

results on two farms were as follows: Of 812 vaccinated ewes the pulpy kidney losses among their lambs were 2 (0·24 per cent.), whilst among 840 unvaccinated control ewes the losses among their lambs were 59 (7·02 per cent.). The indications are that a degree of immunity is conferred on the lamb through the colostrum of the vaccinated ewe. These initial trials, although on a small scale, can be regarded as most promising. Mr. Dayus, District Superintendent, Dunedin, who organized the trials, is of opinion that the results warrant an extension of the work next season.

Lymphadenitis.—It is again necessary to refer to the economic importance of this disease in sheep, and to impress upon sheepowners the necessity of adopting precautionary measures to remove or lessen its occurrence in their flocks. Its presence in the carcass on inspection at freezing-works necessitates rejection for export, and therefore economic loss. Practical methods of control consist of the precautions recommended at shearing-time. Manual palpation of live sheep to detect the enlarged glands should be carried out annually on all properties where the incidence of the disease is high. Previously published records of this procedure on sheep-farms indicated the very valuable results obtained, and the practice is being carried on with continued decrease of lymphadenitis in the flocks. Its adoption on a large scale is desirable, yet it is discouraging to find that the majority of sheep-farmers treat the matter apathetically. Lymphadenitis in the carcass is viewed seriously by the inspecting authorities in Britain, and the interests of our export trade in mutton and lamb demand full recognition of its elimination from our flocks.

Mycotic Dermatitis.—This disease, which is characterized by the formation of hard scabs which grow with the wool, has been further observed in Canterbury. Its presence is usually detected at shearing-time. A method of treatment by spraying with antiseptic solution has given good results. Sheepowners are again advised to report any suspicious cases to the Department for investigation.

Pregnancy Toxæmia of Ewes (Ante-partum Paralysis).—The season was not marked by any undue occurrence of this trouble.

Contagious Ecthyma (Sore Mouth).—On farms on which this disease occurs in sheep a method of preventive vaccination of lambs has been tried. Reporting on the results of this in his district, Mr. Dayus, District Superintendent, Dunedin, states that encouraging results have followed the vaccination. A continuation of the work will be carried on next season.

Sheep Blow-fly has been fairly prevalent in most sheep districts, dissemination of information relating to the best means of control being called for. The glycerine-boric-acid dressing recommended by Australian research workers has been tried in some districts. Further extended trials must be made, however, before an opinion as to its benefits over other dressings can be expressed. The more extensive use of blow-fly traps has been noted.

Liver-fluke.—The presence of this parasite in sheep bred on a farm in the Bay of Plenty district has been noted, this being the first time it has been recorded in that particular area. Preventive measures have been put into operation on the farm.

Foot-rot.—The incidence of this disease during the year was reported as being somewhat above the average. More individual effort by sheep-farmers by way of proper treatment of affected sheep would go a long way in reducing loss through this trouble. It is a disease which calls for extensive research.

Lice and Ticks.—Increased activity on the part of the stock inspection staff has been directed during the year against lice and tick infestation in sheep. An increased number of prosecutions were instituted against sheepowners for exposure of lousy sheep in saleyards. It is questionable, however, whether this policy in itself can ever achieve satisfactory eradication results. A development in inspectional policy inaugurated in the Poverty Bay district during the year is worthy of mention. Mr. Gill, District Superintendent, Wellington, reports on this as follows: "In view of the numerous prosecutions in past years in the Gisborne district for exposure of lousy sheep, and that in spite of them no headway seemed to be made in controlling the parasites, a change of policy was decided upon. Farms from which lousy sheep had been detected in sales were visited for the purpose of giving the owner notice to dip if lice were found. This action in itself drew attention to the position and would probably induce more care in dipping. In addition, travelling mobs of sheep were inspected on the roadside, and if lice were found notice to dip at the nearest reasonably available dip was served on the drover. Notice of the intention to carry out these two methods of control was published in the local papers in advance. It has involved a great deal of extra work for Inspectors Bould and French, and they deserve considerable credit for the able way in which it has been carried out. No undue hardship has been caused, and the Department's action has brought favourable comment from the farmers themselves."

PIGS.

A further development in the pig-breeding industry has to be recorded. Reference to the number of pigs slaughtered during the year indicates the increasing tendency of dairy-farmers to develop pig-breeding as a valuable adjunct to dairying, and it must be pleasing to all those interested in swine husbandry to see that the one million killing figure has been reached. This is a very substantial increase on last year, the number killed in 1934–35 being 924,979, as against 1,024,990 this year, an increase of 100,011. The season's killings are made up as follows: Export slaughterhouses, 768,976; abattoirs, 143,527; bacon factories, 55,772; ordinary slaughterhouses, 26,564; shop pigs, 30,151. In addition 20,000 pigs are returned as slaughtered by farmers for their own consumption.

It cannot be stated, however, that in keeping with the developing trend of the industry, the general methods of pig-management have improved correspondingly. There is still enormous room for development in this direction. This becomes very evident from the large numbers of pigs which have to be rejected at the works on account of defects which could be obviated by better management. It is the Department's intention to extend its instructional service to farmers in the direction of promulgating improved standards of swine husbandry generally. The work done by Pig Recording Clubs in the Waikato and Manawatu districts is worthy of every support.

Tuberculosis.—An increase in the incidence of this disease as found on inspection of slaughtered pigs has to be recorded. The extent to which tuberculosis was found in any degree in the carcass being 16·78 per cent. In the great majority of cases, however, the infection in the carcass is slight, being found only in the throat glands. Nevertheless, a serious view of the extent to which pigs are affected with tuberculosis must be taken. It is assumed that the chief initial source of infection in the pig is by means of milk, and the by-products of the dairy; perpetuation of the disease amongst the pigs on a farm can occur through contaminated pastures, pig-runs, &c. When the incidence of tuberculosis in pigs from any farm is found to be high, an examination of the cows becomes necessary, more particularly if skim-milk from home-separation be fed to the pigs. Attention to the sanitary conditions under which the pigs are kept must be included. The proper pasteurization of skim-milk on the farm before feeding to pigs is a matter that presents difficulty in accomplishment, the overcoming of which, however, would achieve a very important measure of control.

During the year certain lines of attack on the problems of tuberculous infection in pigs have been commenced. In view of the danger from dairy-factory by-products—skim-milk and whey—a series of these are being collected for submission to the biological test for tuberculosis at the Wallaceville Laboratory. There is little risk from butter-milk, in view of the temperature at which the cream for butter-making is pasteurized, but whey is derived from milk that is only "flash" pasteurized to about 73° C.—too low to affect tubercle bacilli—and the cheese factories make butter for the first few weeks of the season from milk that is unpasteurized, their suppliers using the skim-milk from this source for pig-feeding. This matter is likely to be a highly dangerous source of infection, probably much more so than is whey. It is obviously essential to find out to what extent these wheys and skim-milks are infective. To date a large number of whey samples from the Wellington and Auckland Provinces has been tested at Wallaceville; the skim-milk will be collected for testing at the commencement of the coming season. The final results should afford valuable information and assist in formulating a definite programme of attacking the problem of tuberculosis in pigs.

Pasteurellosis and Suipestifer Infection.—These infections are responsible for a large proportion of cases of pleurisy and pneumonia in pigs. Field experience has shown that these conditions are associated with bad feeding and housing, and will disappear largely when these factors are attended to.

Sarcoptic Mange.—The outbreaks of this skin disease in pigs during the year were not numerous and were quickly controlled by appropriate treatment. This disease is now well under control.

Necrotic Ulceration of the Skin.—This condition still remains all too common, and is the cause of a large number of rejections on slaughter. Improvement in sanitation and the general conditions under which pigs are kept should go a long way in causing this trouble to entirely disappear.

Malnutrition and Nutritional Paralysis.—On these conditions, Mr. McIlwaine, Veterinarian, Palmerston North, writes: "Malnutrition of pigs is quite prevalent on many farms, especially after the weaning period. Overstocking is sometimes a cause, and irregular farrowing may also be responsible. There is still plenty of evidence of rickets and paralysis in pigs, though the latter has tended to disappear under the grazing system. Many sows are inadequately fed during the suckling period, and as a result are reduced to a low state. At the end of the dairying season many unfinished and intermediate pigs are sent into the works for slaughter."

Meat Inspection.

Following complaints from England during the previous year, that diseased meat was escaping detection at this end, the position was very carefully reviewed and it was realized that increases in staff were essential, particularly where pigs were killed for export. These increases were made, and a system was instituted whereby all pig carcasses exported as headless pigs were check inspected by an experienced officer before being passed for export. This system has worked well, and the incidence of disease in carcasses exported from the Dominion and re-examined in England has been negligible throughout the present season. Such cases as have been found there have been small lesions in remote parts of the carcass that could not have been detected at this end. The meat-inspection staff is deserving of high praise for the excellent work it has done in this connection. Their work has been well and conscientiously performed, though very long hours have often been demanded of them.

Slaughter of Stock.

The total numbers of stock slaughtered at registered premises were: Sheep, 2,674,554; lambs, 8,685,536; cattle, 563,488; calves, 1,074,656; swine, 994,839.

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, 1936.	Year ended 31st March, 1935.	Increase.	Decrease.
Cattle	305,868	239,877	65,991	..
Calves	986,145	675,488	310,657	..
Sheep	1,882,446	2,569,573	..	687,127
Lambs	8,564,482	9,562,797	..	998,315
Swine	768,976	694,770	74,206	..

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 31st March :—

Stock.	1932–33.	1933–34.	1934–35.	1935–36.
Sheep	1,649,363	1,293,617	1,735,237	1,287,331
Lambs	6,433,741	6,030,575	6,626,315	6,269,694

These figures show a decrease of 447,906 sheep and of 356,621 lambs compared with the same period last year.

The following are the numbers of each class of animal slaughtered under direct inspection during the year ended 31st March, 1935 : Cattle, 478,963 ; calves, 1,072,456 ; sheep, 2,463,183 ; lambs, 8,664,134 ; swine, 968,275.

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

Stock.	Abattoirs.	Meat-export Slaughterhouses.	Bacon Factories.
Cattle	173,095	305,868	..
Calves	86,311	986,145	..
Sheep	580,737	1,882,446	..
Lambs	99,652	8,564,482	..
Swine	143,527	768,976	55,772

Stock slaughtered at ordinary slaughterhouses during the year ended 31st March, 1935, was as follows : cattle, 84,525 ; calves, 2,200 ; sheep, 211,371 ; lambs, 21,402 ; swine, 26,564. Carcasses of pork killed and dressed by farmers, sent into butchers' shops and small factories, and examined by departmental officers, numbered 30,151.

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, 35,473 ; calves, 23,831 ; sheep, 170,041 ; lambs, 93,266 ; swine, 111,479.

Dairy Inspection.

This important phase of public health work which forms part of the Division's duties, has been maintained during the year as satisfactorily as staff conditions would allow. It is apparent, however, that at many centres a strengthening of the staff is necessary in order that more time may be devoted to dairy-inspection work, which of necessity involves considerable instructional service in the bringing about of improved hygienic methods in the milking-shed, and other details of improved milk-production in the effort to generally raise the standard of the public milk-supply.

A noteworthy feature is the trend of public opinion in the direction of a tuberculin-tested milk-supply. This is indicated by the requests of certain local authorities to have all cows supplying milk for human consumption inside their areas subjected to the tuberculin test. There can be little doubt that this requirement will extend, and it would appear that its application generally throughout the Dominion as a compulsory measure is not far off. In my report of last year I advocated its adoption, and I am convinced that it must be regarded as a sound forward movement in the interests of public health.

Live-stock Statistics.

The 1935 sheep returns, collected as at the 30th April, showed that sheep flocks in the Dominion increased by 427,716 to a total of 29,076,754. An increase of 361,729 occurred in the number of breeding-ewes. The number of sheepowners has increased by 438 to a total of 30,238. The number of cattle in the Dominion as at the 31st January, 1935, decreased by 7,629 to 4,293,499. The number of dairy cows within the total shown increased by 19,583 to a total of 1,952,094. The number of pigs in the Dominion as revealed in the 1935 enumeration was 762,755, being an increase of 102,362 on the previous year's figures. Horses have continued to show a decline, the number being 272,986, a reduction of 920.

Compensation paid for Stock and Meat condemned.

Compensation to the amount of £10,544 was paid out during the year for animals condemned in the field for disease under the provisions of the Stock Act, and £24,654 for carcasses or parts of carcasses condemned for disease on examination at the time of slaughter at abattoirs, meat-export slaughterhouses, &c., under the provisions of the Slaughtering and Inspection Act.

Importation of Stock.

The following stock was imported during the year : cattle, 56 ; sheep, 409 ; pigs, 12 ; horses, 17 draught and 13 racehorses. Of the above animals, the following were placed in quarantine for the respective periods required : cattle, 56 ; sheep, 36 ; pigs, 8 ; horses, 7 (racehorses) ; and, in addition, 2 dogs.

Exportation of Stud Stock.

During the year under review the following animals were exported: sheep, 3,009; cattle, 48; pigs, 14; horses, 63 draught and 10 racehorses.

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

Poultry.

Conditions have on the whole operated quite favourably for poultry-keepers during the year, particularly in respect to market prices both local and export; but, unfortunately, a rather severe outbreak of fowl-pox broke out in the Auckland District during last autumn, which, in addition to taking heavy toll of the young stock, severely affected egg-production for a time. Fortunately the disease cleared up and there has not been a further recurrence. It is necessary, however, to issue a warning to poultry-keepers to be ever on the watch for any appearance of disease and to nip it in the bud in its early stages. Care should be taken to purchase only birds from absolutely healthy foundation stock.

This is all the more necessary in these days of mass production, and poultry-men cannot be too careful not only in respect to disease-free stock but also as regards the maintenance of strongly-constitutioned, vigorous birds, as it is only by care in this direction that it is possible to maintain healthy and heavy producing flocks.

The following extracts are taken from the report of Mr. Cussen, Chief Poultry Instructor:—

"*Export.*—During the past season some 11,915 cases—357,450 doz.—of eggs were shipped to the United Kingdom as compared with 11,527 cases—345,600 doz.—shipped the previous season. This shows an increase of 11,750 doz. over the previous season's export. Particulars of exports are as follows: Auckland, 2,610 cases, 78,300 doz.; Wellington, 191 cases, 5,730 doz.; Christchurch, 6,366 cases, 190,980 doz.; Dunedin, 2,748 cases, 82,440 doz. The increased export was due to the record shipment from Canterbury. Reports to hand indicate that the eggs arrived in good condition and were well received. Though the prospects of building up a large egg-export trade do not appear very encouraging, and our present export represents only a very small percentage of the eggs reaching the local market, yet it is most valuable in removing the surplus during the flush season."

"*Chick-sexing Examination.*—The first chick-sexing examination in this country was conducted at the Wallaceville Poultry Station on 4th November last, when fifteen students presented themselves for examination, but only three were successful in qualifying for a second-class certificate. One student sat for a first-class certificate, but he was unsuccessful. In this connection it may be mentioned that in order to obtain first-hand information as to the advantage or otherwise of sexing, arrangements were made and one hatch from a 500-egg incubator was sexed at the Department's Wallaceville Poultry Station. The sexed pullets were reared by themselves and they made slightly better growth than a hatch of unsexed chickens reared under similar conditions. The sexed pullets are now laying, and so far no ill effects from sexing have been apparent, though Mr. Cocker reports from Canterbury that complaints were received from poultry-keepers regarding mortality in young sexed pullets due to, in his opinion, inexperienced handling by unskilled operators."

"*Chilled Eggs (Marketing) Regulations.*—Regulations governing chilled eggs were gazetted during the year, and visits of inspection to the various cool-stores showed that, generally speaking, those concerned have complied with the regulations. Some trouble, however, was experienced in Auckland where attempts were made to evade these regulations. In the circumstances, and in order to avoid future trouble, I would recommend that the regulations be amended so as to provide for the stamping of all cool-store eggs."

"*Wallaceville Poultry Station.*—The chief functions of this station are to demonstrate up-to-date methods in the management of poultry, to supply sittings of eggs, day-old chicks, and breeding stock of undoubted quality, vigour, and constitution, and to conduct experiments connected with the various branches of poultry culture. These functions have been carried out during the year. Two feeding tests with adult birds and two chicken-feeding tests were carried out, and at the present time six feeding tests are being conducted, which should be of value to producers and the industry generally."

"*Disease.*—It is regrettable to have to report that disease has been more in evidence during the past year. Last autumn an outbreak of fowl-pox was fairly widespread in the Auckland District, but this trouble was cleaned up, and no recurrence has been reported this season. Intestinal coccidiosis is assuming rather serious proportions, and some heavy losses have been experienced in the Manawatu, Foxton, Rangitikei, Wellington, and Hastings districts, and to a lesser extent in Canterbury and Auckland Provinces. Reports to hand indicate that in several instances where this trouble is being experienced the owners attribute the start of the trouble to pullets purchased from other breeders. Again, it would appear that owing to inexperience, stale ground, and breeding from inferior specimens, the vigour and constitution of the stock have been allowed to go back on many plants, with the result that the stock has not got the power of resistance against disease."

"*Instructional Staff.*—During the year Mr. H. Kitto, who for some years was Overseer at the Wallaceville Poultry Station, was appointed Poultry Instructor with headquarters at Wellington."

Wool.

The wool position showed considerable improvement during the season, and very good clearances were made at all sales, the percentage of passings being low.

For the four months January to April inclusive, 616,954 bales were exported as compared with 389,007 for the same period of 1935. As an indication of the increased price obtained during the 1935–36 season, the Otago wool realized on an average £14 17s. 8d. per bale as against £10 10s. 8d. for the previous season, an increase of £4 7s. per bale. The southern wool comprises more of the finer-quality wool than that of the North Island, but nevertheless these figures are indicative of the relative increase that took place throughout the Dominion.

The quality of the wool offered at the sales was on the whole up to the average, and apparently met all the varied requirements of the respective purchasing countries.

The Department's instructional work on wool improvement lines was continued during the year, and numerous demonstrations and lantern lectures were given throughout the Dominion. In addition, wool samples were examined microscopically for hairy fibres, and reports made to the owners. Unfortunately the Department suffered a severe loss in the sudden death on 31st January last of Mr. J. G. Cook, Wool Instructor. Steps have been taken to fill the vacancy thus created.

Rabbit Nuisance.

The condition of the rabbit pest generally shows some improvement over that of last year, despite the fact that in most districts the weather during the spring and summer was not favourable for poisoning operations. A good deal of the rabbit-suppression work is now carried out by Rabbit Boards, but during the past year where Boards are not operating a number of local committees were set up to work under the Unemployment Board's scheme for supplying subsidized labour for rabbit-destruction purposes. Reports indicate that these rabbit committees where properly organized have operated with decidedly beneficial results.

The various Rabbit Boards have worked successfully throughout the year, and Board control is meeting with such general favour that several new Boards have been constituted under the Act.

The keeping of Angora rabbits for industrial purposes is practically abandoned, and very few rabbitries are now in existence.

Noxious Weeds.

Reports from various districts indicate that noxious weeds on the whole have been reasonably well controlled. In some districts a definite improvement is reported as far as ragwort is concerned, due to the increasing use of sodium chlorate and the grazing of sheep. Unfortunately, however, this weed still has a strong hold in some areas of the country, and after several years of clearing little progress is apparent. It is the Department's intention to adopt special measures for the clearance of ragwort next season in some of the worst affected districts of the North Island.

Variegated thistle is causing concern in certain North Island areas, particularly in East Coast districts of the Island where this weed has spread considerably during recent years. Measures for its clearance are to be more strictly enforced with the co-operation of local authorities.

Blackberry and gorse are still present in abundance in certain areas, and flame throwers have been tried as a method of clearance.

Sweet briar appears to be increasing in portions of the South Island, and is proving a most difficult plant to subdue. Experiments with various preparations were carried out on this weed during the past two years, without very satisfactory results, except that in one instance sodium chlorate crystals applied to the roots during April and May proved effective.

Californian thistle and other noxious weeds have received attention, and while in many instances occupiers have co-operated with the Department in arranging clearance there is a strange apathy in many cases which allows the weeds to get a strong hold and makes eradication more difficult.

As in the past, the Department has carried out considerable clearing of weeds on unoccupied Crown lands and unindividualized Native lands adjoining or near to farming lands.

Fifteen counties have so far taken advantage of the power given them under the 1934 amendment to the Noxious Weeds Act to assume control of the administration of the Act within their areas.

Staff.

To the staff as a whole I desire to again express my appreciation of their assistance so loyally and efficiently given during the year.

WALLACEVILLE VETERINARY LABORATORY.

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

Staff.—Mr. W. M. Webster, B.Sc., M.R.C.V.S., left the Laboratory at the end of July to take up a position at Massey College. The services of Lt.-Colonel H. A. Reid, O.B.E., F.R.C.V.S., D.V.H., F.R.S.E., were therefore retained. At the end of the year Mr. L. W. N. Fitch, B.V.Sc. (who had been appointed to the Department three months previously) arrived from Australia to take up the duties of a veterinary officer in the Laboratory. Dr. I. J. Cunningham, the nutritional research officer, was given the opportunity to obtain his veterinary degree in Sydney and obtained three years' leave of absence, less long vacation, when he will return for duty at Wallaceville. During his absence Dr. Marion Cunningham is undertaking his work.

Mr. S. W. Josland spent some three months at the commencement of the year in a visit to the Animal Nutrition Laboratory in Adelaide where he was able to carry out work under the direction of Mr. Hadley R. Marston. This work was performed at Mr. Josland's own expense.

Mr. R. D. Thompson was transferred from the Laboratory to the clerical staff at Christchurch, and Mr. I. G. Watt, M.Sc., has been employed in his place.

Mr. J. Evans, Farm Overseer, has been away for several months sick, and it is not anticipated that he will be well enough to return.

Diagnostic Work.—Specimens have remained varied and give a fair indication of the troubles of stock in the districts. Hamilton Laboratory is keeping up the number of milk samples examined in the mammitis-control scheme and at Wallaceville such examination is increasing.

The following material has been received for examination:—

	Wallaceville.	Hamilton.
Mastitis milk-samples—		
Routine—		
Positive	417	..
Negative	533	..
Miscellaneous milks	..	5,578
Mammitis-control scheme—		
A Group	3,200—72 per cent.	24,216—69·4 per cent.
B Group	1,038—24 per cent.	7,878—22·5 per cent.
C Group	182— 4 per cent.	2,854— 8·1 per cent.
Quarter samples	..	1,199
Tuberculosis—		
Milk samples for biological test—		
Positive	..	..
Negative	265	..
Whey samples for biological test—		
Positive	(at six weeks and three months.)	
Negative	77	..
Agglutination test for contagious abortion—		
Whey samples—		
Positive	..	74
Negative	..	219
Blood samples—		
Positive	450	159
Negative	878	438
Cattle specimens	218	..
Johne's disease—		
Positive	47	..
Negative	27	..
Sheep specimens	268	..
Pig specimens	390	..
Horse specimens	27	..
Poultry specimens	195	..
Miscellaneous specimens	87	..
Tumours	91	..
Biochemist's Analysis—		
Blood	474	..
Urine	18	..
Bones	148	..
Total	9,030	42,615

Blackleg vaccine prepared and issued: 32,500 doses; tuberculin issued: 2,032 c.c. crude; Johnin issued: 182 c.c. crude.

CATTLE DISEASES.

Johne's Disease.

We are much indebted to Mr. G. W. Dunkin, of the Mill Hill Laboratories, for supplies of Johnin which have been donated to the Department. Mr. Dunkin has been most helpful not only in the supplying of Johnin but in information on the disease generally, and also supply of cultures and special media. It is hoped later to make Johnin successfully for our own use.

Ten new farms have been found definitely affected during the year, and it will have been noted that forty-seven positive specimens were received while of the twenty-seven negative specimens a large number were suspicious but the organism was not proved to be present.

Measures for the control of this disease are urgently called for.

Biological Test of Milk for Bovine Tuberculosis.

Unfortunately, mortality of guinea-pigs did not enable the usual number of milks to be put through, but 265 from numerous town supplies were inoculated without sign of tuberculosis. In fifty-three *post mortems* evidence of Br. abortus infection was obtained.

Because of the large numbers of pigs showing tuberculosis, it was decided to test whey samples biologically the samples being obtained from the factory whey-tanks before being carted out to pig farms. Seventy-seven such samples were collected. They were inoculated each into two guinea-pigs, one to be killed at six weeks and the other at three months. After centrifugalization the whey deposit, diluted with saline because of the acidity, was used for inoculation. Inoculated guinea-pigs on *post mortem* examination were found to be free from both Br. abortus and tubercle bacillus infections. One case was found subsequently from the seventy-seven samples collected.

A start is being made on biological test of skimmed milk samples from farms where pigs are showing an unusual amount of tuberculosis and where home-separation is carried out.

Mastitis.

The attention paid to mastitis in recent years had to be curtailed to a large extent in 1935 owing to lack of staff. This did not, however, interfere with the activities of the Hamilton and Wallaceville Laboratories in their examination of samples for the mammitis-control scheme. It will be noted from the table of specimens that the farmer is alive to the advantages of the scheme. In the group of cows examined at Wallaceville, the increase in A group and the decrease in C group is remarkably good, while at Hamilton the groups have not quite held their own. These figures are, however, only surface figures and mean very little. They give some indication of the state of the herds from month to month. It is hoped that the true position will be traced statistically during the coming winter after five years' work.

The work of Mr. A. E. Kidd at Hamilton, the constant examination of many thousand samples and the interest which he engenders in farmers in the scheme, is to be commended.

It is interesting to note that several factories in the North Island now examine milks of suppliers by the leucocyte-assessment method. These factories employ assistants who are becoming trained in the work.

Mr. T. A. Blake has again supervised mastitis control in some three herds, and has shown that the number of normal cows is still high, though not quite as good as after the original culling in 1930. However, the owners are very pleased with the success of the work, and their heifers offer a marked contrast in freedom from mastitis to those where no care is taken with the herd.

Treatment of cows with azamine, entozon, and chlorine has been fairly successful in the hands of Mr. Blake, and it would seem advisable to encourage local treatment of the mammary gland with recognized drugs.

Sterility in Cattle.

Mr. Blake in a report on his activities in the Waikato stresses the large number of bulls to be found in dairy herds showing a poor sperm morphology. He reports that he examined ninety-four bulls, five stallions, and one boar during the year with results as follows:—

——	Bulls.	Stallions.	Boar.
Good or fairly good	23	1	..
Fair	31	1	..
Poor	18	1	..
Bad	12	2	1
Sterile	10	..	..

Only five of the first group of good bulls were actually first-class, and they were putting 80 per cent. of cows in calf at the first service.

