1930.

NEW ZEALAND.

DEPARTMENT OF AGRICULTURE.

ANNUAL REPORT FOR 1929–30.

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

Wellington, 31st July, 1930.

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, 1930.

The reports of the Director-General and heads of Divisions outline a wide range of effective work for the benefit of our agricultural industries. The remarkable expansion recorded in the country's flocks and herds, and the substantial increase in production of our main staples of dairy-produce, meat, and wool are due mainly to improved grassland-farming practice, and to better animal husbandry and hygiene. In the promotion of these matters, as well as in the development of the fruitgrowing industry, the Department has given an excellent lead. As regards dairying, herd-testing has been an important factor.

The Department, with its strongly established organization and wide resources and experience, is keeping well to the fore in agricultural research and instruction. Good fundamental work is being done at many points, and in applied agricultural science New Zealand is achieving an acknowledged place. This cannot fail to assist our primary industries in the world trade competition which, under present conditions, steadily grows more intense.

The year has been marked by a more or less heavy decline in world prices for the primary products which form our main export staples. It is seldom indeed that such an all-round simultaneous fall has occurred, the more common experience being a balancing of one commodity against another in market fluctuations. But although a general downward trend or reversion of values seems to be establishing itself, a fair recovery in certain products, such as wool, may be anticipated.

While the position can be regarded with reasonable optimism, it certainly calls for serious study and action at every weak point capable of amelioration. Due provision will be made to enable the Department of Agriculture to take its full part in this respect.

I have, &c.,
A. J. MURDOCH,
Minister of Agriculture.

His Excellency the Governor-General.

REPORT OF THE DIRECTOR-GENERAL.

THE HON. THE MINISTER OF AGRICULTURE. Wellington, 30th June, 1930.

I beg to submit the following report upon the work of the Department during the past official year :—

THE AGRICULTURAL POSITION.

The season of 1929–30 has been marked by a serious decline in values of export commodities, almost without exception, with a consequent shrinkage of national income. Had the lower price-levels been confined entirely to those products from grassland—wool, meat, and butterfat—the production of which is steadily expanding, it could be viewed that a temporary saturation-point for these, our major exports, had been reached on our present overseas markets ; but such is certainly not the case, and the general fall in values for all primary products the world over is more an indication that a period of comparatively low prices lies ahead of the farmer than of overproduction having been reached. The policy of " increased production on an economic basis " still holds true as New Zealand's remedy for lowering prices, combined with ever-improving quality to enable the markets we have to be held and extended.

GRASSLAND PRODUCTION.

So far as increased production of our grassland products are concerned—wool, meat, and butterfat—from which the major portion of our national income is primarily derived, the position is exceedingly satisfactory, and the past season marks a new high level. In the five-year period 1921–25 the average annual value of grassland products on a standard-price basis was £34,626,000. During the five years 1925–30 the average annual value amounted to £41,456,000.

Even more significant is the yearly increase since 1925 (calculated on the same standard-price basis) over the average of the previous five years, which indicates the upward movement that is taking place, and which is being more than maintained :—

Year.	Amount of Increase. £	Approximate Percentage Increase.
1925–26	2,324,000	6·7
1926–27	4,804,000	13·9
1927–28	6,524,000	18·8
1928–29	8,624,000	24·9
1929–30	11,874,000	34·3

In no period of New Zealand's history has production increased to the extent that is taking place at the present time, and this is a direct reflection of improving farm practices in which top-dressing, better stock, and better grassland-management are all playing their parts.

PASTURE-IMPROVEMENT.

The essentials in grassland-farming are pasture, live-stock, and management. All these three factors are equally important. Improvement in live-stock and improvement in management are generally recognized by farmers, while herd-testing and culling, animal hygiene, top-dressing, controlled grazing, and grassland-manipulation generally are becoming standard practices. The significance of actual improvement in the components of grassland itself, apart from that brought about by management, has, however, up to the present not been sufficiently recognized. In point of fact, strain in grasses and clovers is of equal importance to top-dressing or any other of the factors of management. All our common grasses and clovers consist of a large number of types, as essentially different from one another in performance and value as are live-stock. Until such time as pasture species become graded and pedigreed, as is becoming the case with live-stock, the full measure of scientific grassland farming cannot be realized.

The work of the Plant Research Station at Palmerston North has clearly shown the importance of strain in rye-grass, cocksfoot, white clover, and red clover, and demonstrated that many pastures in New Zealand consist of strains of outstanding merit, showing high leaf-production, a long seasonal growth, and a high degree of permanence. It is clear that these types only should be perpetuated for seed-production, and the system of pasture-testing followed by certification which is being adopted should finally eliminate undesirable strains being used in the laying-down of pastures. A good start has been made with perennial rye-grass, and over 20,000 bushels of true type has been certified to during the year. It has also been shown that many of the lines of white clover produced in New Zealand are outstanding, and certification of these will be put into operation in the coming season.