The herd histories of some of the bulls examined have been obtained with the following result:—

Sperm Morphology.	Number of Bulls.	Average per Cent. Success First Service.	Average Number Cows served.
Good or fairly good	10	68	34
Fair	13	48	40
Poor	8	43	24
Bad	5	35	33
Sterile	10	Nil	30

Mr. Blake expresses the opinion that the condition of bulls is due to infection and not diet deficiency. He has been unable to substantiate this by cultural tests, mainly because of lack of assistance. Mucus from cervices of thirteen cows yielded a Streptococcus in seven instances, while out of twenty-one semen samples Streptococcus was found in three cases only.

No further work has been attempted on the position of the cow in temporary sterility.

During September and October an attempt was made by Mr. T. A. Blake, herd-testing officers, and myself to use a bull provided by the New Zealand Herd-testing Association for artificial insemination of cows in the Waikato. Unfortunately the bull was found to have a very poor sperm morphology and actually the scheme was of too ambitious a nature. Other bulls had to be utilized, but again several were bulls graded as poor by sperm examination and results on the whole confirmed that examination.

Results of the attempt were as follows: Bull "Ngahiwi," 15 per cent. cows held of 192 inseminated; bull "Colin," 50 per cent. cows held of 10 inseminated; bull "Gold Fortune," 100 per cent. cows held of 2 inseminated; Candy's bull, 33 per cent. cows held of 82 inseminated; Wyllie's bull, 59 per cent. cows held of 22 inseminated; Allen's bull, 20 per cent. cows held of 15 inseminated.

It is believed that the technique was not responsible for the poor results gained. With regard to "Ngahiwi," interesting facts were observed:—

(1) Semen in bulls where sperm morphology is not found to be good on microscopical examination, fluctuates in quantity ejaculated at each service.

(2) Motility and density of sperm of each service differs. Occasionally no semen is delivered. In one trial of four services the first two gave no semen, the third plenty of optimum density and motility and the fourth a poor supply of thin semen. The third service, however, was non-motile by mid-day.

It is this fluctuation in bulls with abnormally developed spermatozoa that, combined with the frequent short-lived motility and poor density, makes service with such bulls very uncertain and leads to considerable return of cows.

Whether infection is to be found in such types of seminal fluid is still unknown, opportunities for working on this point not having presented themselves. Certainly no outbreaks of sterility resulted from the artificial insemination trials.

It is believed that there is little fluctuation of semen in completely normal bulls, and this forms part of the new year programme. Attempts to obtain seminal fluid by other means than cow service have completely failed.

The result of male sterility work in rats is contained in Dr. Cunningham's report:—

"It was reported previously that two types of sterility could now be produced in rats:—

"(*a*) That due to excess dietary protein, and

"(*b*) That due to dietary protein of poor biological value.

"Work on the second type of sterility has yielded hopeful results concerning the nutrition requirements of the testis. It has indicated that certain of the amino-acids are essential to the production of normal and healthy spermatozoa.

"The work has opened up an entirely new field of investigation and progress is necessarily slow. Lack of funds for the purchase of amino-acids, moreover, greatly handicaps the progress.

"An experiment with pigs using a diet with biologically poor protein has given results, so far, which suggest that in this species as well as in rats, the nature of the protein may have an important bearing on the reproductive capacity."

Sterility in Sheep.

Artificial insemination in sheep during the early part of the year demonstrated that coincident with the very great flush of pasture in the autumn, many rams were not fertilizing ewes as they should. At Wallaceville the rams, Southdown and Romney, after a short season of service became sterile, no semen being formed, and they remained in this condition for several weeks, thus tending to produce two crops of lambs. The reason for such abnormality, although apparently originating in diet, cannot yet be suggested.

Paspalum Staggers.

Investigation into paspalum staggers which was seen for the first time in New Zealand last April, has shown definitely that the ergotized seed head is toxic and sets up the trouble when fed to cattle.

Preliminary experiments on guinea-pigs and rats with small quantities of ergot gave no harmful results. A collection of plant heads was, however, made in February and March, and a feeding experiment on two heifers arranged. Each received 2½ lb. daily of seed head containing at least 20 per cent. ergotized seed. Typical symptoms of staggering were observed in eight days. The heifers, when turned out, took about six days to return to normal.

Further trials with ergotized seed alone got by screening, have so far given only nervous muscular twitchings and have not resulted in the inability to use the limbs and consequent staggering and falling when excited.

Grass Staggers.

Grass-staggers work is to be seen in Dr. Cunningham's report (attached).

SHEEP DISEASES.

Photosensitivity.

Hereditary Sensitivity.—A breeding experiment was attempted with Southdowns, using a ram which was sensitive to light and had to be kept in a darkened shed during the day. He was bred to eight Southdown ewes, two from an affected flock and six from a Government flock. No lambs were affected at birth, but one ram lamb from a ewe known to have produced affected lambs previously, become photosensitive at four weeks old when he commenced eating green pasture. Placed on hay for a fortnight and then kept in the sun, this lamb was found to be quite insensitive, but when fed green maize or other green forms of food, he quickly became sensitive and sought shade.

Post mortem has yielded no apparent anatomical defect to account for this.

Facial eczema.—Photosensitivity with oedema and scab formation of the exposed parts of the skin, was noticeable to some extent again both in the North and South Islands. An examination of the South Island pastures has shown the presence of species of native hypericum, and it is considered this might be causative in the southern areas. A feeding experiment in Merinos on 500 acres of lagoon land has been arranged. The photosensitivity of Romneys of the Gisborne district has again been investigated, but beyond finding the phylloerythrin in bile samples no great advance has been made. The condition occurs apparently where there is a combination of high temperature, plentiful rainfall, and intermittent dull and bright days, so that chlorophyll content of pasture is abnormally high and growth of pasture very fast. The factor causing liver damage one believes occurs in such pasture. In letters received from Dr. Steyn of the Onderstepoort Laboratory, South Africa, it has been stated that a similar condition has been known in similar circumstances, and need not necessarily occur on the plants usually blamed in South Africa.

Feeding green leaves of *H. perforatum* in quantity to sheep has not resulted in photosensitivity, nor has any result been obtained in feeding of native *H. japonicum* to Merino lambs.

Mycotic Dermatitis.

Mycotic dermatitis has been recognized over a wide area, but only occurs in small numbers of sheep, particularly in Merinos. The use of rabbits for diagnosis of the condition is proving useful. Scarification and rubbing in of scab from an affected sheep produces a very definite dry, raised scab on rabbits' skins in six days. Haemolysis on blood plates also affords a useful means of isolating the organism.

Arthritis in Lambs.

Thirteen lambs were used to show that by placing material on the cut end of the tail at docking time lambs could be given arthritis. The infective materials used were (1) culture of organism in broth of the arthritis organism *Erysipelothrix rhusiopathiae* (sheep strain); (2) pus from joints of a lamb affected with the above organism and obtained from the South Island.

Four ewes and two wethers were given culture, and three ewes and four wethers were given pus. The wethers were operated upon with a Daroux crusher. Pus developed on the end of the tail under the scab to an abnormal amount in six cases, and in three of these lameness developed. Subsequently arthritis was shown, and in one which became seriously affected, the organism was recovered. The other two are still alive but have enlarged hock joints.

Ante Partum Paralysis.

An experiment was commenced at tupping time, 17th March, 1935, with eighty-two ewes. All ewes were hand served with either a Southdown or a Romney ram, and were run together until the 17th July. They were then split into two groups, "A" group with forty ewes on poor pasture, and "B" group with thirty-nine ewes on rich pasture. Until the 18th September, when the groups were interchanged and most of the lambing was over, a date too, when all pastures were showing decided improvement, three ewes died in A group and four were sick or aborted dead twin-lambs, while B group ewes remained quite healthy and had no trouble lambing.

Average weights, in pounds, of sheep in each group were as follows:—

——	17/3.	13/6.	19/7.	29/7.	12/8.	19/8.	26/8.	2/9.	9/9.	18/9.
Group A	130¼	144⅛	142¼	141	140¼	138	134½	135	128	150
Number of ewes ..	39	39	39	39	39	38	35	32	30	26
Group B	130	142½	141⅓	141¼	141½	149½	149	162	163	148½
Number of ewes ..	39	39	39	39	39	36	33	32	29	17

With the serious loss of weight of the ewes a ketosis occurred which resulted in a mortality in ewes and lambs and also resulted in a more weakly group of lambs than in B group. Pulpy kidney (*enterotoxaemia*) did not occur in lambs from either group. Before death in one of the ewes intravenous injection of asparagin was made, but without any benefit occurring. Meat-meal appeared to assist a sick ewe, which recovered and lambed a fortnight later; but given to a second had no beneficial effect. Liver fat in the sheep which died was shown on analysis to have increased, and had a lower iodine value, while glycogen was exceptionally low.

Tongue Ulceration of Hoggets.

Tongue ulceration was observed in a number of young sheep slaughtered in meat works during the autumn. The ulceration was unaccompanied by ulceration of the lips as is usual in contagious ecthyma due to virus.

Scrapings from the tongue ulcers placed on scarified areas of the tongue or inner cheek of experimental healthy sheep produced lesions. Later, further ulceration occurred, commencing first on the dorsum of the tongue as raised areas, which later sloughed out or developed as vesicles in the softer tissue of the mouth, and later became ulcerative. No lip ulceration occurred. Apparently the condition is infectious and contagious.

Stomatitis.

A dried scab vaccine produced at Wallaceville was tried in Otago by Messrs. Dayus and Thompson, apparently successfully.

Pulpy Kidney.

Vaccination was carried out in Otago by Messrs. Dayus and Thompson with a formalinized culture of *Cl. ovitoxicus* grown at Wallaceville. Results have been good and encourage further trials.

Pneumonia in Sheep.

A greater number of cases of pneumonia in sheep was observed this summer. Although one hæmolytic organism was recovered almost in every case, no cases of experimental pneumonia were produced by insufflation, drenching, or intratracheal inoculation, but by intravenous inoculation a sheep was killed in fifteen hours with very serious pleural effusion and congestion of lungs. Organisms have not yet been identified.

Circling Disease.

A further trial of drenching sheep with a freshly isolated organism from the brain of a sheep which died from circling disease was made. This organism is probably a strain of the new genus *Listerella*.

Three sheep were fed with 20 c.c. 24-hour broth culture. Temperatures rose to 106–107 on the second day. Serious scouring occurred on the third day, and one sheep was found dead on the fifth day. The organism had caused serious ulceration and hæmorrhages of the mucosa of the abomasum and much of the intestine. Small hæmorrhages were found in brain sections from capillaries, but there had been no mononuclear reaction as is seen in naturally occurring and less acute cases.

PIG DISEASES.

Arthritis in Pigs.

Whole joints and pipettes of synovial fluid have been examined to find the causative organism of this lesion. In synovial fluid from the Waikato pigs the predominant organism has been a streptococcus, while in joints from Ngahauranga, there has been a mixture of *S. suipestifer*, *pasteurella*, Streptococcus and *B. pyogenes*. In no case has the organism of swine erysipelas been recovered by culture or inoculation of mice.

Pleurisy in Pigs.

The amount of condemnation from pleurisy in pigs for export led to the examination of a number of lungs from recent and from chronic cases of pleurisy. Material was forwarded from various meat-works.

Two hundred and four specimens were cultured and the type of lung lesion beneath the pleural adhesion was noted. In cases of solidification with pus in the bronchus, pasteurella was commonly obtained. B. pyogenes was found in the larger walled-off abscesses. Congested lungs frequently gave a pure culture of Salmonella suipestifer but often Streptococcus were also present. In oldstanding cases where the lung appeared fairly normal except for the pleural adhesion Streptococcus were commonly found present. The general belief was that Salmonella suipestifer set up an acute congestion of the lung which was followed by Streptococcus and B. pyogenes. Pasteurella itself could also set up consolidation without prior lung injury.

Mottled Kidneys.

Mottled Kidneys received in numbers from meat-works have not yielded anything specific by cultural methods. The lesion, when found in the works is apparently of some considerable standing even though the kidney is showing localized hæmorrhagic areas only. Apparently the condition resembles white spotted kidney of young calves due to B. coli for the final appearance is a multiple localized interstitial nephritis.

POULTRY DISEASES.

In general, diseases in poultry are becoming more common. Those requiring urgent attention are coccidiosis of birds of 5 to 7 months of age, leukæmia in young birds and to some extent, fowl-pox and roup.

Coccidiosis.

The greatest danger is the spread of the coccidiosis by sale of infected young stock. Considerable work is required concerning the methods of carriage and the best method of control, but with the limited staff there is no possibility of this at present.

Leukæmia.

Leukæmia is occurring on a number of poultry-plants. It crops up in a flock of young birds less than one year old, killing a few, and then seems to appear only at infrequent intervals in after years in odd birds. The condition cannot be reproduced by inoculation of filtrates nor of actual cells. Cultural work on a number has yielded in five of the cases, three enteritidis cultures and two pullorum. Mr. W. M. Webster before leaving the Division carried out intravenous inoculation of a number of cockerels daily for some weeks with various organisms of the Salmonella group, and was able to produce a condition very similar to some of the cases of leukæmia received from the field, thus bearing out American work on the subject. No cases of transmissible leukæmia have yet been noted.

Fowl-pox.

Fowl-pox vaccination has been advocated where necessary following trial with Australian vaccine. It is proposed later to make fowl-pox vaccine at this station.

Distemper in Dogs.

An experimental vaccination of puppies with vaccine virus sent to New Zealand by Burroughs, Wellcome, and Company by air-mail proved only partially successful. The reasons for this failure were either that the virus had died *en route* through the tropics or that the puppies used for the experiment accidentally contracted distemper in a mild form before vaccination. The former reason is believed to be the true one for control pups inoculated with virus did not become infected.

Material which was to have been supplied by the Australian Commonwealth Serum Laboratories was not available.

FARM.

The usual activities on the farm have been carried on with some difficulty owing to the illness of the Farm Overseer, Mr. J. Evans. Haymaking was long drawn-out by reason of heavy crops, lack of men, and lack of horses. However, considerable quantities of silage, hay, roots, and green maize and oats were obtained. Paddock 5, the last of the paddocks to be brought under the plough, has been sown in permanent pasture.

NUTRITIONAL RESEARCH WORK PERFORMED BY Dr. I. J. CUNNINGHAM.

Dr. Cunningham supplies the following sub-report :—

During the year work has continued on grass staggers and magnesium metabolism, on the relation between dietary protein and sterility, on the toxicity of common smuts, and on vitamins.

Grass Staggers in Dairy Cows.

Preventive treatment.—Experiments were arranged in collaboration with Mr. D. Marshall, M.R.C.V.S., for supplementary feeding of dolomite on four farms where grass staggers occurs very regularly. The dolomite was incorporated in the silage or sprinkled on hay as it was fed out. Results were complicated by an unusually good season—grass being so plentiful that little hay or silage was employed. Consequently, the expected quantities of dolomite were not consumed by the cows before the period of their susceptibility to grass staggers had arrived. In spite of these difficulties the results of the experiments offered some degree of hope. Of the four farms, one had no cases of grass staggers, the second had one mild case which recovered on treatment with Epsom salts, the third had two cases of which one recovered spontaneously, while the fourth had three cases. On the last farm the affected cows had had no dolomite-treated feeding-stuff.

More extensive experiments have been arranged for the coming year. Five tons of dolomite have been purchased by the Department, and this material has been distributed by Mr. Marshall to about twelve farmers.

Grass Staggers and Magnesium Deficiency.—An investigation has been concluded into the question whether grass staggers is due to a deficiency of magnesium in the food. The following lines of work have been carried out :—

(*a*) The determination of the magnesium content of pasture samples, taken regularly throughout the year, from plots on farms where grass staggers has frequently occurred. Also the examination of hay and silage samples for magnesium content.

(*b*) The examination for magnesium of specimens of bones and organs from cows which died of grass staggers. It has been necessary to investigate healthy animals to establish normal magnesium contents and also to establish experimentally whether change in dietary magnesium will affect the magnesium content of bones and organs.

(*c*) The attempted production at Wallaceville of grass staggers in cows the magnesium-content of which was more restricted than that of affected cows.

Results :—

(*a*) The average magnesium-content of thirty-nine samples of pasture was 0·40 per cent. magnesium oxide. This was only slightly lower than the amount found in dairying pastures where grass staggers never occurs. Samples taken during July to September and those taken during outbreaks of grass staggers averaged 0·34 per cent. magnesium oxide. The difference, however, was not sufficient to justify the conclusion that a deficiency of magnesium is the cause of grass staggers. Hay and silage samples were not abnormally low in magnesium.

(*b*) The bones and other specimens of grass staggers cows (liver, spleen, lung, muscle, heart) had closely similar magnesium-contents to those found in normal slaughterhouse animals. Since other experimental work showed that bone magnesium drops with dietary deficiency of magnesium, it was concluded that no prolonged deficiency of magnesium had occurred.

(*c*) Unsuccessful attempts were made to produce grass staggers artificially by feeding two cows with a diet containing 0·25 per cent. magnesium oxide for three months before calving with a change to green oats on calving.

It was concluded from these three lines of work that grass staggers is not due to dietary deficiency of magnesium. The characteristic low blood-magnesium of affected cows, together with the response to magnesium therapy and the hopeful results in the preventive experiments referred to above, indicate still that some disturbance in magnesium metabolism is a factor. The nature and cause of this disturbance will be the subject of future work.

Dietary Protein and Sterility.

Work is proceeding in collaboration with Dr. Hopkirk.

It was reported previously that two types of sterility could now be produced in rats: (*a*) that due to excess dietary protein; and (*b*) that due to dietary protein of poor biological value.

Work on the second type of sterility has yielded hopeful results concerning the nutrition-requirements of the testis. It has indicated that certain of the amino-acids are essential to the production of normal and healthy spermatozoa. The work has opened up an entirely new field of investigation and progress is necessarily slow. Lack of funds for the purchase of amino-acids, moreover, greatly handicaps the progress.

An experiment with pigs, using a diet with biologically poor protein has given results, so far, which suggest that in this species as well as in rats, the nature of the protein may have an important bearing on the reproductive capacity.

Toxicity of Smuts.

Five samples of smut-infected grasses and cereals were received from Dr. G. H. Cunningham, and feeding experiments with rats carried out. In addition the toxicity to rats of ergot infecting paspalum and causing staggers in cows was investigated. No effect on rats could be demonstrated with the paspalum smut.

Of the other five materials four infected with *Ustilago bromivora*, *Tilletia tritici* and *Tilletic levis*, *Ustilago jensenii*, *Ustilago tritici*, proved acutely toxic to rats.

The work is still in its early stages and is to be continued and extended in the coming season.

General.

In collaboration with Dr. Hopkirk, tests have been carried out on rats of the physiological action of an alkaloid extracted from ragwort by Dr. J. R. Hosking of the Dominion Laboratory. This alkaloid was extremely toxic to rats but less so to guinea-pigs.

Various suspected poisonous materials have been tested for officers of the Dominion Laboratory.

Vitamins.

Further assays of the vitamin D content of New Zealand fish-liver oils have been completed by Dr. Marion M. Cunningham. The very high value of groper-liver oil (2,250 international units per gram), reported last year, has been confirmed on a separate sample and the probable commercial importance of this oil is therefore indicated. Results on other oils were as follows: Skate (completed assay), 15 international units pre gram; shark (preliminary assay), 8 international units per gram; kahawai (preliminary assay), 150 international units per gram; flounder (preliminary assay), 760 international units per gram; snapper (preliminary assay), 200 international units per gram.

The investigations of the vitamins A and D contents of milk, grass and hay, in relation to the vitamin supply of pigs, have been completed and the results published. Investigations of vitamin A content of other common pig foods—*e.g.*, meat-meal, pollard, &c., are under way.

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

Mr. Josland supplies the following sub-report:—

It is pleasing to report that increasing use of biochemical facilities is being made by field officers in the investigation and control of stock diseases. At Wallaceville the fullest co-operation is maintained with the veterinary research officers and with the research officer in animal nutrition.

Through the courtesy of the Department I was able to spend four months in Australia visiting the biochemical laboratories and making contact with other workers. Three months of this period were spent working in the Animal Nutrition Laboratory of the Commonwealth Government at Adelaide. There I was privileged to form one of a team of workers investigating the factors governing the level of blood-phosphate in the ewe. I was able to confirm both in Adelaide and on my return to New Zealand the finding that marked irregular variation in the level of blood phosphorus occurs in the normal ewe under standardized pen-feeding conditions and at pasture. Experiments suggested that the variation might arise from the rate of secretion of phosphorus in the saliva (about 2·5 to 7·0 grammes of phosphorus enter the alimentary tract each day from the saliva), and its subsequent absorption from the intestine. The continual depositing and mobilization of phosphorus from the bony skeleton, may lag behind the rapid changes of secretion and absorption of the "floating phosphorus" in the intestinal tract. However, in spite of the fluctuations that do occur in the same aminal, the Adelaide

workers believe that if a sufficient number of animals are sampled so that the values obtained may admit of statistical analysis, then the use of blood-phosphate determinations offers a satisfactory method of diagnosing phosphorosis in the field. A separate report has been made covering my observations on the many activities of the Division of Animal Nutrition.

Photosensitization of Sheep.—In two cases investigated from the Gisborne district, a pigment has been isolated from the bile, identical with phylloerythrin, a fluorescent porphyrin which has been shown to cause geeldikkop in South Africa.

Cobalt Metabolism.—In view of the prominence given to cobalt by the findings of Filmer and Underwood in Western Australia, and Marston and Lines in South Australia, that the administration of cobalt was successful in combating enzootic marasmus and coast disease of sheep, feeding experiments have been instituted. Reference to the literature will show that surprisingly little is known of the part played by this element in animal nutrition. Several workers have reported a polycythæmia following the ingestion of cobalt so as a starting-point it was thought desirable to confirm some of the observations recorded.

In one experiment where rats were placed on a diet containing 1 per cent. cobalt sulphate a marked polycythæmia occurred after eight weeks. During this period the average values for hæmoglobin and red cell counts rose from 93 per cent. (Sahli) and 9·3 millions per c.mm. to 120 per cent. and 15·2 millions per c.mm., while the average weight fell from 190 grammes to 149 grammes. The control group were normal. Another experiment is in progress wherein rats are receiving 0·5 and 1·0 mgm. cobalt daily. At the time of writing, four weeks after the administration of cobalt, a slight rise in hæmoglobin and red cell count is apparent.

In the case of hoggets receiving 5 mgms. cobalt as cobalt sulphate daily no blood changes have been observed after a period of eight weeks. It is intended to continue this experiment over a long period, and to institute others using increasing amounts of cobalt.

Mineral Deficiency.—Ash determinations are being made on bones from lambs of varying ages in order to establish provisional limits of normal variation. It has been shown that the head of the femur and proximal epiphysis of the humerus are normally lower in ash than other bones, and that in cases of mineral deficiency a lowered ash content is first observed in these bones.

General.—Blood and other analyses have been performed for field officers dealing with the following conditions:—

In sheep: Congenital deformity in lambs, ante-partum paralysis, milk fever, facial eczema, suspected mineral deficiency, and hæmolytic jaundice.

In cattle: Grass staggers, milk fever, ergot poisoning, and redwater.

In most of these cases isolated investigations were made so that no deductions could be made. In addition blood and bone analyses were performed in connection with poultry feeding experiments in co-operation with the Poultry Station.

Total Specimens examined.—Sheep blood, 301; cattle blood, 34; pig blood, 8; fowl blood, 43; rat blood, 88; urine samples, 18; bone samples, 148; total, 640.

FIELDS DIVISION.

REPORT OF R. B. TENNENT, DIRECTOR.

The Fields Division, in a broad sense, has as its main objective the improvement of the general farming practices of the Dominion. Its principal work is along the lines of advising and instructing farmers and others by correspondence, personal visits by the Division's instructional staff, lectures, field days, &c., with respect to all improved methods in grassland management, top-dressing, silage-making, the growing and improvement of all farm crops, and such matters. Research work with a view to elucidating farmers' problems, and discovering improved methods of farming practices, is undertaken, and any desirable improvement is rapidly brought to the notice of the farming community mainly per medium of the instructional staff of the Division and the columns of the Department's monthly *Journal*. There is no question the Fields Division is an important arm of the Department and is of real value to the farming and pastoral interests of the Dominion.

The major operations of the Division are reported on below under specific headings and following a few comments respecting the weather conditions generally during the year, and the outcome of the season's cereal crops.

Weather Conditions.

These varied greatly throughout the length of the Dominion, but the one outstanding point was the heavy summer and autumn rainfall, resulting in much more than usual grass growth. This was such in many districts that control with stock became difficult, and highly farmed land had the appearance during the summer of being under-stocked. In the Auckland Province the spring was cold, particularly in North Auckland, while the summer and autumn were exceptionally wet. The southern half of the North Island experienced a wet winter followed by a favourable spring, but a phenomenal summer on account of heavy rain in all districts. With respect to the South Island the weather was most variable. The winter was more or less normal but the spring somewhat dry. The summer, however, was unreliable, high rainfalls being experienced. These exceptional rainfalls followed by a broken autumn assisted pastures considerably and also had a beneficial effect on green crops.

Arable Crops.

Conditions throughout the growing season were good, and prospects of heavy yields bright. Unfortunately in some localities harvesting was made difficult by wet weather and a fair amount of grain sprouted while in stook, while in some cases, through severe floods, crops were washed away. In districts where no severe damage was received record yields of grain have been secured—the yields as disclosed by threshings up to the end of April being appreciably higher than for many years past.

As regards the wheat crop, that portion of it threshed during the period January–April, 1936, amounting to 5,914,005 bushels, gave an average yield of 38·86 bushels per acre as against an actual yield for the 1934–35 season of 26·32 bushels. However, the per-acre yield of 1934–35 was the lowest on record for a number of years except for the 1931–32 season. The threshings of wheat up to the end of April accounted for 152,192 acres of the total estimated area of 240,200 acres in wheat for threshing. Thus, almost two-thirds of the area had been dealt with for an average yield per acre of just under 39 bushels. It is probable, however, that owing to flood damage part of the area sown will remain unthreshed or will give a reduced yield if threshed.

So far as oats are concerned, the position is quite satisfactory. The estimated area sown to oats for 1935–36 was 344,000 acres as against an actual area harvested the previous season of 274,616 acres. Threshings for the January–April, 1936, period disclose a per-acre yield of 48·26 bushels as against an actual yield over the whole Dominion for the 1934–35 season of 35·99 bushels.

It is estimated that 26,500 acres were sown to barley for the 1935–36 season as against an actual area harvested the previous season of 19,194 acres. Severe flooding was experienced in the main Canterbury barley-growing districts during the harvesting period, with the result that prime malting barley has been in limited supply and fairly heavy importations of Australian malting barley have had to be made to meet requirements. The growing of barley sufficient to meet the country's needs is a matter which must receive attention, and it is fully intended to give this matter special attention in the hope that arrangements satisfactory to both producers and users might be made prior to the sowing of the 1936–37 season's crop.