Ensilage.

Largely due to the instructional and advisory work of the Department, the practice of ensilage-making has made rapid strides during the year. Even now more grass ensilage is being made than in any other country in the world, but up to the present it is mainly confined to the dairy-farmer and used almost exclusively for the feeding of milking stock. Ensilage-making, however, should be an integral feature of all extensively managed grassland, irrespective of whether it is used for cattle or sheep, and a movement over to the fat-lamb farm must be its next development, with consequent raising of ewe-carrying capacity, and the better later growth from the early-mown pastures providing good fattening feed for the later drafts of lambs.

Animal Health.

As regards animal health, the report of the Director of the Live-stock Division furnishes details regarding the various troubles affecting live-stock, and from this it is interesting to note that the severe mortality which occurred among hoggets in the Wellington Province during the late autumn of 1929 was not repeated this year, the prevalence of dry weather and sunshine having the effect of rendering the pastures suitable for the maintenance of health and vigour in the young animals. Good management methods constitute the best means of keeping sheep, young or old, in good health and condition, and had weather and food conditions during the recent autumn been similar to those the year before the experience gained then and the application of the advice given regarding prevention would probably have resulted in a smaller loss occurring.

The losses of dairy cows, or of production from dairy cows, still continues to be a source of trouble to dairy-farmers, though, on the whole, showing a lessening tendency. Research into the particular troubles—mammitis, temporary sterility, and abortion—is being actively pursued, and, though no positive results have been attained, some good progress has been made in knowledge regarding mammitis and temporary sterility. As regards contagious abortion, it is possible by a simple blood-test to determine whether cows or heifers are carrying infection, and a large number of these tests are being made. But no simple and easy method of prevention or of freeing an animal from infection is known here or anywhere. The number of cases of mammitis occurring can undoubtedly be reduced by care in handling and operating milking-machines, both as regards the maintenance of cleanliness and the proper regulation of pressure, by general cleanliness in milking-sheds, and by good herd-management. It is important that cases be detected at the first onset, when proper treatment carefully applied will often bring about recovery. The research work into temporary sterility is following more or less defined lines, including the influence of the bull and the possibility of periods of impotency in bulls, the influence of varying phosphatic and lime content of the herbage, and the existence of diseased or abnormal conditions in the ovaries or other parts of the generative system of cows. There is also the question of nature enforcing upon cows a temporary rest from calf-production and milk-yield by way of maintaining a normal balance of health and continued later productive power. Research work at the Wallaceville Laboratory and in the field has been vigorously prosecuted.

The returns from Inspectors at meat-export slaughterhouses and abattoirs, covering 284,254 head of cattle, other than calves, a considerable proportion being fattened dairy cows, show a total percentage of 5·11 affected with tuberculosis in any degree, this being 0·11 per cent. less than in the previous year. There is some degree of satisfaction in knowing that in spite of the increase in cattle, and their much closer segregation owing to greater carrying-capacity of pastures, the tendency of our already low degree of infection is a declining one. Pigs show a reduction of 0·4 per cent. of cases.

Live-stock.

As will be gathered from the appended report of the Director of the Live-stock Division, the Statistician's returns for the year 1928–29 giving the numbers of farm animals in the Dominion, show that sheep increased in number by 1,917,572 as compared with the previous year, and cattle of all classes by 172,021. The increase in dairy cows alone was 18,665. In the case of swine, however, it is regrettable to note that a decrease of 30,166 occurred. Horses also decreased by 8,174.*

This large increase in the number of sheep, and the noticeable increase in the number of cattle, can be regarded as being mainly due to the great improvement in farming practice which has come about by the increased use of fertilizers and by better grassland-management. Seeing that the area under settlement has not appreciably increased, while the number of dairy cattle has not increased to a very noticeable extent, the yield of dairy-produce has been much greater in proportion; and here again fertilizers, improved grassland-management, herd-testing, improved quality of herds from a yield standpoint, and better animal husbandry must be credited with the marked increase in the volume of these products which has taken place.