The area in potatoes in 1935–36 was estimated at 22,900 acres as against an actual area for the Dominion for the previous season of 23,001 acres. The planting of purer and better lines of seed potatoes as a result of the certification of potatoes is fully expected to have a great influence on the season's yield. Growers are looking forward to high yields, but at time of writing it is too early for the position to be stated with any accuracy. In some places on the heavier soils a fair amount of rotting of tubers has taken place due to the floods in late summer and in the autumn.

Instruction in Agriculture.

As reported in my last annual report, there is an ever-increasing demand for advice and instruction on all manner of subjects pertaining to farming matters. These are met by correspondence or by personal visits by the instructional staff. The personal visit is the most desirable method, and it is

personal contact between the officer and the farmer that is essential to efficient service by way of advice and instruction. The districts controlled by individual officers are extremely large; and while one or two additional men have been appointed recently, the appointment of more men is most desirable to allow of even a higher degree of efficiency being obtained.

Experimental Farms and Areas.

The Division continues to control the work on seven experimental and demonstration farms in various parts of the Dominion. Some of the work is of an intensive technical nature and is carried on in co-operation with the specialist officers engaged in grassland research work. Other work is relative to experiments and demonstrations on a scale and of such a nature that a co-operative trial with a farmer would not be possible. It is in work of this description that these farms are of a real and definite value.

Ruakura Farm of Instruction.

Weather conditions for the year ended 31st March, 1936, were practically the reverse of those experienced during the previous year. The winter was fairly mild, frost not being too severe and rain not excessive. The spring was, however, very late, but when grass growth commenced it came away with a tremendous rush, and, favoured by intermittent warm and showery weather, feed was produced in such vast quantities that it was found impossible to control it.

The season was a most trying one so far as the hay harvest was concerned. Eighty-six and a half acres of moderate quality hay was stacked, while $18\frac{1}{4}$ acres, although cut and partly cured, finally had to be destroyed by fire on account of its having been completely spoiled by the continuous rain. An area of 50 acres of grass was converted into silage, and altogether 110 tons of hay and 265 tons of silage were made.

Following the practice adopted during the previous two years, no annual sale of surplus stock was held on Ruakura, but all such stock was sold at the Combined Breeders' Sale held at Claudelands during September. This method of sale has the effect of lessening the expenses of selling.

At the sale thirty-four yearling bulls were disposed of at an average price of £15 17s. 6d. The demand for Shorthorn and Ayrshire cattle was particularly keen, but that for Jerseys was much slower. A much keener demand than for some time past set in for Ruakura Berkshires. Tamworths also sold fairly well, but there has been no demand for Large Whites. Prices realized for pedigree pigs during the year have averaged as follows: Berkshire, £5 0s. 2d.; Tamworth, £4 15s. 7d.; Large White, £4 0s. 8d.

The maximum number of cows in milk during the season was 132, and the total butterfat produced amounted to 25,024 lb. The average price per pound of butterfat received in 1935–36 showed an increase on the price for the previous season, the actual amounts being 1935–36, 11·8d. per lb.; 1934–35, 9·03d. per lb.

The position with regard to the flock sheep at Ruakura continues satisfactory.

Taking everything into consideration, the Ruakura Farm of Instruction had a very successful year.

Pig-feeding Experiments.—Pig-feeding experiments were conducted at Ruakura to measure usefulness of good grass in fattening baconers and to get some preliminary information on maize feeding on carcass quality. The experiments were controlled by a committee comprising members of the Live-stock and Fields Division—viz., District Superintendent, Fields Superintendent, Farm Manager, and Veterinarian and Fields Instructor at Hamilton. The results of the trials were that "sty" fed pigs had a mean daily carcass gain of 0·89 lb., and "cow pasture" grazed pigs 0·88 lb. The sty fed pigs required 560·7 gallons of milk per 100 lb. carcass increase, and the cow pasture fed pigs 564·5 gallons. Pigs fed on barley and maize finished too fat, whilst milk feeding gave first-class carcasses. Next season these trials are being repeated, and further work will be done relative to the place of maize in Auckland pig-feeding. Maize is used in the Bay of Plenty fairly extensively for the winter feeding of pigs, and apparently with excellent results.

Ruakura Farm Training College.—This institution, which has been in operation since 1923, was continued during the year, but unfortunately the attendance has been disappointing. Quite a good class of student has been forthcoming, and, taking everything into consideration, things at the college have run smoothly. It is thought the present course of eighteen months could, with advantage, be reduced to a straight-out one year's course. This matter is being looked into further at the present time, and the likelihood is that an alteration will be made during the 1936–37 year.

Field Experiments.

The Division continues to carry out a comprehensive series of field experiments and demonstrations in co-operation with selected farmers, and during the year the number of co-operative experiments in hand increased from 771 to 902. These experiments relate to a great variety of subjects, such as variety trials with wheat and oats, manurial trials on various crops, the trying-out of numerous kinds of fertilizers and combinations of such fertilizers, and the like.

With the careful summarizing of the results of experiments 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.

Two outstanding points which have come to light as a result of the Division's experimental work have been with respect to the manuring of the wheat crop and the control of mottled heart in the swede crop.

Wheat manuring experiments have disclosed that the average increased yield per acre from the use of 1 cwt. of superphosphate in 124 experiments was over 4 bushels, and this represents a profit of approximately 300 per cent. on the outlay for manure. The Division's recommendation for the manuring of the wheat crop has been broadcast as widely as possible, and the fact that this recommendation is being acted on is apparent from the much higher percentage of the area sown to wheat being fertilized than in former years.

A disease known as mottled heart in swedes has for some years been taking a heavy toll of the swede crop. During the last twelve months the Division has been working along the lines of discovering some method of combating this disease, and from numerous experiments put in hand throughout the Dominion a satisfactory treatment was discovered. This consists of applying 10 lb. per acre of ordinary commercial borax to the land at time of sowing. A deficiency of boron in the soil is apparently the cause of a number of diseases of crops, and it will be of interest to farmers to know that such a simple and cheap remedy is so effective in controlling the particular disease of swedes mentioned above.

The whole of the experimental work of the Division is supervised by the Crop Experimentalist, and a comprehensive report by that officer on the experimental work in hand for the year ended 31st March last is appended.

Feed Flavour Investigation.

During the 1934–35 season the Agrostologist investigated feed flavour in butter, and suggested that a detailed study of pastures might indicate the causes of flavour and suggest methods of control. During the 1935–36 season forty farms in the Morrinsville district were put under observation and an officer stationed at Morrinsville in July, 1935, to carry out the experimental and observational work. Some experimental control work was carried out. On ten farms about 20 acres were treated with nitrogenous fertilizers, but owing to feed shortage farmers grazed these fields so hard that the suggested management-methods could not be carried out. Field observations of grazed pastures and examination of the cream supplied showed that (1) pastures with less than 15 per cent of clovers caused no flavour or only a mild flavour; (2) grass-dominant pastures with clovers sub-dominant caused comparatively strong flavours, particularly in October; suckling and/or subterranean clover with white clover caused stronger flavours than white clover alone; (3) clover-dominant pastures caused stronger flavours than those which were grass-dominant; (4) suckling and subterranean clovers caused more intense flavours than white clover; (5) in the early spring, and to a much less extent in the autumn, 10 per cent. or more of sweet vernal caused a distinct "Coumarin" flavour; (6) feed flavours in the night's cream were normally much stronger than in morning's cream; (7) the average "feediness" gradually increased in August and September, reached its peak in October and November, and then declined to end of March, when it was very mild. The experimental work (nitrogenous and phosphatic fertilizers, and the sowing of grass and pasture management) is being continued next season.

Eradication of Ragwort.

The spread of ragwort is giving great concern in some parts of the Dominion, particularly in the Auckland Province. On small dairy farms ragwort can be controlled, but possibly not eradicated, by the use of sodium chlorate. The control on large dairy farms can only be done with sheep. So far as the Auckland Province is concerned, the most serious problem is to control ragwort on farms on the fringe of the Central Plateau and the western upland of South Auckland on sections originally devoted to dairying, but where the weed has spread to such an extent that dairying cannot now be carried on. Sheep are being used in these localities to some extent, but farmers are faced with very poor returns from sheep. Losses are considerable. Very low prices are paid for fat ewes from ragwort country, and on many areas lambs cannot be fattened, but have to be disposed of as stores. If kept after January most of them die. Experiments have been carried out with "Atlacide" in comparison with sodium chlorate, and the former appears to be quite as satisfactory as the latter. About the year 1931 eggs of the Cinnabar moth were liberated, but very few reports of its successful establishment have been received. In one or two localities moths were seen last season, but no effect has been noticed on the ragwort.

Artificial Fertilizers: Topdressing.

The topdressing of pastures with artificial fertilizers and with lime continues to be viewed by the farming community as of great importance, and it is pleasing to record the use during the 1935–36 season of a greater quantity of both artificial fertilizers and lime when compared with the previous season. Definite information available regarding artificial fertilizers and lime is with respect to deliveries made at officered railway-stations throughout the Dominion. These figures, of course, do not allow for the whole of those two commodities used, as no record is on hand with respect to fertilizers and lime delivered apart from the railways. However, they do give a fair indication of the extent to which they are used, and so far as artificial fertilizers are concerned the amount delivered to officered railway-stations for 1935–36 shows an increase over the corresponding amount for 1934–35 of slightly over 38,000 tons. With respect to the deliveries of lime, the amount delivered in 1935–36 was only 1,000 tons or so ahead of that for 1934–35, but for both years an increase is shown of over 50,000 tons for any previous season.

The national wealth of the country is so bound up with its primary products that the increase in the amount of artificial fertilizer being used is a most pleasing feature.

Seed Certification.

Seed certification activities have proceeded along smooth and steady lines in the year under review. The kinds of seed coming under the certification scheme continue to increase, and for 1935–36 certification was undertaken with respect to potatoes, wheat, white clover, perennial rye-grass, brown top, cocksfoot, Montgomery red clover, Italian rye-grass, *Phalaris tuberosa*, turnips, swedes, and rape.

The value of certified seeds is widely recognized throughout the Dominion, but it yet remains for overseas seed-markets to be thoroughly explored. The one exception is in the case of Australia, where New Zealand certified seeds are receiving considerable publicity.

A comprehensive report prepared by the Certification Officer at headquarters relative to the operations of the seed certification scheme is attached.

Pedigree Grass and Clover Seeds.

With a view to further improving the pastures of the Dominion the Division early in 1935–36 had harvested some Government pedigree grass and clover seeds. Such seed, which will be produced during each succeeding year, has been grown on contract from seed especially raised at the Plant Research Station at Palmerston North. The production of such seed is considered to mark a further advance in the already high standard of the Dominion's certified seed. Pedigree stock seed is intended for sowing-down areas to be devoted to the production of certified pedigree seed. No difficulty whatever was experienced in the disposal at remunerative prices of the 800 bushels of Government pedigree stock perennial ryegrass seed and several hundred pounds of pedigree white clover seed.

Farm-management Survey.

During the year a start was made with a farm-management survey of Hawke's Bay. Such survey is being undertaken in conjunction with the soil survey of Hawke's Bay at present being carried out by officers of the Department of Scientific and Industrial Research. The work is as yet in its initial stages, but nevertheless progress has been made sufficient to indicate the possibility of obtaining much knowledge of direct value in respect to the absorption of labour and the utilization of land in Hawke's Bay. The farming and mercantile communities of that province are distinctly interested in the work in which they are helping usefully in directions in which their co-operation is desired.

Irrigation in Canterbury.

The Government is further developing irrigation farming in Canterbury, and in connection with such development it has been found desirable to institute an advisory service with the object of rendering assistance to farmers by placing at their disposal the full-time services of a special officer whose duty it will be to consult with irrigators in the application of water to their crops. It is fully realized that knowledge of the most satisfactory methods of irrigating different types and grades of country and the water requirements of the various crops is necessary if irrigation farming is to be an economic proposition. It is for the purpose of ensuring that sound advice in this direction will be forthcoming that this special service has been instituted. With the development of irrigation in Canterbury it is anticipated that the demands upon this service will increase, and provision will be necessary to reinforce the irrigation advisory service in the not distant future. This matter will be presented for consideration at the appropriate time.

Pasture Survey.

Towards the end of 1935 the Division put in hand the making of a detailed pasture survey of the North Island. It is intended that such survey will demark the principal grassland types at present prevailing in all North Island districts, and should prove of considerable value in determining the potentialities of different soil types on completion of the soil surveys, which are also being conducted by Government officers.

Farmers' Field Competitions.

These competitions, the value of which it is difficult to overestimate from the point of view of agricultural instruction, have been continued in various parts of the Dominion on much the same lines as in past years. The Division's assistance, however, has been mainly along the lines of judging the competitions. It is unquestionable that the competitions provide a ready means whereby both local farmers and the departmental officer for the district gain first-hand information and much valuable field experience.

Young Farmers' Clubs.

The Young Farmers' Club movement started by the Fields Division in the Otago District in 1932 has greatly extended during the year, and at the present time there are thirty clubs in the North Island and fifty-six in the South Island, with a total membership of approximately two thousand young farmers. Clubs are self-supporting, having for members youths between the ages of sixteen and twenty-five. Regular monthly meetings are held by the club members, who discuss agricultural problems, while at the same time regular lectures are arranged for by departmental officers and others. Field days are held at convenient Government institutions or on some high-class farm in the district. There is no question that this club movement has a great future ahead of it if properly developed. It is the intention of the Department to recommend the appointment of a full-time officer as general secretary to the movement and, in addition, to use field officers of the Fields Division as local organizers and secretaries, and with this arrangement in force there is no doubt the movement will thrive, and thrive rapidly.

Purchase of Seeds and Manures for Government Departments.

In 1931 an arrangement was made whereby the Fields Division undertook the purchasing of seeds and manures required by Government Departments and institutions. This arrangement continued during the year and has operated quite smoothly. There is no question that so far as seeds are concerned the system in operation of buying on a purity and germination basis is having most beneficial effects so far as the pastures on Government properties are concerned.

The Hemp Industry.

The matter of the hemp industry has been referred by the Government to a committee of departmental officers with a view to considering all phases from the point of view of whether or not it is possible to take some action that will improve the position generally of the hemp industry. This industry should be worth quite an appreciable sum to the country, but of recent years it has been gradually drifting. It does seem that some steps should be possible which would improve the general milling of the fibre. At the present time too high a percentage of the milled article is of low grade, and this, of course, militates against satisfactory business overseas.

For the twelve months ended 31st March, 1936, more hemp and tow was submitted for grading than in the previous year. For 1935–36 the actual number of bales of hemp graded was 26,162—an increase of 7,348 bales on the figures for the previous twelve months. The quantity of tow graded increased by 1,338 bales, the actual quantities graded being for 1935–36, 4,848 bales, and for 1934–35, 3,510 bales.

Departmental Photography.

The Photographer attached to the staff of the Fields Division, as in past years, performed excellent service, and has carried out photographic work of a high order for all branches of the Department and occasionally for other Departments. Excellent use is made of the photographs for lecture purposes, illustrating publications, and for advertising purposes, both in New Zealand and abroad.

Staff.

I desire to tender my best thanks to members of the staff for their loyal co-operation and excellent work during the past season, which has been a particularly arduous one.

FIELD EXPERIMENTAL WORK.

Mr. J. W. Woodcock, Crop Experimentalist, supplies the following sub-report:—

During the year the number of co-operative experiments carried out on farms by the Fields Division has been increased from 771 to 902. Although more standard trials have been laid down, new lines of investigation account in the main for this increase. A detailed summary of experiments in progress is given in Appendix A.

Publication of Results.—Five reports on experiments or articles containing references to results from experiments have been published in the *New Zealand Journal of Agriculture* and a list of these is given in Appendix B.

Description and Progress of Experiments.

Grassland.

Yield Trials under Mowing and Grazing Technique.—At Marton Experimental Area nine trials are now being conducted and two others have been sown recently. The scope of the existing trials was referred to in the last annual report. Both the new experiments are planned to investigate the production from pedigree lines of perennial rye-grass, white clover, and Montgomery red clover, respectively, as compared with ordinary certified strains of these species, but different methods are employed in each trial.

At Ruakura Farm of Instruction an experiment on the use of lime is being continued. Three further trials are to be established shortly to investigate the effect of phosphate, potash, and lime on various soil types. As the recent soil survey of Waipa County has shown these soils to be the most important in the district it is considered that results of such experiments will have wide application. A further trial has been planned to test the value of severe harrowing on paspalum.

Observational Top-dressing Experiments.—The survey of fertilizer responses on grassland is being continued, and these observational top-dressing trials account for 50 per cent. of the total number of experiments. Although the relationship of lime and potash to phosphatic manuring is the main project, the latter sown trials are designed to try out various forms of phosphate in addition, and it is intended in the near future to include the new "Heskett" slag in a number of experiments to be laid down.

Responses to phosphates occur on most soils, but it would appear that in some districts a stage has been reached when the application of potash and lime in addition to phosphates must receive consideration.

Demonstrations and Trials of Grass and Clover Strains (in collaboration with the Agrostologist).—These trials have proved of great value not only for purposes of testing strains of grasses and clovers under varying soil conditions but also for demonstrating to farmers the importance of sowing approved strains. The importance of sowing a good strain of white clover as well as certified rye-grass has been well demonstrated by this series in most districts. Where clover was excluded entirely, the extremely poor appearance of the grasses has often been a marked feature even in localities where good volunteer white clover is believed to come in readily and in spite of heavy top-dressing with phosphate and lime.

Grazing Trials.—Five experiments are being carried out in which the production as measured in grazing days of one field is compared with that of another differently treated. Two experiments in Taranaki compare potash dressings with no potash, and one in Canterbury compares fields which are periodically limed with one unlimed field. One experiment at Winton Experimental Area investigates the relative production of certified rye-grass with that of ordinary Southland rye-grass. It is proposed to lay down a further trial at Winton during the coming season to compare the better type Southland seed with certified rye-grass under sheep grazing, and records are to include not only grazing days but also the weights of lambs reared on the respective areas.

Clover Inoculation Trials (in collaboration with the Mycologist).—There are 123 trials which are being carried out to investigate the effect of inoculating red and white clover seed. In approximately 26 per cent. of trials carried out to date inoculation has given a definite stimulus to white clover establishment and subsequent growth. In a further 13 per cent. of trials inoculum appeared to assist establishment of clover, but differences were not apparent at a later stage. In the remaining 61 per cent. of cases no improvement was noted from inoculum. The positive results were not confined to any particular types of land or systems of farming. The importance of good white clover establishment is becoming more widely realized, and in view of the relative cheapness of treatment it may be considered desirable at a later stage to put clover inoculum on the same footing as lucerne culture.

Investigations into effect of Pasture on Feed Flavour (in collaboration with the Agrostologist).—One phase of the feed flavour in butter investigation has been conducted by the Fields Division on forty farms in the Morrinsville district. Detailed notes were made on the botanical composition of pastures, and records were obtained from the Morrinsville Dairy Factory of feed flavour intensities resulting from each grazing. The results tend to confirm previous findings that clover-dominant fields may give rise to high intensities of feed flavour, whereas when grass-dominant fields are grazed the cream is comparatively free from high feed flavours. On ten of the farms experiments were conducted to investigate methods of promoting grass dominance on pastures, but these were inconclusive and further trials on these lines are to be carried out next season.

Annual Crops.

Wheat and Oat Manuring.—The use of nitrogenous fertilizers on wheat and oat crops sown after a previous stubble crop was investigated in thirteen experiments. Five of these could not be harvested on account of unfavourable weather conditions. The responses to nitrogen varied considerably and in two experiments outstanding increases were recorded. On the other hand, in one trial on oats a depression in yield occurred from nitrogen, although it is interesting to record that in this case the nitrate content of the soil was extremely high when manured, and all treatments gave very high yields.

Wheat Variety Trials.—Ten experiments were carried out in collaboration with the Wheat Research Institute and in most of these, new varieties, particularly those considered suitable for spring sowing, were on trial. Two Portuguese varieties proved of outstanding merit, and although one of these seems to be superior for Canterbury conditions, the other has given more favourable results in Otago and Southland. It is anticipated that each of these varieties will eventually hold an important position among spring sown wheats in the districts mentioned. Where Cross 7 was tried in comparison with solid straw Tuscan the results were generally in favour of the former.

Oat Variety Trials.—In view of the importance of the oat crop in the Dominion it was considered desirable to institute oat variety trials and six experiments on these lines were carried out. Some of the newer varieties were included, and efforts were made in some of the experiments to obtain information in respect of suitability for grazing purposes as well as grain or chaff weights.

Seed Treatment of Cereals (in collaboration with the Mycologist).—Observational trials were carried out on twenty-nine farms to investigate further the merits of "Ceresan New" and "Agrosan G" for dry dusting of wheat, oats, and barley. In three trials actual yields of crop were taken but in two of these no significant differences were recorded. In one, however, in which Agrosan was not included, Ceresan gave an increase of 9 bushels per acre of wheat as compared with formalin treatment.

In the majority of trials both Ceresan and Agrosan appeared to give thicker and more vigorous crop establishment than such standard treatments as formalin, bluestone, or copper carbonate. In none of the experiments was any trace of smut found in plots treated by these dusts.

Potato Manuring.—Seventeen experiments were laid down in 1935, but the crops have not yet been dug. These trials investigate the effect of phosphate, nitrogen, and potash and also are intended to demonstrate the value of certified seed under different methods of manuring.

Swedes and Turnips: Varieties and Manuring.—Seven trials are being carried out in connection with varieties or manuring of swedes and turnips, but results are not yet available.

Control of "Mottled-heart" in Swedes (in collaboration with the Mycologist).—As a result of success obtained overseas in the control of a swede disease similar to that known in New Zealand as "mottled-heart," nineteen trials were laid down to investigate the effect of adding borax at 10 lb. per acre to the fertilizer. Already there are indications that this treatment has been effective since in Westland, where "mottled-heart" is fairly prevalent, borax has so far controlled this disease as compared with severe infection on control plots in at least five of the experiments.

Miscellaneous.

Pampas-grass.—Several experiments have been established to obtain information on the growing and utilization of this species, and these will later be grazed to obtain information on the carrying-capacity and palatability of the plants under different conditions. In addition, a large number of plantations of pampas-grass have been visited by Instructors and careful record taken of the success or otherwise attending the planting. At this stage it is extremely evident that the establishment of pampas-grass by means of root-cuttings is a precarious undertaking, especially when the cuttings have to travel any distance from the source of supply. In the areas under observation the total number of surviving plants represents only 45 per cent. of the cuttings planted. Quite a number of cases are reported where only a few plants survived even after careful planting by the grower.

Other Trials.—Experiments which have not been classified above include trials with lupins in combination with other crops, the control of ragwort and other weeds by spraying, and experiments on the manuring of lucerne.

APPENDIX A.

SUMMARY OF EXPERIMENTS LAID DOWN, DISCONTINUED, AND CARRIED ON, 1ST APRIL, 1935, TO 31ST MARCH, 1936.

Type of Experiment.	Number of Experiments.			
	As at 31st March, 1935.	Discontinued 1st April, 1935, to 31st March, 1936.	Laid down 1st April, 1935, to 31st March, 1936.	As at 31st March, 1936.
1. Pasture (observational)—				
(*a*) L.P.K. (including slag)	37	1	24	60
(*b*) L.P.K.	264	44	51	271
(*c*) L.P.K.N (new series)	50	26	16	40
(*d*) L.P.K.N. (old series)	9	1	4	12
(*e*) Placement of phosphates	..	..	2	2
(*f*) Miscellaneous top-dressing	71	22	28	77
(*g*) Pasture establishment	11	2	1	10
(*h*) Strain trials	66	11	40	95
Grazing trials	8	4	..	4
Seed-production	2	..	1	3
Inoculation of legumes	101	28	50	123
Whangamomona series	10	10	..	..
Mowing trials	1	..	..	1
Miscellaneous	11	7	20	24
2. Experiments at Marton—				
Mowing trials	11	2	..	9
Observational top-dressing	6	2	..	4
Strain trials	2	..	..	2
Fodder crops	1	..	..	1
3. Lucerne manuring	5	1	5	9
4. Crops—				
Potato variety	7	7	2	2
Origin of seed-potato trials	11	9	..	2
Potato manuring	6	9	16	13
Swede and turnip variety and manuring	11	9	5	7
Rape types	10	9	..	1
Wheat manuring	1	..	7	8
Wheat variety	29	26	7	10
Rate of seeding	9	9	..	..
Mangel manuring	1	..	..	1
Mangel variety	1	..	..	1
Oat variety	1	2	7	6
Oat manuring	..	..	2	2
5. Feed-flavour investigations: N. treated	..	..	11	11
Feed-flavour investigations: Miscellaneous	..	..	30	30
6. Disease control	..	..	11	11
Control of ragwort	..	1	3	2
Pampas-grass investigations	..	..	27	27
Ceresan treatment of cereals	13	35	32	10
Miscellaneous	5	2	8	11
	771	279	410	902

SEED CERTIFICATION.

Mr. J. H. Claridge, Certification Officer, supplies the following seed report:—

The organization of seed certification, which in previous years has been undertaken by the Agronomy Section of the Plant Research Station on behalf of the Fields Division, has now become a direct responsibility of the Fields Division, and this report covers the first year's operations under the new supervision.

Pedigree Seeds.—The certification of pedigree seeds has been a feature of the season's activities. Eight hundred bushels of Government pedigree stock perennial rye-grass seed was produced under certification, the total quantity having already been disposed of through trade channels. Orders have also been received for several hundred pounds of white clover seed produced under similar conditions, but the exact quantity of seed being harvested is not yet available. Contracts have been arranged for an increased area of both perennial rye-grass and white clover in the ensuing season, when it is hoped that a greater quantity of this specially raised seed will be available for distribution.

Perennial Rye-grass.—The acreage of perennial rye-grass entered in the 1935–36 season for certification per medium of field inspection has shown an increase of 10 per cent. over the corresponding area for the previous season. In addition to this area, over 100,000 bushels of machine-dressed seed have been offered for certification in the "Commercial" class during the twelve months under review. Two-thirds of this quantity has been accepted as certified seed, an amount equivalent to the harvest of nearly 4,000 acres. The bulk of this seed was the produce of the 1934–35 season, but the number of lines already offered from this season's harvest would indicate that there is good prospect of a considerable increase in the quantity to be offered from the 1935–36 harvest. This scheme of certification was introduced only shortly before April, 1935, so that its development has been very rapid.

Due to the unsettled weather, the harvest season has been rather late, but the germination of lines tested to date is better than was anticipated in view of the unfavourable conditions.