As regards pigs, it is a matter for regret that they have decreased in number, especially as the prices received for porkers and bacon pigs exported to the United Kingdom proved to be payable, and have been still better during the season now in progress. The position of the pig industry demands special attention. A scheme of special instruction and advice to farmers on the subject of management and feeding has been elaborated and put into operation; but, while this will no doubt help, more active steps are needed. The bulk of our pigs are kept on dairy-farms, and the great attention which dairy-farmers have given of late to the increase of production from their herds, and the results attained, seem to have caused the very useful and paying pig to be thrown, so to speak, too much into the background. The main function of the pig seems to be looked upon as being that of a useful means of getting rid of separated milk and of whey, and the quantity of these by-products produced could, if properly utilized and supplemented by other suitable food material, feed a great many more pigs than is the case at present. In meat-meal, for instance, we have a concentrated food material produced in the Dominion, which forms a valuable supplementary food to whey, its composition supplying the nitrogenous content which whey lacks. Separated milk is quite a good food in itself, and it needs very little addition. For the winter feeding of pigs meat-meal makes a valuable addition to roots and other foodstuffs when dairy by-products are scarce.

Veterinary Services.

The continued development of the dairy industry, of which the most marked features are the increased carrying-capacity of dairy-farms and the consequent closer segregation of dairy cattle, together with the increased yielding capacity of cows, is causing the necessity for skilled veterinary services being available for dairy-farmers to become progressively greater. Owners need to do all that is possible to conserve the health and productivity of their cows, and to avoid loss through inability to get the proper treatment applied promptly whenever disease of any kind makes its appearance. More than that, a skilled veterinarian, always available, can be of great assistance in advising, on the spot, on disease-prevention methods, feeding questions, and herd-management generally.

Under the existing system, Government Veterinarians, who are comparatively few in number, each with a large district to cover, supplement their official duties by giving as much advice and assistance to farmers in live-stock ailments and disease-prevention as they are able to do, but the needs of the dairy industry are far in excess of this. What is needed is an organized veterinary service under which skilled qualified men would be engaged to give their whole time to practice among dairy-farms within a definite area, and at the same time act as advisers generally upon all questions bearing upon the health and productivity of dairy herds. The experience of veterinary surgeons who have attempted independent private practice in dairying districts has been that the net earnings they are able to collect do not provide a reasonably sufficient income; hence some other system needs to be adopted in order to combat the avoidable wastage in dairy cows which occurs at present, owing to proper treatment, promptly applied, not being feasible through the lack of skilled advice always near at hand. It is not suggested that the Government should itself operate

* The interim returns for the year 1929–30, which have just come to hand, show further increases in sheep of 1,586,008, in all cattle of 275,179, and in dairy cows alone of 52,804. Pigs show a decrease of 72,912, and horses of 1,722.

such a system, but it is considered that a properly organized service on a self-supporting basis could be established and maintained through the medium of dairy factories. Thus, in the case of a large factory whose suppliers own 8,000 cows or upwards, if the whole of the suppliers would combine in forming a veterinary association and each provide a small sum—say, at the rate of 2s. 6d. per cow—the amount derived from 8,000 cows would be sufficient to pay the salary and travelling-expenses of a good veterinarian, whose whole-time services would be available to the suppliers without extra charge. Or, alternatively, the payment could be made on a per-pound of butterfat basis. Arrangements could also be made for medicines to be supplied on the veterinarian's prescriptions at cost price, plus expenses of preparation, handling, &c. A scheme such as this, properly organized and properly managed, would be of great benefit to dairy-farmers and of great economic value to the Dominion. The Government could well assist in bringing about the establishment of the scheme by selecting veterinary surgeons of the right type, and in other ways which would be helpful in placing it upon sound working lines.

Dairying.

The value of dairy-produce exported has attained to a very high proportion of the value of New Zealand's total exports. For the year under review the value of dairy-produce exports represented £18,842,994 out of a total export of £49,045,817, or 38·4 per cent.

Pasturage has been more plentiful than usual, due to a well-distributed rainfall throughout the year, and to the cumulative effect of top-dressing with artificial manures. The plentiful supply of grass, together with an increase in the number of dairy cows, has resulted in a milk-production never excelled for volume in the Dominion.

The general unfavourable economic conditions, and larger supplies of butter from a number of countries, have prevented the New Zealand dairyman from increasing his income. The larger production will, however, be helpful in offsetting the shortage due to fall in prices, although the net balance to the Dominion shows a reduction of some two millions sterling.

The quality of New Zealand butter has been maintained or improved, and, despite bad marketing-conditions, has been reported upon as favourably as usual. Cheese quality has been less favourably reported upon, due to at least three factors—namely, (*a*) unfavourable market conditions, (*b*) the extensive diversion in the North Island from the manufacture of full-cream cheese, and (*c*) the endeavour in some cases to ensure yield rather than high quality.