Cocksfoot.—Cocksfoot entries are still coming to hand, so that it is too early to give any definite indication of the total acreage likely to be entered. The final figure for the 1934–35 season (7,886 acres) was higher than had been anticipated, and the area entered in the present season is still nearly 2,000 acres below that figure.

White Clover.—A further increase has been recorded in the acreage of white clover entered for certification, with the likelihood of more entries yet to be made. It is anticipated that yields of seed will be lower than usual, while some areas which were entered have been flooded and will not be harvested. Areas sown out with certified mother-seed show definite promise of developing into areas consisting of white clover of a superior type.

Red Clover.—The acreage of Montgomery red clover entered this season has shown a considerable decline. There may be further entries yet to be received, but it is not expected that the amount of seed to be harvested will reach that certified in the 1934–35 season.

Brown-top.—In the 1934–35 season the amount of brown-top seed harvested under certification was twice as great as that harvested in any one previous season. Very little of the seed now being produced fails to come into certification. This season's harvest is only just commencing, and no indication of its probable extent can yet be given.

Italian Rye-grass.—In the second season's operations covering Italian rye-grass, the acreage entered has increased considerably. Practically all the areas entered were sown with certified seed from the 1934–35 harvest, and the standard revealed at field inspection of this year's areas was in the main quite satisfactory. It is interesting to note that all certified Italian rye-grass is of imported origin, no local seed having come up to the standard required for certification purposes.

Phalaris Tuberosa.—The certification of *Phalaris tuberosa* is already being undertaken in New South Wales, and three areas were sown out in Canterbury in 1935 with certified mother-seed imported from Australia, with a view to ascertaining the possibilities of an export trade in this seed. These areas were entered for certification and are being harvested this season.

Potatoes.—The scheme of seed-potato certification continues to widen its scope. There has been a fairly steady increase in the area entered for certification since the inception of the scheme in 1927, and it is estimated that 15 per cent. of the total South Island acreage has been inspected in the field during the 1935–36 season. In this connection it should further be borne in mind that, while a gradual raising of the general standard is being brought about year by year, there also has been an increase in the percentage of crops attaining to that raised standard.

The division into mother and commercial classes of those crops accepted, and the limitation of entries in the following season (in the case of seed purchased) to areas planted with mother-seed, has shown itself to be warranted. In the 1934–35 season 377 of the crops entered were planted with certified mother-seed, and of these 2·7 per cent. were rejected at field inspection. On the other hand, of 79 crops planted with certified commercial seed, 48·1 per cent. were rejected. These figures indicate that the planting of mother-seed gave a grower reasonable assurance that in the following season his produce would again qualify under certification.

Wheat.—The acreage of wheat entered for certification in the 1935–36 season is approximately double that entered in the previous season. This increase has been due in part to the rapid distribution of the new variety "Cross 7." The dissemination of this variety in three seasons emphasizes the great value of the certification scheme in the rapid multiplication of selected strains of seeds, particularly those of annual crops. Taking this variety as an example, the following figures show the acreage under certification in the first three seasons: 1933–34, 7 acres; 1934–35, 89 acres; 1935–36, 1,500 acres, all of which can be traced back to the seven-acre area of 1933–34.

The general standard of crops in respect of varietal purity and freedom from seed-borne diseases is good. The grain quality has been very adversely affected by the weather conditions prevaling since harvesting of the crops. In a number of cases the quality of the produce is well below ordinary milling standards, the grain having sprouted very badly prior to threshing.

Rape.—Four areas of rape, all sown out with seed selected and raised at the Plant Research Station, have this year come under certification. Seed from these areas should be of good quality and, when coupled with the fact that the type of rape is specified, should meet a ready demand in competition with imported seed.

General.—Seed certification activities have proceeded along smooth and steady lines in the year under review. While the value of certified seeds is now widely recognized throughout the Dominion, overseas seed-markets in the main have not been tapped. The exception is in the case of Australia, where New Zealand certified seeds are receiving considerable publicity. The exploiting of other markets would appear at this juncture to be an economic problem, in that local seeds cannot compete successfully against the existing world prices.

The accompanying table records acreages entered in various crops since the inauguration of seed certification in 1927.

The field staff of the Division have undertaken a large volume of work, often at rush periods, in the execution of their duties relative to seed certification operations.

Seed.	Acreages inspected each Season.								
	1927–28.	1928–29.	1929–30.	1930–31.	1931–32.	1932–33.	1933–34.	1934–35.	1935–36.*
Potatoes	821	909	1,200	1,334	1,146	1,154	1,322	1,882	2,400
Wheat	473	1,184	2,277	3,289	1,063	1,873	2,937	2,545	5,400
White clover	..	325	664	311	31	100	538	1,284	1,500
Perennial rye-grass	..	..	3,028	6,539	9,709	22,917	13,236	11,351	12,500
Brown-top	..	..	22,000	24,900	18,300	14,860	17,150	24,310	†
Cocksfoot	..	..	..	..	4,226	5,097	5,485	7,886	8,000
Montgomery red clover	..	..	..	..	9	71	168	392	250
Turnips, swedes, and rapes	..	..	..	..	..	..	128	..	40
Italian rye-grass	..	..	..	..	..	..	..	305	500
Phalaris tuberosa	..	..	..	..	..	..	..	..	20

* Approximate. † Not available.

REPORT OF THE PLANT RESEARCH STATION, PALMERSTON NORTH.

The activities of the Plant Research Station have been well maintained during the past year, 1935–36. The appended reports of the several sectional 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 Department of Scientific and Industrial Research in certain parts of the work.

A. H. Cockayne, Director.

AGROSTOLOGY SECTION.

E. Bruce Levy, Agrostologist.

The work of the Agrostology Section throughout the year has progressed steadily and the staff has been kept exceedingly busy, much good work being accomplished. Strain testing of ecotypes and for certification purposes has been a major feature, and additional grass and clover species are now being studied. Plant-breeding and other work in connection with strain building to pedigree standard has been steadily continued, and it is obvious that this work will gradually raise the standard of ordinary certified seed and, in addition, will afford progressive farmers an opportunity to adopt pedigree seeds for the betterment of their grazing areas. The Section has as its objective in building to pedigree standard the production under certification of such quantities of pedigree seeds and at a price that these seeds ultimately will be within reach of every farmer.

Strain-testing, strain-building, and field trials, thanks to the close and energetic co-operation of the field staff of the Fields Division, have been maintained as a continuous process, and too much emphasis cannot be laid on the value of this close inter-relation between research and field extension. At the time of writing changes are contemplated, and the wisdom of those changes in no small measure will lie on the amount of co-ordination retained between research and extension.

A pleasing feature of the year's work has been the close co-operation of workers in the matter of the investigation into feed flavours in cream. Farmers, dairy factories, cream graders of the Dairy Division, the Dairy Research Institute, the Fields Division, and the Plant Research Station have all linked up in the prosecution of this research. The work at Palmerston North and in the Waikato is well forward, and will be presented for publication in the near future.

The ecological field-work of the Section has been extended and for the time being is being concentrated on a mapping of pasture types survey in the Hawke's Bay District in conjunction with a farm-management survey by the Fields Division, Department of Agriculture, and a soil survey by the Soil Survey Division, Department of Scientific and Industrial Research. This further example of collaborative field-work is to be commended.

During the year negotiations with the New Zealand Golf Council were successfully finalized whereby green-keeping research was placed on a sound footing. A field advisory officer and a permanent hand for the research area have been appointed by the New Zealand Golf Council. This will enable research and extension to be fully co-ordinated.

The work of the year in detail is as follows:—

GRASSES.

Perennial Rye-grass.

Certification and other Plot Trials.—Eight hundred and twenty-two plots were sown for study or report for certification purposes, all the latter of which have been finalized. Included in the study trials were a number of overseas lots which were studied particularly to co-ordinate ultra-violet-light test and type test as determined by plot trial. As a result of these trials it can be definitely laid down that the ultra-violet-light test may not be used as an international test for type determination, and that it is reliable only when taken in conjunction with type as determined by plot trial. Thus it serves admirably as a test for contamination in the Hawke's Bay and Poverty Bay strain, but it does not serve to differentiate between types of true perennial themselves. This is an important finding, and it should have a bearing on the class of certified perennial rye-grass, known as the "commercial class," which has been established on the ultra-violet-light test alone. None of the overseas strains under trial proved superior to the New Zealand certified rye-grass, and most were distinctly inferior. Some few Australian, some British indigenous, and two Hungarian lines were much superior to the ordinary run of lines.

Elite Strain Work.—The 1-acre block of selected pedigree rye-grass has been retained and was again harvested for seed. A yield of 403 lb. of dressed seed was secured, and from this an additional 12 acres have been sown for seed-production on a contract basis. This makes 32 acres now sown out on contract from the nucleus area. A crop was secured from the 20 acres sown on contract in 1935, and a yield of 800 bushels was secured. This has now gone into commercial seed-production channels.

The breeding programme in perennial rye-grass includes a study of 6,700 single plants, the seed for the planting of which was secured as a result of crosses and selfings made in the 1934–35 season. Notes have been taken periodically on these and will continue for another season before selection of the most promising material is made. Further selfings and diallel crosses were made of other promising plants, and studies were initiated to determine the degree of vigour that may be regained in crossing unrelated inbred plants.

Low Germination of Perennial Rye-grass.—The trial of 200 lines conducted at Palmerston North and at Winton in connection with the investigation into the low-germination capacity of certified perennial rye-grass when harvested in a wet season yielded no data as a result of good seed setting and development under comparatively dry seasonal conditions, which are unfavourable for the causal fungus to develop. A preliminary examination of the crop at Palmerston North revealed that there was no fungus present, and consequently it was considered unnecessary to proceed further with the investigation. The crop at Winton was harvested and the samples were forwarded to Palmerston North for threshing and testing. Representative lines were tested but germination in all cases was high, indicating that the season in the South also was favourable to good seed setting and development. The experiment is to be continued at both places.

Single Plant Study.—Four thousand single plants from the South Island and testing low under the ultra-violet-light have been severely culled, ninety-four plants remaining. These have been consolidated in a block for further testing.

Forty-eight of the best commercial lines from various sources have been sown out with the object of raising 10,000 single plants for selection purposes to augment those now used for pedigree seed production.

Tiller-row trials of eighty-four selected plants are being continued under a system of periodical grazing.

Italian Rye-grass.

Certification and other Plot Trials.—One hundred and fifty-nine plots were spring sown, and have been reported on for certification purposes. It has been determined that late spring sowings give a very rapid indication of type owing to the marked differential behaviour of Western Wolths and Italian rye-grass when spring sown, the former bolting rapidly to seed-head and the latter tending to leafiness rather than stem. Inferior hybrid lots also show this tendency to bolt to seed when spring sown.

Elite Strain and Breeding Work.—In the early autumn of 1935, 5,000 single plants, obtained by selfing and crossing sixty-two selected original plants, were set out, and notes were taken periodically until last breeding-season, when 105 of the best plants from the eight best F_1 and L_1 families were selected. These plants were selfed and crossed in intra-family groups of four by enclosing heads from the four plants in a large cellaphane bag. Seed-setting was good, and 8,400 seedlings have been planted out.

To furnish more information on the relationship between the production of single plants, rows, and plots, seed was collected from seven families of known type but showing an extreme range in type between families. The seed thus obtained was used for single plants, rows, and plots, together with three known controls—Western Wolths, certified Italian, and poor Italian lines. Each lot was replicated four times. They will be cut and weighed at intervals throughout the season.

Five thousand single plants from a number of lines of certified and imported Italian rye-grass were set out for comparative study and to afford a mass of material for selection purposes.

Cocksfoot.

Certification and Plot Trials.—One hundred and forty-three plots were sown and all certification lots have been reported on.

Single Plant Study.—Twelve hundred single plants of Akaroa and Plains origin and thirty selected tiller-row plants of various types have been kept under observation and notes kept on superior plants to date. No breeding work has yet been attempted, but a close study has been made regarding the make-up of Lincoln College C. 23 selection, and ten best plants have been split up and planted out for seed production in order to obtain a pure line of seed for field trials.

Brown-top.

Four hundred and six lots have been sown out largely for certification purposes. Those sown in the spring failed to establish and these have now been resown this autumn.

Prairie-grass.

Investigations in strain within this species have been commenced, twenty-four lots being sown out as broadcast plots, spaced rows, and single plants.

Phalaris tuberosa.

Twenty lines of *Phalaris tuberosa* have been sown as broadcast plots, spaced rows, and as single plants. The majority of these lines are of Australian origin.

CLOVERS.

White Clover.

Certification and other Trials.—Six hundred and forty-eight lines were spring sown and the 845 lines sown the previous spring have been finalized. Herbage tests for HCN on all lines have been conducted by the Plant Research Chemist.

In the plot trials pedigree lines and the good mother-seed lines are showing marked superiority in growth over all other types right from the time the seedlings commence growth.

Elite Strain Work: Breeding.—The original eighty-nine tiller-rows and the 100 tiller-rows planted in 1934 have been retained, and notes on these have been regularly taken. In the early spring a total of 4,500 single-plants obtained from crosses and selfings made last season were put out. Notes have been taken on these plants but no selections have as yet been made from them.

From the crosses planted in 1934, 125 of the best plants from the six best families were selected for further breeding work. These have been back-crossed to both parents, and also crossed in intra-family groups of five by isolating five plants of a family in a cage with bumble-bees. In addition, six inter-family groups were made by isolating together ten plants from two unrelated families. Eight original plants were selected from tiller-rows and diallel crossed to furnish further unrelated families. Seed-setting has been very satisfactory, and a further 8,500 plants are coming on for planting out in the spring.

Pedigree-seed Production.—There has been quite a wide distribution of pedigree white clover seed, and the area sown already runs into approximately 200 acres. A total of 38 acres is sown out from the nucleus area at the Plant Research Station and a further 20 acres is to be sown out this spring. Owing to the exceptionally wet summer experienced, only a small acreage of the area sown was successfully harvested, approximately 400 lb. in all being harvested. This has now gone into commercial seed-production under certification.

Montgomery Red Clover.

Certification and other Trials.—Seventy-five lines were spring sown but type differences will not be clearly marked until the following spring. All lines previously sown have been reported on for certification purposes.

Elite Strain Work: Breeding.—In the spring 2,400 single plants were put out and notes have been periodically taken but no selections will be made until next season. To obtain sufficient seed for plot tests of different types eight crosses have been made, and the seed will be sown in plots in the spring.

The original selection was culled and consolidated and attempts were made to secure a seed crop from this area. The adverse weather conditions throughout the summer reduced the seed yield and only 32½ lb. of dressed seed was secured. Sufficient of this to sow 3 acres under contract was released, the remainder being used for comparative field trials.

Subterranean Clover.

Strain Testing.—Good progress has been made with a study of strains of subterranean clover. Thirty-three lots were planted last May as spaced plants in blocks, and then the plants were allowed to spread and join up to form the equivalent of a broadcast plot. Regular notes and weighings have been taken, and important strain-differences have been noted. The different strains fall into one or other of four groups if dates of flowering and seasonal growth are both considered:—

Group I is early-growing, early-flowering, and relatively low-producing: Group II is early-growing mid-season-flowering, and high-producing. Group III is later-growing, mid-season-flowering, and only fairly good-producing. Group IV is very late to commence growth, late in flowering, and very heavy-producing in the late spring.

The strains which come within Group II would appear to be the best for New Zealand conditions since they are able to yield well in the early spring and in the early autumn. This autumn a further twenty-four lots have been planted out for study, but only six of them are strains which have not been grown at the Station previously.

Seed-production.—Following on the results of strain testing, nineteen blocks of single plants of the different strains have been planted in order to give increased supplies of seed for field trials and for later distribution commercially. The blocks are approximately 1/100th acre in size.

Lotus major.

The tiller-row trial has been continued, and late in the spring a selection of eight plants was put out in an isolated corner. The plants recovered very slowly after transplanting, and as a result did not flower this season. The selection is being kept for seeding this coming summer and the seed obtained will be increase-grown.

Two hundred and fifty L1 plants obtained by selfing three original plants have been planted out but no selections were made from these this season.

ECOLOGY.

Field Trials.

A comprehensive series of strain trials has been arranged for the purpose of species, strains, and seed-mixtures trials on various soil types and conditions. Thirty-two trials have been made up during the year, and these have been laid down by the Fields Division and regular reports have been received. There is now a total of ninety-one trials in progress.

Pasture Analyses.

The pasture analytical work has increased greatly during the year and further technique work has been carried out with the following methods: (1) Eye-determination; (2) point analysis; (3) dissection analysis of cut or plucked herbage.

The greater amount of this work has been in connection with the pasture trials at Marton, the feed-flavour investigation at the Dairy Research Institute, Palmerston North, and in conjunction with seed-mixture trials.

Much more of this exact work should be done in conjunction with plot and field trials.

Pasture Survey Work.

This has for its objective the mapping of pasture types in such a way as to indicate the following three phases of pasture progress: (1) The vegetation that each soil and climatic type will support in its natural or unimproved condition; (2) the modifications that have taken place to date in general; and (3) the potential type of sward that such soils or climatic type will support when fully improved. The pasture survey commenced in the Hawke's Bay County in January of the year under review, and up to the 31st March approximately 150 square miles had been mapped. This later will be correlated up with farm-management and soil-type, which surveys are proceeding hand-in-hand with the pasture survey.

Feed-flavour in Cream Investigation.

This has been continued in the Waikato and further extended at Palmerston North in close collaboration with the Dairy Research Institute and the Fields Division of the Department of Agriculture. An extensive programme of work was undertaken and the work in the Waikato enlarged to include work at Frankton and Te Awamutu as well as at Morrinsville. Forty farms at each centre were botanically surveyed and the cream-supply from these farms was subject to critical grading on the 0 to 10 basis for feed-flavour intensity. The major points determined in the previous year's work were confirmed. These may be again summarized as follows:—

(1) Grass-dominant farms yield a cream low in feed-flavour intensity:
(2) Clover-dominant farms yield a cream high in feed-flavour intensity:
(3) The lower per-acre producing pasture types, consisting mainly of suckling clover, subterranean clover, and sweet vernal, produce the highest feed-flavour intensity, but the high feed-flavour intensity period is of comparatively short duration.
(4) Dominant white clover farms with some rye-grass sub-dominant are high in feed flavour, and these extended well through the season:
(5) Dominant rye-grass farms with white clover sub-dominant produced the best quality creams, these possessing a relatively low feed-flavour intensity throughout the season:
(6) The evening cream gave a consistently higher feed flavour than the morning cream and this is evidently associated with the time prior to milking that the feed is consumed.

Control of feed flavour would appear to lie along the lines of pasture improvement and some experimental work was initiated to see how best pasture could be translated from clover-dominant to grass-dominant. Some 200 acres on ten farms were experimentally treated with nitrogenous manures, and paddocks so treated were compared with other paddocks on the farm. Owing, however, to the lateness of the spring growth little could be done to ration the herd on these nitrogen-treated fields owing to the fact that the areas treated were constantly in use by the herd because of a general feed shortage.

It is intended to continue the investigation and in addition to compare heavily phosphated fields with fields treated with nitrogenous fertilizers.

At Palmerston North the work involved the preparation, sowing down, and fencing of special pure and mixed pastures for field grazing, and the provision of pure feeds that were cut and fed indoors to stall-fed cows.

In both trials the herbage consumed was botanically analysed and dry-matter determinations made by the Station Chemist. The general results of these trials went to confirm the field trials in the Waikato in so far as they went to prove—

(1) That pure grass diets yielded a cream almost entirely free of feed flavours:
(2) All clovers fed produced feed flavour in the cream, and the indications were that suckling clover and subterranean clover were more potent in this respect than white clover or red clover:

Further pure sowings covering 6 acres of ground have been made, and the work involved in maintaining these crops in a pure condition is considerable, all clovers being sown in drill rows and inter-tilled to control volunteer species and weeds.

GREEN-KEEPING RESEARCH.

This work has progressed well during the year, and I am pleased to report that the New Zealand Golf Council has appointed a field advisory officer and permanent labour to the research area in order that this work may be more efficiently carried on and that the results may be extended to actual field practice. The actual control of the research area is now vested in the advisory officer, and this has released my assistant for ecological pasture work in the field. The direction of green-keeping research is still under the Agrostology Section.

PUBLICATIONS.

The following articles have appeared during the year:—

"Garden Lawns and Playing Greens," E. A. Madden: *Journal of Agriculture* for June.
"Third Annual Report, Green-keeping Research."

Papers were contributed by the following officers to the New Zealand Grassland Association Conference: L. Corkill, S. H. Saxby, L. W. Gorman, E. A. Madden, and E. Bruce Levy.

DEMONSTRATIONS, LECTURES, AND CONFERENCES.

The number of farmers and overseas visitors to the research area has increased during the year, and this alone involves a good deal of time of the Station's staff. Such visits, however, are encouraged, and are most convincing as to the value of the work being done.

LAND AND EQUIPMENT.

An additional 4 acres of land has been leased from the City Council, and 1 acre has again been loaned by the Massey College for isolation work with Italian rye-grass. This question of isolation became very acute during the season, and will need to be considered more and more as work with additional species progresses.

EQUIPMENT.

A seed-cleaner and huller have been secured to deal with nucleus pedigree lots of seed. Also a second-hand car engine has been installed to drive huller and thresher, but the performance of this engine is poor, and it will need to be replaced. A gravel tractor has been purchased and is doing very good work.

LABOUR.

Unemployed labour continued during the greater part of the year, but latterly an arrangement has been made for full-time subsidized men to be employed. The benefits to the work and relief to the Overseer in this arrangement have been even greater than expected.

STAFF.

The services of Mr. S. H. Saxby were lost to the Section during the year owing to the temporary-service policy of the Scientific and Industrial Research Department. The loss of this trained officer is much regretted.

It has been very gratifying that all officers connected with this work have again performed a strenuous year's work in a most satisfactory manner. The work at the Station area has been efficiently run under the overseership of Mr. Todd, and it is anticipated that, with the permanent labour now available, even better work in the future will be accomplished.

AGRONOMY SECTION.

J. W. Hadfield, Agronomist.

The work of the Agronomy Section has been carried out as in the past at the Pure Seed Station, Lincoln, and at the Plant Research Station, Palmerston North.

Growing conditions were favourable at Lincoln and heavy yields resulted, but the harvesting conditions caused heavy losses, there being recorded 16·22 in. of rain for February and March. The season was very late at Palmerston North and conditions far from ideal for seed setting.

The policy of producing nucleus lines of pure and smut-free seed has been continued, and it is satisfactory to report that the Canterbury Agricultural College has taken over much of the seed so produced. The balance has gone into the hands of seed-growers, and will be distributed under certification.

Several new wheats were placed under yield trial. Lin Calel, a variety from South America, shows promise in baking-quality and yield when autumn sown. Ben Cubbin, an Australian wheat, may have merits as a spring-sown variety.

The main work has consisted of an extensive yield trial comprising most of the New Zealand commercial varieties and several introductions from overseas. Of the recently imported varieties Resistance, raised by the National Institute of Agricultural Botany, proved very promising for Canterbury, Otago, and Southland conditions. It is not yet fixed in type and its high susceptibility to rust renders it quite unsuitable for North Island conditions.

Breeding work has been confined to the selection of crosses suitable for North Island conditions with rust resistance as a special consideration. F3 seed has been harvested from: Ruakura x Algerian x Lampton x Ruakura. F2 seed has been harvested from: Lampton x Gartons x Ruakura.

Garden Peas.—Acre lots of nine varieties were grown under order for various merchants to replace their deteriorated stocks. The demand for good seed is very keen, and the area devoted to this crop could well be increased.

Breeding has been confined to two crosses from which F3 and F4 seed was harvested. The following results indicate promise in the yield column.

Cross 11: (Greenfeast x Harrison's Glory) x Greenfeast.
Cross 8: Greenfeast x Great Crop (Yorkshire Hero).

——	Pod length.	Peas per Pod.	Weight per Hundred Seeds.	Yield Seed per Plant.
	Inches.		Grams.	Grams.
Parent Greenfeast	3·75	8·5	28·6	37·5
Parent Great Crop	3·25	5·6	43·4	52·0
16 families Cross 11	3·6	7·1	32·0	64·0
8 families Cross 8	3·5	7·7	34·5	74·0

Field Peas.—A wide range of crosses between varieties of field peas and between field and garden peas is being worked with. Unfortunately two adverse seasons have been experienced, and although some progress has been made, it has been impossible to evaluate at all satisfactorily the material on hand.

Potatoes.—Trials are being undertaken of several recent introductions including the American varieties Chippewa and Katahdin.

Several hundred crosses were made between *Solanum andiginum* (a wild species from South America) and standard commercial varieties. From these about eighty fruits were saved and it is intended to explore the possibilities of these hybrids next season.

Lucerne.—Breeding commenced in 1931. By in-breeding and selection it has been possible to advance along two lines. In the first, those parents which have given consistently good in-bred progenies were grouped according to type, and the parents crossed one with the other. The F1 progenies of these crosses have been under trial this past season and have given, over a period of three cuts, substantial increases over Marlborough commercial.

Marlborough commercial = 100.
14 F1 families of flat types range from 114·9 to 137·9 (average) = 128·1.
14 F1 families of upright types range from 97·3 to 123·0 (average) = 108·9.
40 F1 families of intermediate types range from 99·2 to 146·1 = 124·1.

Plants have been selected from within the best F1 families and these will be used for strain building. In the flat and intermediate groups only those families above 130 will be used and in the tall only those above 110.

Secondly, the best plants within the best in-bred progenies have been grouped according to type and unrelated plants intercrossed necessitating 260 separate crosses. Since the plants and families utilized were selected on account of their uniformity and small loss of vigour on in-breeding, it is hoped, by further in-breeding and combination, to build up strains of good type that will lose only the least possible vigour on self-fertilization.

Investigations in connection with the pollination of lucerne have been completed and the results are being published.

Rape.—Each year an attempt is made to raise mother seed for distribution to growers who are producing seed commercially under certification. A measure of improvement has been attained each year as indicated by yield trials conducted this past season.

Best commercial giant rape = 100.
Mother seed distributed for 1934–35 = 107·4.
Mother seed distributed for 1935–36 = 116·0.
Mother seed distributed for 1936–37 = 122·4.
Mother seed for distribution for 1937–38 = 125·6.

An attempt has been made to combine in one cross the best features of giant and broad-leaf Essex rapes. This has been to a large extent successful. The type has been improved and is associated with a marked increase in production.

Best commercial giant = 100.
(Giant x broad-leaf Essex) x giant = 122·6.
Best commercial broad-leaf Essex = 100.
(Giant x broad-leaf Essex) x broad-leaf Essex = 128·0.

Brassica Crosses.—Some 259 intervarietal and interspecific crosses have been made during the past season. Certain of these have as a direct objective the breeding for resistance to club-root.

Hybrid Vigour in Tomatoes.—The combination in F1 of early maturity in association with high yield that characterized the preliminary work warranted further investigation and fifty-nine crosses between seven varieties have been made. It is hoped that estimates of hybrid vigour attending these crosses will be undertaken next season.

Miscellaneous Trials.—A variety trial with soya beans was undertaken and has revealed much preliminary information in regard to yield, maturity, and synonymity.

Several selections of onions were seeded, and sufficient seed is now available for yield trials next season.

Austrian winter field peas have proved to be very resistant to severe winter conditions, and superior in this respect to Partridge. Seed is being increased for distribution.

Trials of vetches and tares indicate that purple vetch and woolly-podded vetch may prove useful varieties in New Zealand.

Safflower, a new oil-bearing plant, was tried out for the first time. It grows to perfection at Palmerston North; but owing to the spiny and unpalatable nature of the plant it was deemed unwise to extend these trials and the plot was destroyed.

Maize variety trials were destroyed during a severe storm.

MYCOLOGY SECTION.

J. C. Neill, Field Mycologist.

The Mycological Section is concerned with the fungi and bacteria associated with plants and plant products, with the reduction of economic losses caused by plant diseases, and with the supply of micro-organisms beneficial to agriculture. Work undertaken during the past year is reported briefly as follows:—

Brassica Diseases.

Dry-rot (*Phoma lingam*).—Some seventy varieties and strains of swedes are under field test to determine their relative powers of resistance to this disease.

Club-root (*Plasmodiophora brassicae*).—Field tests of over one hundred varieties and strains of swedes and rape are in progress following up the results obtained during the previous season in regard to the fixation of the quality of resistance to this disease. The results to date show that in highly-infected soil, with favourable conditions for attack, no strain has yet been found that remains free from the disease. However, some varieties and strains have proved must more resistant than others, and future work should involve hybridization of these on an extensive scale to evolve a type highly resistant and suitable to New Zealand conditions.

Brown-heart (mottled-heart).—This disease of swedes, the cause of which is as yet unknown, has become increasingly prevalent in all swede-growing countries, including New Zealand. Elsewhere the use of small quantities of boron has given good control of the symptoms, and trials of the method are in progress both at the Station and by the Fields Division, in various parts of the Dominion.

Turnip-mosaic: This virus disease has assumed epidemic proportions on the brassica crops of the Station, very seriously interfering with the experimental programme. Its effects are particularly destructive to turnips but almost equally so to swedes, causing stunting and defoliation, followed by an offensive bacterial rot. It reduces the yield of rape by 25 per cent. The virus has been transmitted artificially to cauliflower and broccoli, causing mild mosaic symptoms. A survey is planned to determine the relative importance of this disease in the main turnip-growing districts.

Cereal Diseases.

Rusts.—Investigations on the biotypes of cereal rusts in New Zealand have been continued in collaboration with specialists overseas.

Seed-dressings.—Extensive field trials on the effects of organic-mercury dusts on wheat, barley, and oat seed sown at weekly intervals, have shown that, within limits, they are efficient controllants of such seed-borne diseases as the covered smuts and stripe, and result in an average increase of 10 per cent. in plant establishment.

Potato Diseases.

Virus.—It has been found that the variety "Aucklander Short Top" is a carrier of a masked virus causing severe losses when transmitted to other varieties—a discovery of great practical significance to growers of seed potatoes.

Internal Brown Fleck.—Experiments with various minerals for the control of this disease yielded negative results.

Diseases of Legumes.

Virus.—Investigations on the host range and methods of transmission of "pea-mosaic" have been carried out with a view to evolving measures for control. "Pea-streak," a disease which has troubled growers for some years past, has now proved to be of virus origin, and work is in progress to determine its host range and methods of transmission.

Bacterial-wilt of Beans.—Tests are in progress of varieties reported from abroad as being immune to this disease.

Seedling-vigour.—Experiments on the effect of organic-mercury dusts and of nodule organism inoculations on pea seed have yielded conflicting results—in some cases remarkable improvement in crop being obtained, in others little or none. The probable reason for this lies in the balance of seedling vigour and soil flora as governed by temperature and moisture, and this aspect will be considered in conjunction with the general investigation of soil flora now being undertaken.

Diseases of Tomato and Tobacco.

Damping-off of seedlings.—The investigations on methods for the prevention of this trouble, continued from the previous season, have now been completed, and the results published for the guidance of growers.

Leaf-mould of Tomatoes.—The experiments on methods for the control of this disease on tomatoes under glass have also been completed and the results published.

Virus Diseases.—"Spotted-wilt" has been found to occur on tomatoes throughout the North Island but has not been reported from the South Island. The same virus has been proved to cause the disease known as "black-wilt" of tobacco, prevalent in Auckland and Bay of Plenty tobacco-growing areas. "Mosaic" of tobacco is becoming steadily more prevalent in New Zealand. Experiments are in progress on its persistence in the soil and on its host range and means of transmission.

Fruit Diseases.

Strawberry Virus.—It has been found that this disease may be transmitted by inarching of runners. Some two thousand plants are under observation at the Station in connection with this disease.

Strawberry Root-rot.—This is the most serious disease of strawberries in New Zealand. Up to the present attempts to find the causal agent have failed.

Bacterial Disease of Passion Fruit.—This disease appears to be widespread in the north. The bacterium has been isolated and its pathogenicity proved.

Hop Diseases.

A survey of the hop-growing areas in Nelson has shown that the only disease of economic importance is "black root-rot." Experiments are under way to determine its cause and control. A chlorotic condition occasionally seen is under test on suspicion of being due to a virus.

Cucumbers, Melons, etc.

Cucumber mosaic has been prevalent during the past season on cucumbers, melons, marrows, &c., especially in the Gisborne district. In experiments the virus has been transmitted artificially to all these crops and to tobacco and blue lupin, producing in the latter symptoms closely resembling those of "sore-shin."

Lawn-grass Diseases.

Experiments on the control of "brown-patch" of lawns have been completed and the results published.

Mould Fungi in Industry.

The study of mould fungi responsible for deterioration and spoilage of food-stuffs, textiles, &c., has been continued, and much information acquired on the conditions which govern their occurrence and on means for checking their appearance. Experiments in conjunction with the Public Works Department have demonstrated a practicable method for the prevention of mould damage to tent-calico which should result in very substantial savings to this and other tent-using departments.

Free use of the expert advice available has been made by various industrial concerns faced with troubles due to moulds.

Miscellaneous.

The supply of pure cultures of the lucerne nodule organism is an important and profitable branch of the Section's duties. During the present season sufficient cultures have been supplied to the farmers of New Zealand to inoculate 122,000 pounds of lucerne seed. The use of similar inoculum for other leguminous plants, notably red and white clovers, lupins, soya beans, peas, &c., has been the subject of field trials, in collaboration wih the Fields Division, with conflicting results. Further investigations are under way to determine the reason why the favourable results obtained with lucerne, and at times with the other crops mentioned, should in many cases fail to appear.

Preliminary work on the technique of biological analysis of soils is in progress with a view to evolving a standardized method for use in collaboration with the physical and chemical sides of soil survey projects.

Large collections and artificial cultures of the commoner fungi occurring on grasses and cereals have been made for use by the Veterinary Division in animal toxicity tests.

More than two hundred specimens of diseased plants have been received at the Laboratory during the year and the senders advised as to their nature and methods for control.

The outstanding piece of work accomplished by members of the section during the year has been the publication by Dr. G. H. Cunningham of the book "Plant Protection by the aid of Therapeutants." This work covers, in condensed form, the whole of the world's knowledge on the subject, and represents a fund of accurate information of incalculable value to users, traders, and manufacturers of the therapeutants used in all forms of plant protection.

SEED-TESTING SECTION.

N. R. Foy, Seed Analyst.

Testing Services.

Purity and Germination Testing.—For the year ending December, 1935, 15,309 seed samples were received for testing, this number representing an increase of three hundred samples on the total for the previous year. As for former years the bulk of this work is done for the seed trade, 12,228 samples representing commercial lines of seed. The general standard of quality shown by the tests is generally very good and judging from the demand for scrupulously accurate and consistent results, a very complete reliance on purity and germination by the New Zealand seed trade is evident.

Various departmental activities, mainly investigational, accounted for 3,081 samples. Altogether, the purity and germination work necessitated a total of 23,960 triplicate and duplicate tests.

Ultra-violet Light Examination of Perennial Rye-grass.—A total of 1,525 samples were received for this examination, and of this number 773 were made on samples of certified seed for the Department's own information in respect of the production areas; 142 for other official activities; 319 for the purposes of the "Commercial" class of certified rye-grass; and 291 on behalf of the seed trade for determination as to classification as perennial and as a preliminary to possible entry as commercial certified.

Certified Seed—Purity Inspection.—A total of 2,512 machine-dressed samples of certified seed were examined for analytical purity and of this number, 45 or 1·8 per cent. were rejected as having failed to conform to the required purity standards for machine-dressed seed.

Certified Commercial Perennial Rye-grass.—Officially drawn samples representing 290 lines or 76,156 bushels of seed were submitted for examination by ultra-violet light to determine their eligibility for certification, and 196 lines representing 51,113 bushels were accepted as having qualified for certification.

Examination of Australian Wheat and Barley.—A total of 88 samples of imported wheat and barley drawn by the Department's Port Inspectors were examined for the presence of skeleton-weed, *Chrondrilla juncea*. All samples were found to be completely free of the weed.

Examination of Samples for Farmers.—Approximately two hundred samples representing purchases and stored seed were received from farmers, either prior to sowing, or more frequently subsequently to crop failure. All such samples are reported upon completely with an estimate as to the market valuation.

State Seed-purchasing.—For the year ending March, 1936, purchases of seed to the value of £21,745 were authorized. The selection of the approved lines is based on unit value, and it is estimated that the present system of purchasing has resulted in very considerable savings. The State's business is keenly sought, and very competitive quotations are received. Some hundreds of individual lines of grass and clover, and root-crop seed have been considered during the year, 1,656 lines representing 330 tons of seed being selected.

Research.

Germination of Algerian Oats.—The germination of newly-harvested Algerian oats was made the subject of further extensive investigation. The causes of the frequent failure of autumn-sown oat crops where new season's seed is used were established and means of avoiding these losses have been devised. As an outcome of this work samples of new season's oats are now tested for germination under two conditions of temperature. At 5 deg. to 10 deg. C. the percentage of live seed is determined, while at 20 deg. to 30 deg. C. the stage reached in after-ripening is gauged and the probable field germination is estimated, for which service the appreciation of the seed trade has been expressed.

The results of certain physical treatments on the rate of after-ripening is being investigated, and although the work is at present confined to oats, it is anticipated that the findings will prove to be of value in the treatment prior to germination of certain species of newly harvested grass seeds.

Germination of Perennial Rye-grass.—The investigation of the causes of low germination of rye-grass seed in certain production areas was continued and a technique evolved for the examination of immature seed-heads for the presence of the disease—Pullaria sp.—responsible for low germination. From this examination the sanitary condition of the immature seed can be determined, and the potential loss in germinating-capacity of the harvested crops estimated. It is considered that an advisory service based on this examination would be of great value to growers, particularly in unfavourable seasons.

Experiments in inoculation of sterile growing plants were continued and although, through scarcity of the disease in the Manawatu, inoculum could not be obtained until late in the season, and despite the infestation of the experimental plants by ergot, the plants were successfully inoculated, thus proving that the disease is the primary factor, and is not secondary to some physiological factors. The work is being continued.

Identification of Agrostis sp.—With a view to establishing a reliable technique for the separation of small quantities of red-top in brown-top, examination of various seed characters has been made, but a reliable method of distinguishing with absolute certainty between the two species was not evident.

Further work, using artificially germinated seedlings has been attended by a fair measure of success, and a very useful method of distinguishing the species at an early stage has been demonstrated. The real measure of its reliability will only be known when a more extensive range of material has been studied.

White Clover: Picric Acid Test.—During the year further comparisons were made between the picric-acid test and the plot-trial method of grading white clover seed according to the value of the strain. This additional work has provided further evidence of the reliability of the test.

In order to obtain a better understanding of the cyanophoric properties of different strains of white clover and of individual plants the study of a large range of single plants has been undertaken in collaboration with the Agrostologist.

Testing Technique.—In the routine testing work problems frequently arise which demand solution and efforts are constantly being made to perfect the laboratory technique. During the past year the utility of low temperatures in germination testing was investigated resulting in the effective use of temperatures of 5 deg. to 15 deg. C. in hastening the germination of many horticultural seeds.

Sensitivity to slight differences in temperature, was found to be the reason for inconsistency and in some instances failure of germination of certain brassica seeds, and many valuable data were obtained for several species of seeds following the use of experimental technique.

General.

Referee samples have been worked on behalf of the International Seed-testing Association, Copenhagen, and of various Australian Seed-testing Stations through the Council of Scientific and Industrial Research, Canberra, in all of which the Station results have compared very favourably with those of other Stations throughout the world. A large amount of correspondence covering all matters relative to seeds and the seed trade has been dealt with.

One feature is the increasing number of visits of inspection paid to the Station by students, farmers' organizations, young farmers' clubs, and visitors to New Zealand, particularly from Australia, where the reputation of the Station is very high.

ENTOMOLOGY SECTION.

J. Muggeridge, Entomologist.

For convenience the work of this Section is dealt with under two headings, (*a*) Routine, and (*b*) Research.

Routine.

During the past year a considerable amount of time was taken up in replying to correspondence concerning the identification of various insect pests and giving information in regard to their control where practicable.

Owing to the abnormally wet conditions in the North Auckland Province there was a serious outbreak of "armyworm" caterpillars. The appearance of the caterpillars in epidemic proportions had the effect of stripping pastures that were being kept for hay or for feeding-off during the late autumn and winter months. The area affected—over 15,000 acres—proved to be low-lying country subject to flooding. A full report on this matter has been presented.

Research.

White Butterfly.—Work on the biological control of this pest was continued throughout the year, and it is pleasing to report that there was a distinct falling-off in the prevalence of the pest in the areas where the parasite was well established. At the end of the 1935 season the butterfly was under good control in Hawke's Bay, so much so that it was difficult to find a butterfly chrysalid in places where hundreds might be found before; in the Manawatu, Taranaki, and Wellington Provinces during this period parasitism of the chrysalids reached as high as 90 per cent., and consequently, towards the end of the season, in these latter places there was a marked diminution in the prevalence of the pest.

At the commencement of the 1936 season there was every indication that the butterfly was under good control in the areas referred to above. As the season advanced, however, it was noted that it was increasing; at first in parts of Hawke's Bay, and subsequently in the Manawatu and Taranaki Districts. The increase did not bring the population up to the original epidemic proportions, but nevertheless it was sufficient to be alarming. As far as time would permit field studies were made and it was found that, apparently due to wet conditions there was a differential rate of parasitism as between material collected from grass, and that collected from posts.

During the 1935 season no such differences were noted, parasitism of the chrysalids being equally high whether they were taken from grass or from posts. It is possible that this trouble may in the future be overcome by the provisions of suitable places in which the butterfly can pupate.

During the 1935–36 season 79,000 parasites were distributed as follows: Canterbury, 30,095; Auckland, 23,285; Marlborough, 9,850; Otago, 8,060; Nelson, 2,610; Southland, 2,000; Westland, 1,460; Wellington, 1,340; Taranaki, 300; total, 79,000.

Diamond-back Moth.—A considerable amount of work in regard to this pest is being carried out both here and in England. From a report on a preliminary survey in connection with the moth and its parasites it is pointed out that the moth is known in England mainly in epidemic form; frequently it is not noticed and recorded by economic entomologists. A number of parasites have already been found in England, but a considerable amount of work remains to be done before any material can be sent out here.

In New Zealand a considerable amount of time has been devoted to field surveys, life-history studies, and the existing host-parasite relationship. A detailed account of this work as far as it has progressed will shortly be available.

White Fly.—Stocks of the white-fly parasite (*Encarsia formosa*) have been kept going throughout the year, and supplies of the parasite have been sent out to various applicants from time to time. This parasite when given time to establish proves a thoroughly effective check to the white fly.

Red Mite.—Further experiments were carried out much on the same lines as those already reported in the *Journal of Science and Technology*, Vol. 16, No. 5, pp. 261–270 (1935). The purpose of the work was to ascertain as accurately as possible the value of applying winter oils against the overwintering eggs of the red mite (*Paratetranychus pilosus*) as a control for this pest. The technique of counting and observing results was the same as that used in the experiments already reported in the publication mentioned above. Infested apple and peach twigs were used, and these were sprayed in batches as required, and immediately after spraying the twigs were confined outside in wire-netting covered cages exposed to the weather from all angles. Sprayings were carried out from the 22nd July, 1935 to 17th September, 1935, and the twigs were then left in the outside cages until November, when kills secured were counted. The aim of this method was to combine normal orchard conditions with accuracy in egg counts. The oils used were straight oils with viscosities varying from 95 to 399 sec. Redwood at 100° F. These oils were used in emulsions of varying stabilities so that both the effect of viscosity and stability of emulsion could be studied. Approximately one thousand eggs were used in each experiment, the total number of eggs counted in the whole work being well over ninety thousand. The results indicate that under the outdoor conditions neither increasing viscosity or stability of emulsion have any significant increased killing effect. The oils applied in July and early August, had no killing effect at all, whereas those applied in late August and September gave only about 40 per cent. kill due to oil, taking into consideration the percentage of natural mortality which was high, being in 75 per cent. of the trials approximately 40 per cent. The weather during the period for which the twigs were exposed in the outdoor cage was abnormally wet and conditions were generally unfavourable to a good control by the oil. From experience in this work it would seem that when the eggs are exposed to outdoor conditions in this way that the method of estimating results described in experiments already reported in the *Journal of Science and Technology* (above) might be investigated with advantage. If suitable supplies of eggs can be secured it is proposed to carry out such an investigation this winter, as this is necessary to interpret the results correctly.

In conjunction with the above detailed work a fairly large field experiment was carried out on Delicious apple trees in a Hastings orchard. Altogether 204 trees were included in the experiment, which was designed to test the effect of viscosity and stability of emulsion on the killing power of winter oils on red mite eggs (*P. pilosus*). The oils were applied in early July on one block, and in early September on a second block. The purpose of this was to discover also whether the time of application influenced the kill secured. In July and September overwintering eggs of *P. pilosus* were very plentiful on most of the trees, but at an inspection in the middle of December mites were extremely scarce on all trees, even on the checks, so that it was impossible to detect any difference between the effects of any of the oils. The season had been an extremely wet one, and apparently this accounted for the disappearance of the mites.

Up to the present there seems to be little evidence to show that winter oils against *P. pilosus* give a good kill.

Insecticides for Controlling the White Butterfly (P. rapae) on Cabbages.—This work was continued at the Area in the 1935–36 season. The insecticides tested were arsenate of lead sprays and dusts, calcium arsenate sprays and dusts, pyrethrum sprays, nicotine sprays, common salt sprays, lettuce decoction sprays, and derris sprays and dusts. The results show the superiority of the derris dusts.

The poison residue problem is also being investigated thoroughly. This is of moment where arsenicals are used. Cabbages were sprayed at various times with lead arsenate and harvested at specified intervals after spraying. The samples have been forwarded to the Dominion Analyst for examination. Results so far show that even if an interval of six weeks is allowed between the last spraying and the time of harvesting, there is a danger of more than 0·01 grain of arsenic trioxide per pound being present if the whole cabbage is analysed. On the other hand, if only the hearts of such cabbages are used there is little more than a trace of arsenic present. The figure 0·01 grain of arsenic trioxide per pound of foodstuff was that adopted by the Royal Commission on Arsenical Poisoning in London, 1903. This figure is accepted in most countries, but in New Zealand the regulations under the Sale of Food and Drugs Act, 1908, do not allow the presence of any arsenic or lead at all on fresh cabbages and cauliflowers. The whole position is unsatisfactory as far as recommendations for the use of arsenicals are concerned, especially since lead arsenate spray will give quite a good control of white-butterfly larvae. Therefore, the present work is designed to clear up the position. This project should be finished after next season.

Red Scale (Chrysomphalus aurantii).—In collaboration with the Horticulture Division, an experiment on the control of red scale on lemons was carried out at Tauranga. The object of the work was to discover the nature of the control secured with summer oil at 1–33 on this pest. The 1934–35 season was a bad one for this scale, and growers claimed that it was very difficult to secure a control by oil-spraying. The plots at Tauranga were sprayed at specified intervals and a week to ten days after spraying samples of the sprayed fruit were forwarded to Palmerston North for examination as to kill. Examinations showed that more adult scales remained alive after spraying than did any younger stage. Particular care was taken to secure a complete spray cover on specimens forwarded, but even so the kill of mature scales varied from 50 per cent. to over 90 per cent. Two consecutive sprayings, on the whole, gave very good control. The results show how important it is to spray thoroughly because a great number of growers cannot afford to put on more than one spray during the season.

Publications.

Papers published during the period 31st March, 1935, to 31st March, 1936, were as follows:—

(1) Red Mite Control by Oil Sprays, *Journal of Science and Technology*, Vol. 16, No. 5.
(2) Six papers on Economic Aphides and their Control, *New Zealand Journal of Agriculture*.
(3) Eelworm Disease of Chrysanthemum, *New Zealand Journal of Agriculture*.
(4) The Use of Insecticides in the Control of the White Butterfly, *New Zealand Journal of Agriculture*.
(5) Experiments on the Control of the Bronze Beetle, *New Zealand Journal of Science and Technology*.
(6) The White Butterfly Menace: Efficient control by the pupal parasite *Pteromalus puparum*, *New Zealand Journal of Agriculture*.
(7) Thrips: With Special Reference to the Greenhouse Thrips, *New Zealand Journal of Agriculture*.
(8) The Potato-Tuber Moth, *New Zealand Journal of Agriculture*.

BOTANY SECTION.

H. H. Allan, Systematic Botanist.

Routine work was continued on the lines of previous years. The work of identifying and reporting on specimens as usual occupied a great deal of time, full advantage of this service being taken by all sections of the community indicated in previous reports. Well over three thousand specimens were dealt with. A number of new records of introduced plants were made, the more important of these being dealt with in articles in the *Journal of Agriculture* in the series "Notes on recently observed Exotic Weeds." A paper bringing our knowledge of introduced species up to date and correcting errors of former accounts by various workers was published in the *Transactions of the Royal Society*. Work on the indigenous plants was continued, and a paper dealing with some of the results was published in the *Transactions*, while other papers were contributed to British and American scientific journals. The book on the grasses of New Zealand reached the page-proof stage, and Mr. Zotov has submitted for publication a paper dealing with certain results of his research into the leaf-anatomy of our grasses.

Further botanical examination was made of areas in the Mackenzie Country affected by facial dermatitis, particular attention being paid to the following stations: Lake Tekapo, Lilybank, and Mr. Burnett's property adjacent to the southern end of the lake. On all these areas species of *Hypericum* were noted, sometimes in quantity. It was planned to give assistance on the botanical side to experiments to be carried out by the Live-stock Division on the properties of Messrs. Burnett and Murray. In company with Dr. Hopkirk, I also visited affected areas in Poverty Bay, where a similar disease is being investigated. *Hypericum* is not a noticeable member of the plant cover of these areas, but a considerable growth of clovers and bur-clovers was observed These plants have elsewhere been suspected of contributing to such outbreaks, and it appears desirable to have feeding tests carried out with these as well as with the *Hypericums*. An illustrated article dealing with the various species of *Hypericum* found in New Zealand was prepared for the *Journal*.

Mr. Zotov made a three weeks' study of the grasslands of the South Island, and continued this at his own expense during his vacation. Much valuable information and herbarium material were obtained, and we are now in a position to conclude our detailed revision of the grasses of New Zealand. Other minor excursions were made, resulting in considerable accessions to the herbarium. Contributions were also received from a number of European institutions, and a specially valuable set of specimens of marine algæ was presented by Mr. R. M. Laing. In accordance with a request from the Director sets of specimens are being forwarded as opportunity allows to the herbarium of the Royal Botanic Gardens at Kew. These will serve to bring up to date the collection of New Zealand plants there, especially of species described by local botanists subsequent to the floras of Hooker.

Preliminary observations were made in the neighbourhood of Te Awamutu, under the guidance of Mr. Melrose, of ragwort-infested areas. Special attention was paid to the area at Terau-a-moa and the Barton Estate. The period of the visit was not suited for extended investigations on the spread of the weed by seed, but preliminary experiments were carried out. These would suggest that though wind-carriage is a factor it is not the most important one. It would appear that seed is in general not carried far by wind and spread by this means is comparatively slow. Of more importance is carriage by stock. It is proposed to make more detailed studies next season.

A commencement was made, at the request of the Division of Horticulture, with anemone and ranunculus bulbs. The object is to secure a better grade of bulbs than has hitherto been available from New Zealand-grown plants. From the areas planted a supply of bulbs and seeds has been obtained for experimental purposes.

The section of the fruit-research work entrusted to this Section has occupied the full time of Mr. Woodhead, and his report is attached.

STOCK AND SCION INVESTIGATIONS.

Mr. C. E. Woodhead supplies the following subreport:—

Stock Trials.

Apple Stocks.—Growth records of the trial blocks of apple-trees on several East Malling stocks and the Northern Spy stock, which were established at the Plant Research Station and throughout the country nearly three years ago, indicate that, with one exception, the East Malling stocks are up to the present time superior in vigour to the Northern Spy. Taking the average of all the trials, the order on the basis of growth is as follows, the East Malling stocks being indicated by the letter "M":—

1st.	2nd.	3rd.	4th.
M. XV.	M. I.	M. XII.	N. Spy.
		M. XIII.	M. XVI.

Obviously, until the trees reach the bearing stage rootstock influence can only be studied from the aspect of vigour. Other equally important factors such as influence on cropping and on the quality and colour of the fruit will be investigated when the trees commence to crop.

It is worthy of note that the non-immunity of the East Malling stocks to woolly aphis attack does not appear to have affected their superiority in vigour over the Northern Spy, all immune stock.

An additional stock trial block of approximately an acre has been planted at the Plant Research Station with 119 trees received from the nursery of the Research Orchard, Nelson. These consist of the varieties Cox's Orange, Delicious, Jonathan, and Sturmer, on Northern Spy and from East Malling stocks.

Stone-fruit Stocks: (a) Peach.—Progress reports on the trials of three East Malling plum stocks—viz., Common Mussel, Brompton, and Black Damas C., budded to "Lee's Seedling" peach, reveal very little difference between trees on the three stocks, although those on Brompton are a little more vigorous. It was noted that the plum stock had a dwarfing effect on the peach scion.

(b) Cherry and Plum.—To furnish material for trials, some two hundred stocks of six East Malling selected types of the Mayyard Cherry have been budded to the fruiting variety Black St. Margaret. A similar number of plum stocks, representing five East Malling selections have been budded to two fruiting varieties of plums—viz., Grand Duke and Monarch.

New Apple Stocks.

Clone races of new apple stocks are being established. These include several promising stocks discovered during the stock survey of Dominion orchards conducted in 1931.

Strain Investigation of Apple Varieties.

This work has been extended this year to include the varieties Jonathan and Granny Smith. Orchard Instructors throughout the Dominion were requested to send in to the Station budwood of as many strains of the two varieties as they could locate. As a result much bud-material has been received and worked on stocks in the nursery.

The varieties now being investigated for possible strains comprise Cox's Orange Pippin, Sturmer, Delicious, Jonathan, and Granny Smith. Unfortunately, owing to the severe gale experienced in February, the first results of this work have been lost, the immature fruit being blown off the trees. Given favourable conditions, fruit of the first three varieties above-mentioned will be available for study next summer. It is hoped that among the many strains of Delicious now being grown at the Station a type may be discovered having a closed calycine sinus and consequently less susceptible to "Mouldy Core."

Hazelnut Culture.

Trees of the species Corylus maxima grown in the Station nursery were planted out for trial three years ago in the following localities—viz., North Auckland, Auckland, Tauranga, Gisborne, Nelson, and Central Otago. The annual progress reports received last June showed that the trees were doing well in the two most northerly districts. Elsewhere, growth had been poor.

Walnuts.

Twenty walnut-trees imported by Dr. Cunningham from Australia have been planted for trial on the boundaries of the Tiritea Area. These consist of the varieties Wilson's Wonder, Franquette, Freshford Gem, and Kelvin. With the exception of the last named, these varieties are reputed to be resistant to bacterial blight (*Pseudomanas juglandis*).

Tests are also being carried out to discover a successful method of budding walnuts. While they can be grafted with little difficulty, attempts at budding appear to have been universally attended with indifferent success. With a view to discovering a suitable technique, a number of seedling stocks in the Station nursery have been budded by different methods.

Area of Orchard and Nursery.

The orchard at the Plant Research Station (Tiritea Area), now covers 2½ acres. Particulars of trees planted are as follows: Apple (stock trials), 219; apple (strain investigation), 116; pear, 18; peach, 19; apricot, 33; plum, 12; total: 417 trees. There is an additional area of approximately ½-acre occupied by the nursery.

Storm Damage.

Being in an exposed position, the orchard experienced the full force of the gale which occurred on 2nd February. It has been necessary to stake about two hundred trees, where the root-hold was affected. All trees suffered injury to foliage, in many cases being almost completely stripped of leaves. Budded trees also incurred much damage through breakages.

The provision of adequate shelter for the orchard is an urgent necessity, without which the successful conduct of the rootstock trials and other investigations referred to in this report will be seriously jeopardized. The present shelter consists for the most part of a hedge about 8 ft. in height, which is totally inadequate for the purpose.

CHEMICAL SECTION.

B. W. Doak, Chemist.

The work of the Section has been, in the main, along the lines of previous years. This has been the investigation of the chemical composition of herbage samples and the analyses of soil samples for plant nutrients. All work has been carried out in co-operation with other officers of the Station, and the samples have been drawn from definite experimental areas.

Marton Experiments.

Routine determinations of the dry matter percentages of the herbage from all mowings from all mowing-experiments have been carried out. In addition to this the analysis of herbage from some of these trials has been continued. Soil samples have been regularly taken from several experiments and the results of the analyses so far carried out show that some valuable information concerning lime and phosphate fertilizing is likely to be obtained

Efficiency of Ground Limestone from various Sources.

Unfortunately it has been impossible to devote much time to this project. The data, so far, show good correlation between efficiency and origin of the limestone—*e.g.*, foraminiferal, shelly, &c. With very fine grinding the differences between the various limes diminishes fairly considerably, emphasizing the desirability of very fine grinding.

Mangels.

An investigation of the dry matter and sugar content of several varieties of mangels was carried out on material supplied by the Agronomist. These samples showed that the dry matter and sugar of mangels under the conditions prevailing in this trial are considerably lower than the figures given by English investigators for the same varieties. This may be due largely to the difficulty of maturing mangels in this district.

Hydrocyanic Acid (HCN) in White Clover.

Determinations of the HCN content of a large number of samples of white clover were carried out in co-operation with the Agrostologist. Although an investigation which had been carried out previously for a complete season to investigate the variation (time of day and day to day variation) in the HCN content had shown that the variation was not great, an exception to this was noted during the past season. Samples collected one morning were found to be considerably higher than those collected during the afternoon of the same day or during the morning or afternoon of succeeding days. No explanation can be given of the reason for this, but the observation again emphasizes the necessity for an adequate number of controls, and the determination of the HCN in a casual sample of white clover might lead to serious error if any attempt were made to indicate type by HCN determination.

Palatability of Rye-grass.

Some work has been carried out on this problem, but while indicating a promising line of research the results are inconclusive.

Feed-Flavour Investigation.

The analysis of the herbage fed to cows in connection with the co-operative experiment carried out by the Dairy Research Institute and the Plant Research Station has been undertaken. Dry-matter determinations have been carried out and the chemical analysis is well under way.

Various.

Determinations of nitrate nitrogen in soil samples from experiments in connection with nitrogenous top-dressing of cereals were made at the request of the Director of the Fields Division. A number of soils were analysed for available potash, and salt determinations on a considerable number of samples were made for the Fields Division.

As usual a number of analyses of fertilizers, weed killers, &c., were made at the request of various officers.

DAIRY DIVISION.

REPORT OF W. M. SINGLETON, DIRECTOR.

The Season.

Owing to the exceedingly dry summer and autumn of the preceding season, which occasioned a shortage of supplementary crops for winter use, followed by a very cold and wet winter and late spring, dairy herds were generally in poor condition at the commencement of the season. In South Canterbury, Otago, and Southland the shortage of feed was particularly acute, and this resulted in a considerable mortality amongst dairy stock. From November onwards conditions materially improved, and the growth of pastures has been phenomenal throughout the summer and autumn. In most districts earlier hay crops were successfully harvested, but considerable quantities of the later cuttings were completely spoiled owing to erratic weather conditions.

Production.

Notwithstanding the lessened production of butter and cheese during the earlier part of the season due to the cold, late spring and consequent shortage of feed, the out-turn over the flush months owing to an abundance of succulent grasses was so phenomenally high that an increased production of butterfat over the preceding year has to be recorded.

For the year ended 31st March, 1936, 145,990 tons creamery butter and 86,250 tons cheese came forward for grading, as compared with 132,415 tons butter and 90,049 tons cheese for the previous year, an increase of 13,575 tons butter (10·25 per cent.) and a decrease of 7,799 tons cheese (8·29 per cent.). Reduced to a butterfat equivalent, there is an increase of 9,610 tons, equal to 6·61 per cent.

Creamery Butter.

Of the 145,990 tons creamery butter which came forward for grading, 100,006 tons of which were graded at the Auckland port, 111,489, or 76·36 per cent., were classed as finest, 32,644 tons, or 22·36 per cent., as first, and 1,857 tons, or 1·27 per cent., as under first. By arrangement, the disposal of all butter of a lower quality than first grade through a channel which prevents it coming into competition with the higher grade has been continued. Quality has been well maintained, the average grade for the year being 93·158, as compared with 93·141 for the previous year. A more extended daily delivery of cream-supplies, together with a considerable improvement to buildings and plant, both at dairy factories and dairy-farms, and the amalgamation of dairy interests by reducing the number of factories in certain areas, have been influencing factors in maintaining and improving the quality of our creamery butter. Complaints have again been fairly numerous regarding the condition, on arrival in Britain, of some of the lighter packages of butter-containers owing to the warping of the timber, allowing the access of sawdust and dust to the butter, and to their susceptibility to mould-development. As a means of safeguarding the position the further use of the peeled type of Saranac container was prohibited as from 1st February, 1936.

Whey Butter.

The quantity of whey butter graded totalled 1,412 tons, compared with 1,576 tons for the previous year, a decrease of 164 tons. Although the quality of this class of dairy-produce shows some improvement, considerable effort is still required towards a more efficient handling and treatment of the whey cream prior to churning, in order to ensure a quality more pleasing to purchasers. This class of butter is disposed of similarly to second-grade creamery.

Cheese.

The quantity of cheese forwarded for grading totalled 86,250 tons, 17,191, or 19·94 per cent., of which were graded as finest, 66,252 tons, or 76·81 per cent., as first, and 2,807 tons, or 3·25 per cent., as under first.

Many abnormalities in manufacture, chiefly the sudden and persistent failure of starters, were experienced by cheesemakers during the season, but no effort was spared in endeavouring to deal with these problems as they arose. Notwithstanding these difficulties, a fair percentage of good, close-bodied cheese was manufactured, although uniformity of quality has not been quite so high as for the previous year, the average grades being 91·979 and 92·035 respectively.

A number of complaints were received from Britain concerning cracked crowns and mould-penetration. Special care in handling the cheese in the curing and packing rooms is desirable in order to avoid damage to lips and rinds, and thus tend to minimize the danger of mould gaining access to the cheese. Considerable attention has been given during the year to improving temperatures under which cheese are held prior to despatch to grade stores, and a number of companies have erected new curing-rooms, using cork slabs as insulating material. In addition, as a means of improving quality, a regulation was gazetted on the 12th September, 1935, which prevented the waxing of cheese in curing or packing rooms. Cheese made from pasteurized milk during the year totalled 87 per cent. and 60 per cent. were wax coated.

Casein.

Casein graded during the year totalled 2,141 tons, as compared with 1,933 tons for the previous year, an increase of 208 tons. New Zealand casein is in keen demand on account of its uniformly high quality, and finds a ready market overseas. Grading is not compulsory, and as from February of this year the company shipping through New Plymouth ceased the grading of their output, and Auckland and Wanganui are at present the only ports at which the grading is carried out. In addition, a considerable quantity is shipped at Auckland ungraded. The total exports for the year amount to 3,404 tons, valued at £163,235.

Export Values.

Prices for dairy-produce, it is pleasing to state, have been on a higher level than for the previous year, although these have been offset by a lesser tonnage for exports totalling 1,741 tons butter and 15,610 tons cheese. Taking the Customs figures as a basis of export values, including butter, cheese, casein, dried milk, condensed milk and cream, and milk sugar, there is an increase of £2,503,558, the total values for the two years being £18,645,718 and £16,142,160 respectively.

Testing Butter for Moisture and Salt Content.

In order to safeguard the shipment of butter over the legal moisture content of 16 per cent., the practice of testing each churning forwarded for grading has been continued. By this means all over-moisture butter can be withheld from shipment and is returned to the respective dairy companies to be reconditioned. During the year 188,470 churnings were tested, 0·3 per cent. being over the legal limit.

Salt tests totalled 171,111. Of these, 0·1 per cent. were not in accord with the regulation range, and were withdrawn from shipment. By request a few shipments below the minimum legal limit, to fill special orders requiring a very light salting, have been permitted.

Grading of Cream.

A fairly close adherence to the standards set by the Division for the grading of cream has been maintained, and although complaints have been received that some companies were inclined to be easy in their standard of grading, and more especially with border-line cream, these on investigation were not substantiated. It is generally conceded that cream-grading, together with an increased daily delivery, has considerably decreased the quantity of lower-quality cream delivered to the factories.

Grading of Milk.

The grading of milk and payment according to grade has continued along satisfactory lines, the combined curd and reductase tests being in general use. Although it is optional to grade either daily or at least three times each ten-day testing-period, quite a number of companies have adopted daily grading, recognizing that this method is the most satisfactory in maintaining a more uniform milk-supply.

Farm Dairy Instruction.

Thirty-nine Farm Dairy Instructors—three more than for the previous year—have been carrying out this service during the year, and a striking result of the instruction given by these officers has been the improvement shown in the quality of the cream from suppliers, who previously delivered a poor-quality article. It is very evident, therefore, that there is an urgent need to make this service Dominion-wide in its application in order to ensure the delivery of a greatly improved milk and cream supply.

These thirty-nine officers are employed by eighty-nine dairy companies, whose suppliers number 36,092, of a total of 70,258 for the whole of the Dominion. There are therefore 34,166 suppliers who receive no direct instruction in the care and handling of their milk and cream supplies.

Inspection of Milking-machines.

As the installation of new and reconditioned milking-machines is governed by the regulations the necessary work of inspection is carried out by Farm Dairy Instructors in the districts where these officers are operating, and elsewhere by the Butter and Cheese Instructors and Check-testing Officers. Vending and erecting firms desire to co-operate with the Division, and it is a pleasing feature that very few erections are now found to contravene the regulations. Any minor alterations that may be required are readily made. During the year notification of 2,454 installations were received, as compared with 1,608 for the previous year.

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

During the year check tests numbering 440 were carried out by Divisional officers. A pleasing feature of the testing as carried out by the dairy companies is the very few variations found between the factory results and the check tests. It is now the exception for the Division to receive samples of milk or cream from suppliers for check-testing which is an indication that the factory testing is being carried out on approved lines and that suppliers generally are satisfied with the general accuracy of the factory tests.

Dairy-factory Managers Registration Board.

The Dairy-factory Managers Registration Board, which consists of eight members and which was set up to administer the Dairy-factory Managers Regulations, held four meetings during the year. In all, 596 applications for certificates were dealt with, of which 590 were granted certificates, 554 of these being renewals from the previous year and thirty-six new registrations. The balance of six were declined registration.

A further amendment to the regulations, known as Amendment No. 2, dealing mainly with qualifications necessary for applicants to be successful in being certificated as a Creamery and/or Cheese Factory Manager, was gazetted on 5th December, 1935.

Inspection of New Zealand Dairy-produce in Britain.

The examination of butter and cheese on its arrival in Britain has been carried out as in the past by Messrs. F. H. Taylor and G. V. Were, assisted during a portion of the year by Mr. C. C. Robertson, formerly Dairy-produce Grader in charge at New Plymouth. That these officers have had an extremely busy time is demonstrated by the exceptionally large number of quality reports received by the Division for distribution to the dairy companies concerned. The value of these reports as a means of keeping dairy companies in close touch with the quality and condition of the produce as it reaches the selling market is greatly appreciated by the producers.

Dairy Laboratory, Wallaceville.

The work carried out at the Division's Laboratory at Wallaceville has been continued under the direction of Dr. G. M. Moir, Dairy Chemist.

As in previous years, a feature of the work has been the examination of starters in use in cheese-factories throughout the Dominion. In many cases better equipment and more careful handling have enabled starters to be kept in better condition. In some factories, however, either the equipment or the personal element, or both, still leave a great deal to be desired. While the most recent researches suggest that contamination may not have quite as important a bearing as was formerly thought upon the sudden failure of good starters, a few simple precautions easily enable a man to keep his starter in the clean condition which is desirable. The presence or absence of foreign germs in the starter is therefore some indication of the general interest and care which a manager takes in maintaining his starter in the best possible condition.

A small number of starters from butter-factories have been examined, but in most cases these have not been in the best condition. If the practice of using a little starter to make the best butter is to be extended, butter-makers will need to learn to take more care of their starters, and to this end they should be provided with much better facilities for the purpose. A simple test has been successfully used to indicate the amount of the desirable butter-flavour substance (diacetyl) present in starters. One starter which gave a very good result by this test has been cultured and supplied at the request of the Division's Butter Instructor to a number of his factories, and very satisfactory reports have been received upon the butter made with it.

Since the beginning of the summer samples of butter for bacteriological testing have been regularly received from the Dairy-produce Grader at Auckland. Simple methods have been developed whereby some idea can be formed of the numbers and undesirable types of germs present. Lower-grade butters have predominated, and in an appreciable proportion of these the bacteriological quality has not been satisfactory. A number of samples of finest butter were similarly tested, and some of these were found to be of satisfactory bacterial content, while others were not so good. Further investigations are necessary to determine the importance of certain undesirable germs which might later affect the quality of finest butter. Although it is not to be expected that all butter defects are of bacterial origin, there is a sufficient amount of lower-grade butter manufactured to warrant larger numbers of these tests being made to investigate defects which may be due to excessive numbers or bad types of germs.

The testing of butter for alkalinity has been continued, chiefly in collaboration with the Auckland grading store, for the purpose of checking the neutralizing of the cream. In some factories insufficient care is given to this operation, while in others excessive amounts of neutralizer are used. The increasing tendency to use starter in butter made from the best cream may lead to the development of an acidity which, though not excessive, may border on that which is likely to affect the keeping-quality. Closer control of butter alkalinity and acidity seems, therefore, desirable.

As in the past years, a variety of other dairy-produce samples have been tested for various purposes. A considerable number of water-samples from factories have been examined, and recommendations made for improvement or treatment where necessary. Further work of this nature is especially desirable to ensure the purity of water used for butter-washing purposes.

Certificate-of-record Testing.

Statistics relating to C.O.R. testing for the calendar year 1935 indicate a marked falling-off in the number of first-class certificates issued, the figure for the year under review being 554, as compared with 639 in 1934, a decrease of 85. Of the 554 certificates issued in 1935, 450 were in the yearly-test division and the remaining 104 in the 305-day division, as against 536 and 103 respectively for the preceding season. Twenty-nine second-class certificates were also issued in 1935, as compared with 41 for 1934.

Third-class C.O.R. certificates issued during 1935 totalled 140, as against 212 for the preceding season, a decrease of 72. The third-class certificate is of fairly recent origin, having been in existence for the three last seasons.

The average butterfat-production for the 450 first-class yearly certificates issued in 1935 was 516·30 lb., as against 527·45 lb. for 1934, a decrease of 11·15 lb. butterfat per cow. The 104 first-class 305-day division certificates issued averaged 417·76 lb. butterfat, compared with 426·23 lb. for 1934, a decrease of 8·47 lb. butterfat per cow.

Government Official Herd-testing.

The number of cows tested under O.H.T. for the year ending 30th September, 1935, totalled 2,058, these being in the herds of 195 C.O.R. testing breeders, the corresponding figures for the preceding season being 2,185 cows and 184 breeders, a decrease of 127 cows, but an increase of eleven breeders. Classified on the basis of all cows in milk 180 days or more, the average yield for 1934-35 works out at 310·04 lb. butterfat from 6,348·2 lb. milk, some 1,876 cows qualifying for inclusion.

Ordinary Dairy-herd Testing.

The returns for 1934-35, on the basis of all cows tested twice or more, show a total of 256,944 cows tested in the Dominion, as compared with 297,647 for the preceding season, a decrease of 31,703 cows. Classified on the basis of all cows in milk one hundred days or over, the average production per cow was 252·01 lb. butterfat, 256,931 cows being eligible for inclusion. Of the last season's total, 247,150 cows were tested under the group system, 17,544 cows under the association own-sample system, and the balance of 1,250 by dairy companies on behalf of their suppliers.

Reorganization of Group Herd-recording.

On the 27th February, 1936, an Order in Council was gazetted bringing the future control of the group-herd-testing movement under the New Zealand Dairy Board, provision being made for the new organization to function as from the 1st April, 1936.

Prior to this new arrangement the only control of the work was that provided by the restricted powers of the Dominion Group Herd-testing Federation, essentially a voluntary organization and without statutory power.

Under the new arrangement the Dairy Board has power to regulate and control the group-herd-testing system and the calf-marking schemes associated therewith. It will be compulsory for all group organizations to register with the Board and to abide by rules laid down by the Board, and no organization will be permitted to operate without the sanction of the Board. It is also expected that the new control will include a certain amount of association own-sample testing.

The actual supervisory work will be done by a Committee of the Board. The Herd-testing Central Executive will be replaced by what is to be known as a Herd-recording Council. The Dominion Group Herd-testing Federation will cease to function except from the point of view of periodic meetings and the selection of representatives for appointment to the Herd-recording Council. Mr. C. M. Hume, previously Federation Supervisor of Herd-testing, is to be the officer in charge of the work.

So far as finance is concerned, the Government has agreed to make certain annual grants until 1941, at which time the matter is to come up for review in the expectation that the Dairy Board will therefrom provide the whole of the necessary finance.

Government Subsidy.

During the financial year 1935–36 the sum of £4,000 was expended by way of Government subsidy to herd-testing.

Unemployment Boards Scheme B 2: Subsidies on Dairy Buildings and Equipment.

In connection with the above scheme for the payment of a subsidy on building work, water-supply, and equipment of New Zealand manufacture carried out at manufacturing and supplying dairies which came into force in June, 1935, it was arranged, at the request of the Unemployment Board, that the Division should, through its field officers, approve and pass all work carried out under this scheme. The Butter and Cheese Instructors were therefore instructed to handle the position in so far as it related to manufacturing dairies, and with supplying dairies in districts where no Farm Dairy Instructors were operating and elsewhere the Farm Dairy Instructors dealt with supplying dairies.

Although the scheme came into operation in June, 1935, it was made retrospective to include all subsidizable building work and installations put in hand as from the 1st April, and has since embraced all similar work up to the 30th April, 1936, which had been recommended by the inspecting officers by that date.

In order to deal expeditiously with applications, divisional officers travelled, up to the end of March, 1936, approximately 152,000 miles, which necessarily considerably curtailed their ordinary routine duties, but it is considered that the many permanent improvements effected has fully justified the course taken.

Figures furnished by the Department of Labour, which subsequent to the commencement of the scheme absorbed the Unemployment Board, indicate that up to the first week in June, 1936, 8,556 applications were dealt with, of which 538 were declined, the estimated value of the building work amounting to £348,981, equipment to £328,044, and the amount distributed in subsidy to the Dairy industry £59,681.

No effort has been spared by the Labour Department in dealing successfully with the many problems which arose during the period under which the scheme has been in operation.

Staff.

Owing to the additional duties entailed through the operations of the subsidy scheme and to the increased volume of dairy-produce handled, the staff have had an exceptionally busy year, and I desire to thank one and all for their loyal and enthusiastic co-operation.

Thanks are also extended to co-operating organizations for their assistance during the year.

HORTICULTURE DIVISION.

REPORT OF J. A. CAMPBELL, DIRECTOR.

The Fruitgrowing Industry.

The climatic conditions prevailing generally throughout the Dominion during the 1935–36 fruit season were not at all favourable for the satisfactory carrying-out of orchard operations, particularly in regard to spraying, and fruitgrowers have experienced a somewhat trying time.

Conditions earlier in the season indicated that the crop would be above the average, some districts carrying heavy crops both of pip and stone fruits.

These encouraging prospects were, however, considerably upset by a gale of exceptional force, accompanied by heavy rain, which swept the North Island on the 2nd February and caused severe damage in a large number of commercial orchards, some growers losing from 50 per cent. to 60 per cent. of their crop, as well as having many fruit and shelter trees blown over. In a number of instances the tomato and other crops were ruined by flood-waters. Assistance to those growers who were in financial difficulties as the result of the storm was afforded by the Government by means of loans, and this is being taken advantage of by a considerable number of those affected. In a portion of the Motueka District extensive damage was caused to the apple crop by a hailstorm.

Russeting of apples, due to weather conditions, in combination with spray applications, was very prevalent, and considerably affected the quantity suitable for export.

The season was also favourable for the development of fungous diseases, such as black spot, &c., but, generally speaking, was not conducive to the spread of insect pests, and as a result red mite, codlin-moth, leaf-roller caterpillar, &c., were more readily kept under control.

Fireblight has not made any serious headway during the year; any outbreaks have been small, being chiefly confined to isolated trees in domestic orchards, which were promptly dealt with.

Although fruitgrowers, in common with other primary producers in the Dominion, have suffered from the effects of the world-wide depression, there are signs of an improvement in marketing conditions, and it is satisfactory to note that the majority of growers are showing an optimistic spirit. Their faith in the future of the industry is shown in the maintaining of their orchards in good condition and the installing of up-to-date methods of orchard cultivation, control of diseases, &c. Progress is specially noticeable in the installation of stationary spraying-plants which enable spraying-operations to be carried out at the proper time irrespective of the state of the soil. With portable outfits much valuable time is frequently lost when the land is in too wet a condition for haulage. The increased number of up-to-date fruit-grading machines in use is also a distinct sign of progress.

Citrus-fruit culture is making satisfactory headway, more especially in the northern districts, which are well adapted to the growing of this class of fruit. The total area now planted in citrus fruit is approximately 1,884 acres (lemons 1,300 acres and oranges 584 acres). During the year 72 acres of lemons and 50 acres of oranges were planted.

Good seasonable crops of lemons have been obtained, and while there is a noticeable improvement in the grades and keeping-qualities of the fruit offered for sale on the local markets, further efforts in this direction are still desirable. Careful and methodical attention to orchard-management generally and in the harvesting, handling, and curing of the fruit are factors of the utmost importance in connection with successful citrus-growing. Growers have shown a keen desire to improve their knowledge by attending in goodly numbers field-days and addresses which were arranged for their benefit.

Regulations covering the grading and packing of citrus fruit were brought into force in December last, and growers are gradually working towards the standards required.

The New Zealand grape-fruit (Poorman orange), Morrison's Seedless strain, is rapidly coming into favour as a breakfast fruit since the practice of allowing it to ripen upon the trees has been adopted, and further plantings are taking place to meet the demand.

The preliminary work in connection with the establishment of a citrus grading and packing shed on a co-operative basis at Keri Keri, North Auckland, is nearing completion, and it is anticipated a commencement will be made with building operations at an early date. This movement should prove of inestimable value to the industry, which is assuming considerable proportions in that district. Several investigations have been conducted into various matters in connection with the industry, and others are contemplated.

Passion-fruit culture, which a few seasons ago gave promise of being developed on a large scale in the North Auckland District, has not progressed to any extent during the past two years. While a considerable proportion of the fruit produced is disposed of on the local markets, it is understood that the company engaged in extracting and exporting juice is experiencing some difficulty in finding a market at a payable price for their product.

While there has been a slight extension in general orchard planting during the year, this has been largely offset by the cutting-out of certain areas that have become unprofitable. It is estimated that the total area in commercial orchards in the Dominion is in the vicinity of 27,000 acres, of which some 11,700 acres are situated in the North Island and 15,400 acres in the South Island.

Export of Fruit.

The long spell of hot, dry weather experienced during the 1935 growing season considerably affected the quantity of apples suitable for export purposes. The climatic conditions were also favourable to the development of insect pests, and in the Auckland District codlin-moth infection greatly reduced the export of the Delicious variety.

As a result of the abnormal conditions the quantity of fruit exported overseas during the 1935 season was the lowest since 1929, the total number of cases shipped being 1,063,420, which was a decrease of 511,492 cases as compared with the previous year's figures (a heavy export year).

Of the total exported, 703,770 cases apples and 94,159 cases pears were consigned to Great Britain, 80,164 cases apples to the Continent, 67,747 cases apples to North America, 42,579 cases apples to South America, 47,028 cases apples and 26,965 cases pears to Sweden, and 1,008 cases apples to the East.

In connection with the 1935 fruit exports, the Government guarantee applied only to fruit shipped to new markets, and in respect to the fruit shipped to established markets the Government agreed to contribute, irrespective of claims, to an export-guarantee fund to be established by the New Zealand Fruit-export Control Board on a pound-for-pound basis up to £12,500.

In 1936 and 1937, where a grower's average return is below the average rate determined by the Board, the Government will pay to the Board's central fund 50 per cent. of the shortages, provided the agreed-upon rate does not exceed 9s. New Zealand currency per case c.i.f. overseas destinations, and provided the fruit has been exported in accordance with Government export requirements.

The liability of the Government under this arrangement is not to exceed £12,500 for each year. Government assistance to the central fund will cease with the payment made for the year 1937.

Reports to hand indicate that the bulk of the 1935 fruit shipments arrived at its destination in good condition, with the exception of Cox's Orange Pippin, which showed a considerable percentage of bitter-pit. Prices realized for apples on the overseas markets right through the season were considered very satisfactory, this being largely due, no doubt, to the reduced exports. Pears were, however, disappointing, both in regard to condition and price, the keeping-quality being poor as compared with the 1934 shipments. This, combined with excessive quantities from Australia, had the effect of making a low price range. The following figures show the quantities of fruit (apples and pears) exported from the Dominion during the last five years: 1931, 1,349,895 cases; 1932, 1,596,058 cases; 1933, 1,430,513 cases; 1934, 1,574,912 cases; 1935, 1,063,420 cases.

Owing to the effects of the February storm and the inclement weather conditions encouraging the development of black-spot and russeting, it is anticipated there will be a considerable reduction in the quantity of fruit available for export during the 1936 season. The first of this season's (1936) fruit for overseas markets was despatched from Wellington per m.v. "Waiwera" on the 11th February, and consisted of twelve thousand cases of apples and forty-six cases of pears.

Local Markets for Fruit and Vegetables.

The local markets have been well supplied with fruit and vegetables, and the inspection of shops and auction-rooms in the main centres has been systematically and regularly maintained.

While the standard of marketing has been generally satisfactory, closer attention is necessary on the part of some growers to the quality and grading of the produce sent forward. The fair-packing regulations, especially in regard to vegetables, are being more strictly complied with, the number of infringements in this connection being comparatively few. Brown-rot was more in evidence and caused considerable losses in stone fruit.

The prices realized by growers did not show any marked improvement, but, generally speaking, the returns for the year's working were considered to be fairly satisfactory.

Imported Fruit, Plants, etc.

All reasonable precautions are taken to prevent the introduction of diseases and pests into the Dominion, and the inspection of imported fruit, plants, bulbs, &c., was carefully carried out by the Fruit Inspectors attached to the Division at the different ports of entry—viz., Auckland, Wellington, Lyttelton, Dunedin, and Bluff. They report that while some consignments arrived in a more or less "wastey" condition, the bulk of the fruit was clean and free from disease, and it was found necessary to take action in connection with only one or two lines found to be affected with mealy bug requiring fumigation before being allowed entry.

Imported nuts, especially almonds and walnuts, are subject to the attacks of the Indian meal-moth, and several lots found to be infected with the larvæ of this insect were dealt with in the usual manner.

There was a falling off in the quantity of fruit received from the Cook Islands, due mainly to the effects of the severe hurricane experienced there early in the season. The majority of the consignments arrived in good condition, though some shipments of oranges showed a fair percentage of wastage when opened up. Imports from the other Pacific Islands were in excess of those of the previous year. A considerable quantity of grass-seed, chiefly from Australia, requiring fumigation at this end, was dealt with.

Fruit Cold Storage.

A matter that has been receiving considerable attention for several seasons past is the cold storage of fruit, both on land and on overseas vessels, the successful carrying-out of which being of vital importance to the fruit industry. With the view of gaining first hand information regarding fruit shipments from New Zealand, Mr. R. Sutherland, Cool Storage Officer attached to the Division, proceeded to London in April last per m.v. "Rangitane" for the purpose of observing conditions and recording data relative to the cargo of apples on that boat; also to examine shipments on arrival in the United Kingdom, conditions of handling, storage, and transport to the markets, and to make contact with the various research organizations in England engaged in investigating fruit storage and transport problems. These matters were fully investigated, and valuable data have been supplied by Mr. Sutherland in his report.

The experimental work inaugurated some three or four seasons ago in conjunction with the Department of Scientific and Industrial Research for the purpose of determining the effect of a number of factors on the keeping-qualities of fruit during cold storage is now reaching finality, and some very useful information is now available in this regard. These investigations cover a wide field, and include the influence of locality and soil types on the keeping-qualities of apples, influence of maturity at time

of picking in respect to the incidence of bitter-pit in Cox's Orange Pippins, use of oiled wraps in relation to the control of superficial scald, influence of storage temperatures in the prevention of internal breakdown, control of grey mould on pears, and effect of orchard manurial treatments on the keeping-quality of apples.

An interesting feature in connection with the export trade is the number of new ships fitted with the most up-to-date methods of cold storage that are gradually replacing the old type vessels. As the outcome of increased shipping trade there have been changes in the methods of dunnaging fruit cargoes in the ships' holds, with the object of increasing cargo-space capacity and reducing costs. Experiments in this connection have been inaugurated by the Department for the purpose of ascertaining the influence of the different methods of dunnaging on the successful transport of fruit overseas.

Numerous requests for advice in regard to local cold-storage problems have been dealt with during the year, and a series of illustrated addresses given to fruitgrowers in commercial areas on matters connected therewith.

Instructional and Experimental Work.

In the carrying-out of orchard operations growers are continually being confronted with problems of a more or less complex nature, and in this connection the demands made on the Department for information and advice, both in regard to fruit-growing and horticulture generally, have been considerable. Every effort has been made to comply with these requests, both by correspondence and by personal visits by the Instructors as far as restricted travelling-expenses would allow. The giving of public lectures and practical demonstrations in pruning, spraying, &c., is a feature of the work of the Division, which is much appreciated by growers.

The interests of fruitgrowers have also been furthered by the conducting of classes in the grading and packing of fruit in the chief fruitgrowing centres, and the facilities given for obtaining the departmental certificate of competency in these subjects, and also in respect to orchard pruning and spraying, have been taken advantage of by a number of persons.

The programme of experiments on the manuring of fruit-trees has been maintained during the year. The trials at present being carried out number seventy-five. In the series of trials, with the exception of Hawke's Bay, nitrogen appears to be the most important element in fruit-tree manuring. Since, however, the complete manure plot is invariably the best in the majority of trials, it would appear that the elements phosphate and potash are also contributing to the improvements which have been obtained. This has been particularly noticeable during the past season, and it would appear, therefore, that the effects of phosphate and potash are slow to become apparent in contrast to nitrogen, which shows up fairly quickly in nitrogen-deficient soils. In Central Otago responses to nitrogen have been outstanding on stone-fruits. Carbonate of lime has given very little response, except in certain cases, such as in some North Auckland experiments, where the beneficial effect of lime upon the growth of the trees, and also upon the establishment of cover crops, has been noted. In Hawke's Bay during the five years the experiments have been in progress no responses whatever have been obtained from the treatments applied. The various experiments laid down two years ago in which the concentration of fertilizers about the trees in comparison with the broadcasting of the applications, and the experiments investigating the effects of injecting fertilizers in solution into the soil, have so far given no results.

The potash and sulphate of ammonia were donated by Pacific Potash, Ltd., and the Imperial Chemical Industries, Ltd., respectively, during the past season. These donations have materially assisted in the carrying-out of the programme of work which had been undertaken, and thanks are due to the donors of the fertilizers and also to co-operating orchardists for their continued interest.

The experimental plots of East Malling pip and stone fruit stocks established three years ago, and plots of seedling stocks planted out earlier in a number of the commercial fruit-growing districts, are now reaching a stage when some definite indication of their influence upon the development of the tree may be expected to manifest itself. Apple-trees worked upon the imported stocks and upon seedling stocks generally have made better growth than the trees upon Northern Spy stock. Peaches worked on East Malling plum stocks have so far shown no marked differences in growth. Cherry and plum stocks obtained from the same source were worked this season for the purpose of testing the stocks in the principal stone-fruit districts of the Dominion.

The experimental plots of hazelnuts (*Corylus maxima*) established three years ago in six districts have so far made poor growth, except in two instances in which the trees are reported to be making good progress.

Spraying experiments were conducted for the control of red scale of citrus trees and leaf-roller-caterpillar control on stone-fruits. Trials were also conducted with proprietary tree-banding materials for preventing earwigs gaining access to the fruit on stone-fruit trees, with satisfactory results.

At the Research Orchard, Nelson, spraying operations were greatly interfered with by wet weather, and as a result black-spot and Botrytis (eye-rot) considerably reduced the quantity of fruit available for export purposes.

A large amount of work of an experimental nature has been carried out at the orchard during the year in co-operation with the Department of Scientific and Industrial Research, including manuring, spraying, root-stock and variety tests, grafting, &c., and the data obtained from these investigations should prove of considerable value in the interests of fruitgrowing.

Viticulture and Wine-making.

Satisfactory progress continues to be made in the growing of grapes, both for wine-making and table purposes. The total area under outdoor-grown vines is now estimated at 433 acres.

Reports to hand indicate an increasing demand for New Zealand wines, and this is supported by the increased number of licensed wine-makers and the extensions that are taking place to established vineyards. Unfortunately, owing to unseasonable climatic conditions, the past season was one of the worst experienced by growers of outdoor grapes. In addition to the damage resulting from the February storm, considerable losses occurred from attacks of fungous disease, which were difficult to control on account of the unsettled weather. It is anticipated that the total quantity of wine produced from the season's crop will not exceed 100,000 gallons, a considerable decrease on the previous year's production of 148,000 gallons.

The growing of grapes under glass continues to attract attention, and the number of vineries is gradually increasing. There has been a good demand for hothouse-grown grapes at satisfactory prices to the grower.

Cider-making.

The manufacture of cider on a commercial basis has not made any considerable headway, although an increase has taken place in the quantity manufactured during the year, the total approximating 45,300 gallons, as compared with 36,500 gallons for the previous year.

Te Kauwhata Horticultural Station (Lower Waikato).

The usual farming operations have been carried out at the Station. Weather conditions were very favourable to the growth of grass right throughout the year, and this enabled a larger number of stock than usual to be pastured for fattening purposes. Sales of live-stock, wool, and skins amounted to £277. A further five acres of scrub and wattle have been cleared, half of which was sown in turnips and the balance prepared for laying down in grass. Approximately 5 acres of grass were harvested for hay.

While the climatic conditions favoured the growth of feed, the position in respect to the vineyard was not so fortunate. A cold, late spring retarded the vegetation of the vines considerably, and ripening of the fruit was delayed by inclement summer weather. The grape crop also suffered from the effects of the cylonic storm experienced early in February, and considerable damage was done to the leaves. Fungous diseases were unusually prevalent during the fruiting period, and downy mildew rendered many of the grapes unfit for wine-making purposes.

As a result of the unfavourable conditions it is estimated that the quantity of wine produced will not exceed 12,000 gallons, which is some 2,500 gallons less than the previous year's production.

During the year a total of 12,626 gallons of wine, which realized £6,303, was sold.

There has been an increasing demand from all parts of the Dominion for vines and cuttings raised at the Station, principally table varieties, some of the orders being for large quantities.

The financial position of the Station is satisfactory, receipts exceeding expenditure by some £1,700.

Tobacco-culture.

The production of tobacco-leaf is now assuming considerable proportions in the Dominion, and is affording remunerative employment to a large number of persons. The total area planted during the 1935–36 season was some 2,651 acres, the bulk of which (2,300 acres) being planted in the Motueka District. Of the balance, 180 acres were grown in the Auckland District, 166 acres in the Nelson District, and 5 acres at New Brighton, Christchurch. The total shows an increase of some 850 acres as compared with the previous year's figures. In the Motueka District the season's crop promised to be a record one. Unfortunately, a hailstorm occurred when the leaf was nearing harvesting and caused severe damage, some growers suffering heavy loss. Mosaic was prevalent in the young plants to a varying extent throughout the district, and to cope with it necessitated a good deal of replanting. The resultant crop is, however, reported to be of good quality and comparatively free from insect pests and fungoid disease.

For the purpose of ascertaining the possibilities of working up an export trade in tobacco leaf, an experimental shipment of approximately 80,000 lb. of Nelson-grown leaf was forwarded to London in October last, the reconditioning, grading, packing, &c., of which was carried out under the careful supervision of the Department's Tobacco Instructor (Mr. C. Lowe). The consignment arrived at its destination in good condition, and created a favourable impression, the price realized being considered to be a satisfactory one. As a result of this shipment inquiries have been received as to the prospects of future consignments being made from New Zealand. An endeavour is being made for a further experimental shipment of this season's best-quality leaf to be made during the present year (1936).

The Pongakawa Tobacco Settlement has been maintained at its full strength of forty settlers. One hundred and twenty acres were planted in tobacco, as against 40 acres in the previous year. Some damage was done to the crop by a gale early in February last, but the leaf, as a whole, is reported to be satisfactory.

During the year eleven air-curing barns were converted to kiln-curing and Dawn furnaces installed. Full use has been made of the experimental plot in the vicinity of Auckland for the raising of tobacco-seed, the crop being confined to new American seed of the Virginian type.

Hop-culture.

The bulk of the hop crop is grown in the Nelson and Motueka districts. The considerable improvement that has taken place in the marketing conditions, and the possibility of a larger export trade in the near future, have encouraged an extension in the area devoted to hop-growing, and several new gardens were established during the year. The season's crop was a satisfactory one, although the hops were somewhat lighter in weight compared with previous years. In a portion of the Motueka District damage was done to the young hops by hail, which caused them to turn brown, and thereby rendered them unfit for drying purposes.

A new method of drying hops was followed during the season, and the results are reported to be quite satisfactory, the process enabling larger quantities to be dealt with at one handling and at a saving in cost. The quantities, in hundredweights, and values of hops exported from the Dominion during the last five years ended 31st March are as follow; 1932, 640, £2,597; 1933, 3,192, £13,793; 1934, 3,872, £17,734; 1935, 3,627, £26,522; 1936, 3,436, £22,684;

Tung-oil Trees.

Further planting of tung-oil trees by private companies in the North Auckland District has taken place during the year, the total area now planted being between 3,500 acres and 4,000 acres. Some of the older trees have now reached the nut-bearing stage. The ultimate success of the plantings as a whole will be watched with interest during the next few years.

New Zealand Institute of Horticulture.

A considerable amount of valuable work has been carried out by the New Zealand Institute of Horticulture in the interests of horticulture and fruit-culture generally. Matters connected with nomenclature, improvement of economic plants by selection and hybridization, recording new varieties of plants produced in New Zealand, and the training of young men and women in all branches of horticulture, are some of the main phases of the work of the Institute.

Under the New Zealand Institute of Horticulture Act passed in 1927 the Institute has full legal authority to grant diplomas in horticulture to those qualified and passing examinations during the course of a special training. This very important phase of the work is being taken advantage of, and quite a number of persons have already gained the diploma in question.

The Loder Cup for the year 1935 was awarded to the Bruce Trust in perpetuation of the memory of the late Robert Cunningham Bruce, the founder of the trust, who left his residuary estate in the hands of trustees "for afforestation and making of National Parks and Domains in New Zealand." The cup in question was presented by Mr. Gerald W. Loder, now Lord Wakehurst, for the purpose of encouraging the protection and cultivation of the incomparable flora of the Dominion, and was first competed for in 1929.

The death occurred in September last of Mr. G. A. Green, Dominion Organizer of the Institute. The existence of the Institute was largely due to his foresight and energy, and horticulture generally has lost the services of a much valued servant.

Registration and Inspection of Nurseries.

A total of 644 nurseries was registered during the year, and the sum of £644 collected in registration fees.

Reports to hand indicate that the majority of the nurseries in the Dominion are kept in good condition, and the stock raised is well up to standard and clean and free from disease.

Nurserymen have in the past contributed very materially to the development of our fruit industry by introducing and raising new varieties of fruit, thereby improving the standard of production, and they are still contributing valuable service in this connection.

Orchard Registration and Orchard-tax.

Registered orchards in the Dominion now total 6,548, comprising 2,804 taxable and 3,744 non-taxable, the total amount of tax payable for the year being approximately £2,304, inclusive of penalty for late payment.

The work of collecting the tax is rendered somewhat difficult owing to the number of properties changing hands, to alterations in areas, and also to financial conditions. A portion of the tax collected, less cost of collection, is paid to the New Zealand Fruitgrowers' Federation, Ltd., for the purpose of furthering the interests of the fruitgrowers of the Dominion, and the balance to the Department of Scientific and Industrial Research to assist in the carrying-out of research work for the benefit of the fruitgrowing industry.

The collection of fireblight tax in two commercial fruitgrowing districts has also been attended to, the proceeds, less collection expenses, being handed over to the fireblight committees concerned for purposes associated with fireblight-control.

The Beekeeping Industry.

Beekeepers have been rather unfortunate in experiencing another disappointing season. The long spell of dry weather during the 1934–35 season resulted in light crops, and this year extremely wet and unsettled conditions were against the harvesting of honey, and in the majority of the commercial beekeeping districts the crop was again considerably below the average. The exceptional storm which occurred early in February last caused considerable damage to a number of apiaries in various parts of the North Island, and the beekeepers concerned suffered a severe set back.

The marketing of honey, both locally and overseas, is a matter that has been the subject of a good deal of controversy for some time past. With a view to endeavouring to bring about an improvement in the general conditions obtaining the Executive Commission of Agriculture was recently authorized to investigate the position. The Commission's recommendations will no doubt receive the full consideration of the Government.

Notwithstanding the unsettled state of the market, it is interesting to note that beekeeping still continues to attract persons with moderate capital who are desirous of making a living by honey-production, and there is a considerable demand for suitable apiary-sites. Faith in the future of the industry is also evidenced by numerous extensions to existing apiaries during the year.

Close attention has been given to the inspection of apiaries for disease as far as restricted travelling-allowances would permit, and, while it has been found necessary to take action for the control of foul-brood in some of the smaller neglected apiaries, the condition of hives generally is satisfactory. The assistance rendered by a number of experienced beekeepers in the capacity of honorary apiary inspectors in some of the main commercial districts has again been of considerable help in connection with inspection work.

In addition to affording advice by correspondence on the various phases of beekeeping, advantage is taken by the Apiary Instructors during the winter months to give practical demonstrations and lectures in their respective districts. These are a valuable aid, especially to beginners, and as a rule such meetings are well attended.

There was a considerable increase this year in the quantity of honey graded for export at the different grading stores, a total of 9,097 cases being dealt with, as against 4,790 cases in the previous year. This increase was mainly due to the unsatisfactory state of the local market, producers preferring to ship their surplus overseas.

The grading was carried out under the standards fixed two seasons ago by the New Zealand Honey Control Board in conformity with its powers under the Honey-export Control Act, 1924. The new system is now working smoothly, and the elimination of low grades of honey formerly sent forward for export should go a long way in maintaining the high position New Zealand honey holds on the English market.

The following shows the quantities, in hundredweights, and values of honey exported from the Dominion during the five years ended 31st March, 1936—1932, 4,749, £17,606; 1933, 2,005, £7,014; 1934, 7,342, £23,784; 1935, 5,427, £17,844; 1936, 10,446, £34,258.

Apiary Registration.

Apiary registrations were fairly numerous during the year, and a number of cancellations, changes in ownership, &c., were attended to. Approximately eight thousand five hundred apiaries are now registered, representing a total of some 135,000 colonies of bees.

Staff.

With the many and varied activities coming within the scope of the Division, together with the increasing calls for advice and information covering a wide field of operations, the past year has been a particularly busy one. Thanks are due to all officers of the Division for their loyal assistance and co-operation.

In September last Mr. W. T. Goodwin, Assistant Director of the Division, was appointed to the position of Director of Agriculture, Rarotonga, for a period of three years under the Cook Islands Department. During his absence Mr. W. K. Dallas, Orchard Instructor, Plant Research Station, Palmerston North, is acting as Assistant Director.

It is with deep regret that I have to record the death during the year of Mr. S. C. E. Rhodes, Apiary Instructor, Dunedin. During his service in the Department Mr. Rhodes proved himself a most efficient and conscientious officer, and his death at a comparatively early age is much to be deplored.

CHEMISTRY SECTION.

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

Deficiency Diseases of Live-stock.

Bush Sickness.—Investigations in connection with bush sickness of ruminants have now become almost entirely academic in character. From a practical point of view the trouble may be said to be non-existent, or at least entirely preventable with the application of only slight modifications in ordinary sound farming practice. Whatever theoretical developments may take place, it is doubtful whether any remedial measure giving, in the hands of the farmer, safer, cheaper, or more certain results than the approved type of Ruatangata limonite (Reyburn's) used as a lick in equal parts with common salt, could be devised.

It must be remembered that other metal-salts besides those of iron—*e.g.*, arsenic—are capable of curing bush sickness in the individual ruminant, but there is no proof that any element known to be essential for nutrition except iron will prevent bush sickness in a series of generations as iron compounds do.

There exist large areas of border-line country where outbreaks of the sickness occur only in certain seasons (especially wet ones) or are confined to a percentage of young stock, where undoubtedly there exists great scope for extension in the use of limonite.

The amount of Reyburn's Ruatangata limonite distributed during the year for stock-lick purposes, 175 tons, shows an increase of about 15 tons over the previous year. In addition, considerable quantities of limonite from the Okaihau Quarries have been sold. No serious complaints about the quality or effectiveness of the limonite sold have been received. Samples of Reyburn's limonite submitted for analysis have shown little variation in composition or solubility. Although definitely good results were obtained with Okaihau limonite in field trials, there have been cases where farmers using limonite from that source have not been entirely satisfied, and have reported further improvement on changing to Ruatangata limonite. Some early consignments of Okaihau limonite showed marked variations in the solubility of the contained iron. In any case in which a farmer considers that his stock are not showing the maximum response to limonite treatment he should forward a sample of the limonite to the laboratory for analysis.

An interesting deposit of soft, high-grade limonite at Maketu, Bay of Plenty, was reported on and sampled for analysis. It was found to be sufficiently extensive to warrant quarrying for lick purposes. Analysis showed the material to have the very high solubility figure of 12·5 per cent. ferric oxide in the special sugar hydrochloric acid reagent, compared with 2·4 per cent. in the good Ruatangata limonite. Field-feeding trials with this limonite are fully warranted.

It is somewhat curious that in the Bay of Plenty District some farmers still continue to use large quantities of iron ammonium citrate in addition to the now almost universal use of limonite. Probably this is due, first, to the use of iron ammonium citrate having become so firmly established in this district prior to the introduction of limonite, and, secondly, to the initial supplies of limonite tried out in the Bay of Plenty being of the type later found to be ineffective. As departmental supplies are now becoming low it would be as well for farmers still desirous of continuing the use of iron ammonium citrate to make their own arrangements for its importation.

In view of the importance now being attached to trace elements in animal health and nutrition a number of limonite samples were examined for their content of zinc and cobalt soluble in decinormal hydrochloric acid. The following results were obtained:—

	Zinc. Parts per Million.	Cobalt. Parts per Million.
Ruatangata (highly effective)	.. 3·0 to 3·3	5·9
Okaihau (good but variable in effect) ..	.. 0·0 to 2·8	1·0 to 3·4
Puhipuhi (ineffective)	.. 0·0 to 1·7	0·1 to 1·8

Samples of iron and ammonium citrate were found to vary in zinc content from nil to 50 parts per million and in cobalt from 6·8 to 8·6 parts per million. At the recognized daily dosage this would provide less than 0·015 mg. cobalt per sheep.

Analyses were made of various soils, pasture samples, and animal specimens from bush-sick and healthy areas for zinc and cobalt soluble in decinormal hydrochloric acid.

Soils.—The following table indicates the data relative to soils:—

Cobalt in Soils (N10 HCl Extracts).

(Values are given as p.p.m. cobalt on dry weights of soil.)

Bush Sick.			Non Bush Sick.		
Locality.	Lab. No.	p.p.m. Co.	Locality.	Lab. No.	p.p.m. Co.
Mamaku	W 932	0·10	Forest Lake – Frankton Jn.	D 18	0·33
Tokoroa	W 964	0·10	Invercargill	D 699	0·94
Kopaki	A 186	0·23	Miramar	E 382	0·56
Kaharoa	H 509 A	0·05	Waihou (Horahia) ..	E 655	0·93
Atiamuri	H 509 C	0·16	Hamarana	H 509 E	0·61
	Average 0·13			Average 0·67	

Students of these figures must be reminded that bush-sick soils are well-leached soils and likely to be deficient in many elements which have no significance in nutrition compared with soils on country derived from the parent rock containing a superabundance of unessential elements. The great American authority C. A. Elvehjem, in "Trace Elements in Hemoglobin Building," quotes with evident approval the following on the subject of cobalt with relation to the blood:—

> "Fischer and Scott (Biochem, J., 19, 1055, 1935) have recently reported the non-presence of cobalt in the pancreas of cattle of any age. They place cobalt in the realm of pharmacology and toxicology rather than nutrition; however, an understanding of the mechanism by which cobalt produces polycythemia may be helpful in furthering our knowledge of hemoglobin formation."

Pasture Samples.—Cocksfoot-grass from Kaharoa (bush-sick area) was found to contain 38 p.p.m. of zinc, while a sample of cocksfoot-grass from Northland, Wellington, contained 32 p.p.m.

Cobalt could not be detected in several samples of pasture examined from both sick and healthy areas. It would therefore appear that cobalt is not taken up from the soil by pasture in appreciable amounts and that the good results in preventing bush sickness which are obtained by top-dressing pasture with ferrous sulphate are probably due to increased absorption of iron from the soil by the pasture which might present it in a condition peculiarly suitable for assimilation by the ruminant.

Animal Specimens.—No cobalt was found in the pancreas of a healthy bullock. Traces were found in the testes of healthy rams and bulls (less than 0·2 p.p.m. dry weight). The livers of bush-sick sheep showed faint traces of cobalt (about 0·06 p.p.m.), compared with the value of 0·20 p.p.m. in a healthy sheep. Less than 0·06 p.p.m. was found in the brain of a healthy sheep.

The zinc content of testes of healthy sheep from bush-sick areas ranged from nil to 43·9 p.p.m. of dry tissue, compared with 64.0 to 80.8 p.p.m. for sheep from healthy areas.

A liver of a sick sheep from the bush-sick area contained 140·8 p.p.m. zinc in dry tissue, compared with 254·6 p.p.m. in the liver of a Wellington (healthy) sheep.

Ionizable Iron.—The available or ionizable iron in bush-sick and healthy pastures and root crops is being estimated by the dipyridyl method. Eleven parts per million dry weight were found in cocksfoot-grass from Kaharoa (sick) and 7 p.p.m. to 11 p.p.m. in cocksfoot-grass from Wellington.

Ionizable or soluble inorganic iron is now recognized to be the form in which iron is assimilated by the animal. Organically combined iron is much less readily or not assimilated. Part of the total iron content of most vegetable and animal tissues exists in each condition.

Total Iron.—A liver from a bush-sick sheep contained 151·8 p.p.m. iron in dry tissue, as compared with 234·1 p.p.m. in a Wellington (healthy) liver. In this case, therefore, there was no evidence of storage of excess of iron in the liver due to non-utilization, as is stated to be the case in enzootic marasmus.

Vanadium.—Vanadium was specially sought for in the acid extracts of limonite with negative results. Methods for the estimation of cobalt and zinc in minute amounts have been investigated. It was found that the most suitable reagent for the micro-estimation of cobalt was nitroso R-salt. A standard procedure involving separation of iron, and avoidance of strong oxidizing and reducing agents in the final test solution was evolved whereby estimations down to 0·001 mg. cobalt could be carried out. After trials of other methods, the oxalate-ferrocyanide turbidity method of P. L. Hibbard for the determination of zinc was adopted.

Blood Analyses and Field Experiments.—The field-work in connection with these investigations designed in this laboratory was all carried out by Mr. C. R. Taylor.

Blood-samples numbering 396 have been obtained from Atiamuri and Kaharoa, with a few from Mamaku and Morton Mains. An investigation was commenced at Kaharoa in February and completed in November. Seven sheep were fed as follows: No. 1, Australian limonite; No. 2, specially purified iron and ammonium citrate; No. 3, Reyburn's limonite; No. 4, Kenya iron oxide; No. 5, Lux (a residual iron oxide left after extraction of alumina from bauxite by alkali); Nos. 6 and 7, copper sulphate. The sheep had been on bush-sick country for some time and were low in condition, probably on account of incipient bush sickness. All the sheep were grazing on a pasture that had been heavily top-dressed over a number of years with superphosphate, basic slag, and other manures. This paddock was regarded as less bush-sick than others on the farm, but was handy for attending to the drenching of the animals. Blood-samples were taken once a fortnight, these being analysed for total solids, total iron, non-hæmoglobin iron and copper. The variations for total iron and total solids of each sheep are similar, showing a definite relationship. These values also increased as the health of the sheep improved. The non-hæmoglobin iron was a small fraction of the total iron and seemed to have no significant connection with the health of the animal. The values for total solids varied from 12 gm. to 22 gm. per 100 cc., for total iron from 20 mg. to 48 mg. per 100 c.c. The total iron on normal healthy blood gave an average value of 49·4 mg. per 100 c.c.

The copper content of the blood of sick sheep in the Rotorua District was 0·093 mg. to 0·16 mg. per 100 c.c., which is lower than Tompsett's value for healthy sheep (0·161 mg. to 0·183 mg. per 100 c.c.), but since the figures for healthy sheep in this district vary from 0·083 mg. to 0·160 mg. the copper figures have no clinical value. The sheep fed on copper sulphate gave an average value of 0·148, but they went back in condition. (It is interesting to note that the copper value from Morton Mains samples is very high: healthy sheep 0·165 mg. to 0·230 mg., and sick sheep 0·215 mg. to 0·217 mg. per 100 c.c.) The sheep fed on copper sulphate were changed to cobalt chloride. One died almost immediately, but the other was making good progress.

No. 3 on Reyburn's limonite completely recovered in three months. The total solids of the blood were 20·1 gm. per 100 c.c. and the total iron 48 mg. per 100 c.c. Those fed on Australian limonite, specially purified citrate, Kenya iron oxide, and Lux all improved slowly until they had lambs, and then they went back a little in condition. The total solids of the blood rose from an average of 15 gm. to 19 gm. per 100 c.c., and the total iron from 25 mg. to 35 mg. per 100 c.c.

In February, 1935, five sick and one healthy sheep were also obtained in the Atiamuri District. They were given limonite iron-free extract, Reyburn's limonite, Kenya iron oxide, Lux, and zinc acetate. The healthy one was kept as a control. These were continued until January, 1936. The animal being fed Kenya iron oxide died, and the one on limonite extract made little progress. The two fed on Reyburn's limonite and zinc acetate, respectively, made good progress. The sheep on Lux went back in condition, was changed to cobalt chloride, and then made good progress.

In January more sheep were obtained, and three were given Reyburn's limonite, three cobalt chloride, three zinc acetate, two purified iron ammonium citrate, and one limonite iron-free extract. One sheep on Reyburn's limonite suffered from foot-rot and is just recovering. Two others, one on zinc and one on purified iron ammonium citrate, were lost while shearing.

The available figures show that those on Reyburn's limonite made satisfactory progress. Of those on zinc, two made slow progress and one went back in condition. The purified iron ammonium citrate was of no use at all, but the sheep on limonite extract has made some progress, while the sheep receiving cobalt all made significant advance.

An explanation of the non-success with purified citrate of ammonium and iron is that iron salts may require traces of impurity to effect assimilation of iron by the animal analogous with the change induced by contact (catalysis) with traces of a third compound in two chemical salts. Hence the improved condition of sheep when fed zinc, cobalt, arsenic, and possibly other metallic salts, may be owing to the influence of an element inducing the further assimilation of iron from the natural food or from medicinal iron administered.

To summarize the position to-day it would seem that the wisest course for farmers to follow will be to continue to use as a stock lick approved limonite. This has been proved quite successful and cheap in the treatment not only of bush sickness, but also of other similar but complicated troubles such as Morton Mains disease in Southland and coast disease of South Australia. The utmost caution should be exercised in experimenting with such a potent element as cobalt, which has not yet cured deficiency diseases in a succession of generations of sheep, nor has it yet been proved to be an essential element in animal nutrition. For the present cobalt stands in the same category as arsenic and other poisonous stimulants which may cure bush sickness in the individual but not in the race.

Pampas-grass (Cortaderia Selloana).

Chemical Investigations.—Analyses by a variety of methods of the cellulose, hemicellulose, and lignin components of the pampas-grass have been carried out and the results published in an article on "The Composition of Pampas-grass" in the *New Zealand Journal of Science and Technology*, Vol. XVII, No. 3, pp. 528–30, 1935. It was shown that pampas has a high content of cellulose and hemicellulose combined with a comparatively low content of lignin, and it was considered that this would favour ready digestibility by the ruminant. Later work showed that the succulent leaf-bases which are greatly relished by cattle contained only 14·1 per cent. of lignin in the dry matter, compared with 20·1 per cent. to 21·5 per cent. in the dry matter of the green leaf-blades.

Analysis of material cut from a row of pampas-grass, transplanted as seedlings from Whangarei Harbour shows that the composition of this seedling material is very similar to that from the root-cuttings (offsets) originally experimented with in the Hauraki Plains.

Cut.	Total Hemicellulose.	Pectic Substances.	Lignan.	Cellulose (C. and B.).	Reducing Sugars.			Ash.	Phosphoric Acid.	Calcium Oxide.
					Before Hydrolysis.	After Hydrolysis.	Protein.			
24th December, 1935 ..	24·2	0·53	20·5	45·5	0·82	1·01	8·58	6·88	0·34	0·31
12th March, 1936	27·2	0·56	20·6	39·6	2·17	5·06	11·52	8·75	0·32	0·31

Confirmatory evidence of the value of pampas-grass as stock-food when grown in other soils and locations than those of the Hauraki Plains is now available.

In contrast with the poor strike of offsets (root-cuttings) obtained in many localities, particularly in dry weather, the small seedling plants sent out from Whangarei have in all cases so far reported grown with great freedom.

Seed obtained from Whangarei and also from England has germinated well. The seed germinates best if only the thinnest covering of fine sandy soil be sifted over it, or even when merely laid on the surface of damp, sandy soil in a box with a glass cover in a warm shady place.

A character of pampas-grass in which it differs from most other fodder crops is the ability to stand a high percentage of salt in the soil and the ease with which it colonizes reclaimed estuarial flats. As the reclamation of the many thousand acres of rich estuarial mud-flats at present of no value must form a part of any progressive land policy, pampas-grass for grazing and for planting on salty areas and for consolidating stop-banks will be most useful.

Iodine Investigation.

The analysis of a great many glands already in hand has been proceeded with. A paper on the iodine survey of the Canterbury District is in the press.

It may be stated in general terms that in the North Island no extensive areas have below the critical level of iodine, but some of the recent alluvial or river-bed soils, particularly in Wellington Province, are inclined to be low. Unless evidence of iodine-deficiency disease, such as enlarged thyroids, hairlessness in lambs, &c., occurs, however, the use of iodized licks is not warranted as extra iodine is of no advantage to the animal and may be harmful.

In the South Island, parts of Southland and Otago and the West Coast have a low content of iodine in soils, pastures, and thyroid glands of sheep. Many enlarged glands come from these areas, and the use of iodized licks is indicated.

Soils.

A series of soil-samples collected from the area of blown sands at Ruakaka on the southern side of the entrance to Whangarei Harbour proved to be coarse sands to sandy silts and sandy loams. In some instances the soils were calcareous with fragments of sea-shells. A condition in the cattle resembling bush sickness was found to respond readily to treatment with a limonite lick.

Samples of soil collected from the various plant associations of the mud-flats at Kawhia and Aotea, Opua and Waitemata Harbours, prove on analysis to be of suitable texture for reclamation—namely, sandy loams, silt loams, clay loams, &c.—none being either excessively heavy or light.

In most cases the usual high to moderate amounts of plant nutrients, especially available phosphoric acid, potash, and lime, associated with such mud-flat soils on the coasts of New Zealand, are present in these samples.

At the request of the Public Works Department analyses were undertaken of the soils of reclaimed land at Otaika, Whangarei, which it was proposed to use as an aerodrome. The mechanical analyses showed these soils to be fine sandy loams with one exception, a clay loam. They were therefore expected to drain and grass readily. All the samples contained excess of salt, but it was anticipated that with the shutting out of sea-water no difficulty would be experienced in gradually ridding the land of harmful concentration of salt, as has been the case in the Napier reclamations.

A special survey of a portion of the Kaipara Harbour was made in connection with reclamation plans at the request of the Public Works Department. The mechanical analyses show that the soils as a whole are lighter in texture than those taken from the areas nearer Helensville and reported on in 1933. In the latter case they were usually found to be clays, whereas the present series vary from a silt loam to a silt clay, with the exception of one sample, which is a clay.

The texture is an important point in the reclamation of estuarial muds, as the heavier the soil the greater is the care which must be exercised in cultivating, owing to the danger of puddling salty, heavy soils. The salt content of the areas at present growing salt weed or mangrove is high, but this salt would in time be reduced by leaching and by chemical change on permanently shutting off the supply of sea-water. The plant-food content of these soils is high, the available phosphate being abnormally so (up to 0·064 per cent.). In the case of the soils above the level of the normal tides and now supporting a vegetation of manuka and other shrubs and herbs the mineral plant food is much reduced (available phosphoric acid 0·006 per cent.), although the nitrogen is higher than that of the mud-flats which are submerged at high tides. The Kaipara mud-flats warrant intensive investigation in view of the enormous area available for reclamation and the indications of great richness in plant food.

A further series of samples were collected from the Napier Harbour lands in process of reclamation, particularly from the north end, to ascertain the changes that have taken place in soluble salts and plant nutrients during the past two or three years. Some fluctuations, but no very significant changes, were found, this area not yet being affected much by the drainage operations. A similar study is now being made of the recently drained southern portion. All the work has confirmed the previous favourable opinion as to the future of these soils when drained and brought into cultivation.

Soil samples from the Tiniroto District on which stock ailment occurred proved to be sandy silts similar to the Rotorua bush-sick soils. The use of limonite lick was recommended.

Soils were also analysed in connection with the weed-killing trials with various chemicals as it is recognized that weedicidal action varies with soil texture and seasonal variations in climate.

As a result of investigation and analysis of certain areas of ironstone lands near Okaihau, North Auckland, having a high percentage of iron, alumina, and titanium oxides (see 1934 annual report), it was recommended that liming be tried in addition to the previously unsuccessful phosphate-manuring. Reports to hand show that liming has proved very successful in encouraging the growth of pasture.

Liming-materials.

Several samples described as "burnt lime" on analysis proved to contain either no quick-lime or only traces. Evidently some manufacturers fail to recognize that limestone merely heated (presumably to facilitate grinding) is not thereby necessarily converted into "burnt lime." Numerous samples of limestone and of commercial ground limestones have been examined. In some cases the carbonate of lime content fell considerably short of the claims made by the vendors, and steps were taken to secure better agreement.

Toxicological Cases.

The most interesting investigation during the year concerns the possibility of fairly widespread unthriftiness and mortality in pigs kept in conjunction with dairy-farms, being due to chronic zinc poisoning resulting from skim-milk, conveyed to the piggeries by galvanized iron pipes, dissolving quantities of zinc from the inner lining of the pipes. During recent years there has been a great increase in this method of feeding out the milk, which is often conveyed considerable distances by pipes, 16 chains and over being not infrequent.

In the first case two piggeries had been run in connection with two dairies on the same farm for two years without any trouble among the pigs. These piggeries were situated alongside their respective dairies with only very short lengths of piping to convey the milk. Early in 1935 a new pipe-line 16 chains long was connected with one dairy and the pigs moved out on to clean ground at this distance. Numerous deaths occurred among the young pigs shortly afterwards. During the ensuing winter molasses and water (pumped through the same pipes) were fed to the pigs, very little milk being available, and the remaining pigs did quite well. When milk again became plentiful in the spring and was pumped in quantity through the pipes about forty to fifty pigs died. The symptoms noted were: pigs went off their feed, got up on toes with stilted gait, showed swelling of joints and lameness, became unthrifty, half-grown pigs failed to grow, young pigs died, while sows (suckling young) were mostly unaffected. During this period the pigs at the other shed (short pipe-line) were unaffected. No evidence of ordinary infectious disease could be found. Analysis of organs of a young pig that had died indicated that the zinc in the liver was more than ten times the amount normally present. Bones from this pig were found to contain 0·074 per cent. of zinc in the ash. Subsequent samples confirmed these findings, and on obtaining sections of the pipe-line before and after use it was found that the galvanizing (zinc lining) of the inner surface had been entirely removed, being replaced with a thick layer of curdy or cheesy material.

In view of the great extension in this method of feeding pigs and the apparent increase in obscure mortality and unthriftiness in pigs the matter warrants close investigation. In the meantime caution is advised in installing long pipe-lines to piggeries, particularly when galvanized pipes are used.

Several cases have occurred of cattle dying after grazing on paddocks recently sprayed with proprietary weed-killers to destroy weeds such as ragwort and blackberry. In each case it was ascertained that the weed-killer contained arsenic, and arsenic in quantity was found in the ingesta and organs of the dead animals. Farmers should be warned of the danger to stock in using arsenical weed-killers, and all stock should be kept off paddocks where weeds have been so sprayed for a minimum of several weeks to allow the dead vegetation to decay and until after plentiful rain has fallen to wash the arsenic into the soil.

In a case of pig-mortality following the feeding of roots cooked in a drum which had previously been in use for the same purpose, arsenic was found in the ingesta of the pigs and in the contents of the drum, but no evidence could be obtained as to the source of the arsenic.

Mortality in cattle which had drunk rain-water from a drum left standing after an arsenical dip had been mixed in and emptied from it, was found to be due to arsenic dissolved in the water. Dogs, lapping only the presumably unmixed surface water, were not affected. The dogs may also have vomited.

Several cases of pig-mortality following the feeding of mangels have been investigated. No inorganic poisons could be detected. In one case the stomach contents contained nitrate-nitrogen equivalent to 0·045 per cent. potassium nitrate, the boiled root-mash 0·017 per cent., and the mangel juice 0·41 per cent.

In another case the stomach contents contained the equivalent of 0·115 per cent. potassium nitrate and the mangel juice (95 per cent. of the root) 0·72 per cent.

A previous mortality occurring in cattle under similar circumstances is referred to in the *Journal of Agriculture* for October, 1911. In this case some nitrite (a more poisonous substance) was also found in the mangels, but it is possible that nitrates may be reduced to nitrites in the intestines.

Additional cases of bracken-fern poisoning continue to be reported from time to time. One farmer near Wanganui states that he annually loses a number of young and old cattle in attempting to crush out fern, despite frequent changes of the animals to clean pasture. Symptoms include emaciation, difficulty in breathing, and bleeding from the intestines.

A plant submitted by the Inspector of Stock, Whangarei, as suspected of causing periodical mortality in stock grazing along drains and other waterways in the North Auckland Peninsula, was identified as *Polygonum hydropiper*, or water-pepper.

A case was reported of a young draught horse dying after eating roots of the scarlet-runner bean that had been thrown on a rubbish heap. The scarlet runner (*Phaseolus multiflora*) is a close relative of the Java bean (*P. lunatus*), well known to be at times intensely poisonous to horses and cattle. Some authorities state that the roots of the scarlet runner are narcotic and poisonous, so that it is advisable not to allow cattle or horses access to them.

Mortality in honey bees following spraying operations in orchards nearby was considered possibly due to arsenic. Dead bees picked up near the hives contained 0·6 mg. of arsenic per 100 gm. bees, and bees dying after some time 0·13 mg. per 100 gm. bees. Bees analysed in a previous case with a result which was considered negative contained only 0·05 mg. arsenic per 100 gm. bees.

Miscellaneous.

Coal-ashes from the Dobson Mine, which were reported to have given good results when used as a top-dressing, contained calcium equal to a total of 47 per cent. calcium oxide, 30 per cent. of this being present as oxide, hydroxide, and carbonate, and the remainder as sulphate and silicate. There was also 11 per cent. of magnesia. Coal-ashes of this nature should be quite useful for soil-amendment purposes, but should be stored in the weather for a little while to allow small quantities of sulphides present to be oxidized.

Samples of ash of the wood of the New Zealand mangrove (*Avicennia officinalis*), a tree growing in the shallow salt water of the northern mud-flats, were analysed as the wood was being used for burning lime. The ash was found to have an unusual composition, being very rich in phosphate. The

composition was as follows: Tricalcic phosphate, 18·6 per cent.; sodium chloride, 10·4 per cent.; potassium carbonate, 13·1 per cent.; sodium carbonate, 23·3 per cent.; magnesium sulphate, 6·0 per cent.; magnesium carbonate, 2·9 per cent.; calcium oxide, 9·1 per cent.; combined water and soluble silica, 7·0 per cent.; insoluble matter, 8·8 per cent.; moisture, 0·8 per cent.

A commercial pig-meal on which it was stated the pigs were not thriving was found to contain much hard spicular and chaffy material, apparently barley husks and awns, and a large percentage of cocoa-husks. Such material should not form any great portion of the ration for pigs, especially as cocoa-meal contains the alkaloid theobromine.

Water which came from a bore and which was considered to be the cause of the consistent degrading of the cream was found to contain small amounts of sulphuretted hydrogen.

The analyses were completed for the Plant Research Station of a number of pasture samples already on hand.

At the request of the Imperial Bureau of Animal Nutrition the methods of analysis adopted by the Rowett Research Institute were critically considered in relation to methods used in this laboratory. Some alternative methods were recommended on the basis of comparative tests and additional methods for some of the trace elements outlined for consideration.

Work on Active Principles of New Zealand Plants.

The poisonous tutu plant (Coriaria species), from which the active principle tutin was first obtained in this laboratory in the year 1900, may come into prominence in the field of pharmacological science owing to the fact that it has been discovered that poisoning by barbituric acid, better known when compounded as the medicine "veronal," may be cured by coriamyrtin, the active principle of the European *Coriaria myrtifolia*. This effect is reversible, and coriamyrtin poisoning may be cured by barbituric acid. As coriamyrtin is closely allied to tutin it is likely that barbituric acid may be an antidote for poisoning by the tutu plant; similarly, tutin may be an antidote for barbituric acid poisoning. (See Swanson and Shen of Lilly Research Laboratories, Washington, U.S.A.: Meeting of the Fed. Am. Soc. Expt. Biology., March, 1936.)

Pukateine, one of the alkaloids (first isolated in this laboratory) of the Pukatea-tree, has been studied by Dr. Fogg (late Demonstrator in Physiology at the Otago Medical School), who worked on the pharmacological action of pukateine at American medical schools and has recently published his results (Journal Phar. Exper. Therapeutics, June, 1935). It is well known that morphia induces in some patients continued nausea as an after-effect of the drug. Some of Dr. Fogg's experiments suggest that a use may be found for pukateine as a morphiate for humans without danger of producing the ill effects induced by morphia.

Several overseas research workers on New Zealand plants and their products have been supplied with the material they required from this laboratory.

Work for the Departmental Divisions.

Live-stock Division.—The usual periodical analyses of public cattle-dips have been carried out. Other analyses include toxicological specimens, licks, wool-scouring materials, medicines, &c. Some experimental work was done on the best method of preparing the new brown meat-marking fluid, and samples of the prepared ink have been regularly checked after manufacture by the Government Printer.

Dairy Division.—A successful prosecution of a cheese-factory supplier for supplying milk containing added water was based on the analysis of official samples taken under the Dairy Industries Act.

Fields Division.—Numerous analyses of liming materials were made as in previous years, particularly with regard to applications for free railage concessions. Samples from natural deposits of suspected fertilizing value were also examined. In most such cases the good results reported appear to depend on the large amount applied. Such material would not be economical to transport.

Samples received for analysis from the 1st April, 1935, to the 31st March, 1936, were: soils, 145; liming materials, 103; fertilizers, 21; pastures, 5; weedkillers, 8; waters, 12; licks and medicines, 5; limonite, 5; dips, 18; toxicological, 77; thyroids, 75; bloods, 434; miscellaneous, 86: total, 994.

Control of the Sale of and Technical Advisory Work on Fertilizers and Related Products.

During the year ending 31st March, 1936, the Fertilizer Act administration and registration was carried out as usual. The following are particulars of registration:—

Registration certificates issued to manufacturers and owners	165
Manufacturers and owners of brands registered	92
Branches registered	233
Brand-registration fees collected	£497 16s.
Number of brands registered	924
Number of different analyses registered	464
Number of analyses registered containing—	
One fertilizing ingredient	59
Two fertilizing ingredients	174
Three fertilizing ingredients	231
Secondary vendors registered	446
Branches registered	251

There has been an increase of seventy-three over last year's registrations for the number of brands registered.

Inspections were made in Auckland and Wairarapa districts. Practically all manufacturers' and merchants' premises in Auckland were visited last April, and a number of matters connected with fertilizer sales, invoice certificates, registration, &c., received attention. In the case of the Wairarapa visit, the sale of an unregistered fertilizer as a special mixture was investigated. A report on the various points attended to was sent forward.

Two lectures were given on fertilizers, and an extended series of articles published several years ago in the *Journal of Agriculture* were revised and reprinted in the *Orchardist* of New Zealand in response to requests from fruitgrowers. Several requests from farmers' organizations have also been received for lectures, and there are signs of more interest generally being taken in the question of the choice, quality, unit values, &c., of fertilizers. There has been a good deal of correspondence in this latter connection with farmers and others.

No personal check is kept on brand-registration fees paid by vendors, and there may be some evasion of payment in respect of some fertilizers which are not registered. It appears necessary to have inspections of manures on sale made at intervals in order to render the system of administration effective and equitable.

The number of mixtures containing lime as a diluent has increased during the year, and a few containing as much as 66 per cent. of lime have appeared on the market for sale in small quantities under the name of "garden" fertilizers.

A matter which apparently requires to be closely reviewed is the price charged to the farmer for ground Nauru phosphate, 36–38 per cent. phosphatic-acid grade, which appears to be rather too high. Purchasers have at times made complaint at the high price of £4 4s. per ton charged for this phosphate, which is useful under certain soil and climatic conditions. This price compares unfavourably with English prices, such as £1 12s. per ton to the farmer, for finely ground North African phospate of 26 per cent. phosphatic-acid content.

Some mixtures of incompatible materials are now being sold under such names as "dry neutral ammoniated superphosphate." These mixtures consist of lime, sulphate of ammonia, and superphosphate in proportions of, say, 1 : 1 : 2. Although such mixtures may have fairly good chemical stability under dry conditions of handling or storage, when applied to the land the ammonia from the sulphate of ammonia is rapidly lost in the presence of moisture.

Co-operation with Stock Inspectors was maintained throughout the year in connection with fertilizer sampling and the checking of brands, &c. A considerable amount of inspection is necessary as regards invoice certificates, as it appears that quite a large number of vendors are not furnishing these documents to purchasers, and in some cases certificates are not drawn up in accordance with the Act.

Large quantities of basic slag have been imported, and there is necessity for systematic sampling and examination of fertilizers brought out here, as well as the locally produced goods. The annual publication of the analyses of all brands on the market for the notice of fertilizer-users would be of great assistance.

Weed-killing Experiments.

Further ragwort (*Senecio Jacobaea*) spraying experiments were conducted by Mr. F. B. Thompson under the supervision of Mr. J. A. Bruce, Inspector of Fertilizers.

The conflicting results obtained this year indicate the need of further experiments, preferably in several districts simultaneously, to determine the circumstances that govern the failure or success of the treatments.

Ammonium persulphate, ammonium percarbonate, and sodium perborate were found to have practically no toxic effect on ragwort.

Gorse about 3 ft. high was sprayed with 10-per-cent. and 25-per-cent. solutions of ammonium thiocyanate and 5-per-cent. and 10-per-cent. solutions of 2 : 1 white arsenic-caustic soda. There was no marked difference between the treated and untreated areas except that on the former the burn had been more complete.

Thick blackberry, about 6 ft. high, was sprayed with 25-per-cent. thiocyanate and 10-per-cent. arsenic solutions. These were burnt, and when inspected two months later there was considerably less regrowth on the treated areas and slightly less on the arsenic plot.

Preliminary experiments conducted with ammonium thiocyanate and with various chromate and bisulphite salts on bracken indicated that these chemicals are capable of killing this weed at comparatively dilute strengths of 2½ per cent. to 5 per cent. The ammonium thiocyanate and sodium bichromate were the most effective.

Some reports which are to hand on treatment of sorrel and Californian thistle indicate that ammonium thiocyanate, in strengths varying from 5 per cent. to 10 per cent., was an efficient eradicator under the conditions in which it was tried out.

Publication.—"The Chemistry of Weedkillers—VI: The Bisulphite Group." B. C. Aston, J. A. Bruce, and F. B. Thompson. *N.Z. Jour. Agric., Vol. 52, pp. 137; 1936.*

Approximate Cost of Paper.—Preparation, not given; printing (719 copies), £85 10s.

By Authority: G. H. Loney, Government Printer, Wellington.—1936.

Price 1s. 6d.]