The need for improvement in cheese quality is one of very great importance, and this is being more generally recognized. Since his return from Britain in October last the Director of the Dairy Division has brought before the cheese-producers in the various cheese districts the advisability of considering ways and means of providing a premium for qualities as indicated by the varying grade-points. There is some evidence that this advice is receiving serious consideration in some districts, and, could the principle be adopted in the whole or parts of the Dominion, there are good reasons to expect improvement in quality.

Farm dairy instruction on a voluntary basis has been well established in many dairying districts, and there has been an ever-increasing demand that the service should be placed on a Dominion basis. Resolutions to this effect were carried at the last annual meetings of the South Island Dairy Association and the National Dairy Association of the North Island. An amendment to the Dairy Industry Act is necessary before effect can be given to these resolutions.

The inspection of New Zealand butter and cheese at various ports, warehouses, and retail establishments in Britain has been continued by Messrs. Wright and Ross in a capable manner. Mr. Ross has been stationed in London for some five years and is shortly returning to New Zealand. Mr. F. H. Taylor, Dairy Instructor, Invercargill, is being transferred to London to undertake the duties Mr. Ross is relinquishing.

The work of dairy-herd testing for yield is progressing satisfactorily, and about 19 per cent. of the Dominion's dairy cows are being so tested. This compares more than favourably with the position in most other countries devoted largely to dairying.

During the year Mr. Singleton, Director of the Dairy Division, visited the United Kingdom, Denmark, Holland, Canada, and the United States, and gained much valuable information, which has since been placed at the disposal of the dairy industry here.

The Department is co-operating fully with the Dairy Research Institute at Palmerston North, where extensive research and investigation work is being carried out. The establishment of this Institute, together with the smaller laboratories at Hamilton and Hawera, the work of all being co-ordinated as far as is possible by the Department of Scientific and Industrial Research, should

prove of material aid towards the continued advancement and improvement of the industry. As regards dairying, the Department of Agriculture's laboratory at Wallaceville deals only with routine matters associated with the dairy work of the Department's officers, but in this work keeps in touch with the other establishments.

Agricultural Instruction.

The dominating feature of the progress of the Department during recent years has been its development along the lines of instructional and advisory services. In these the whole of the Divisions are equally concerned, and the demand on the part of farmers for the extension of all phases of instruction along lines of sound and economic management is gratifying, clearly indicating that these services are recognized as playing an important part in agricultural development generally. All instructional officers have had an extremely busy year.

Boys' and Girls' Agricultural Clubs.

This movement is expanding rapidly, particularly in the South Island, where up to the present time staff limitations precluded sufficient attention being paid to it. Southland and Otago are now well organized, and a start is being made in Canterbury, where it is felt the movement will rapidly develop and prove especially popular. The value of these clubs in promoting agricultural keenness, not only among members but also among the farming community generally, is well illustrated in Taranaki and western Wellington, where clubs have now been established for some years. During the year under review there have been over four thousand competitors doing club work.

The Fruit Industry.

The fruit-export industry continues to make satisfactory progress. The export figures for the 1929 season, although somewhat lower than those of the previous season, were the second-highest on record, and the prices realized were quite satisfactory to the producer.

The 1930 apple crop has been the heaviest so far recorded, and the fruit generally is of excellent appearance and condition. This season's export will no doubt constitute a record. However, there is some little doubt as to the final market returns being altogether satisfactory to the grower, owing to the hold-over of a large quantity of last season's American fruit, plus heavy shipments from the Australian States flooding the English and Continental markets.

The need for economy in the cost of fruit-production and cheaper and better means of transportation has given rise to a movement towards the establishment of a Fruit Research Station, where practical and scientific research might be undertaken with a view to improving existing orchard practices, such as varieties, stocks, disease-control, cool storage, &c. In co-operation with the Research Department, together with promised assistance by the Empire Marketing Board and fruitgrowers' organizations, the question of establishing such a station is being actively gone into.

It is alleged by those in the trade that, despite the activities of departmental Inspectors and the prosecutions instituted by the Department on account of false packing, there is a growing tendency on the part of a certain section of producers to place both fruit and vegetables on the market packed in a manner calculated to deceive the buyer. In consequence of this both retailers' and producers' organizations have asked that the matter be fully inquired into, together with the whole question of the packing and marketing of fruit and vegetables throughout the Dominion. It will be of advantage if this can be done.

The Institute of Horticulture.

The New Zealand Institute of Horticulture, which is a national organization receiving sympathetic and practical assistance from the Government and officers of the Horticulture Division, is continuing to make satisfactory progress. One of the principal aims of the Institute is in the direction of horticultural education. The Institute's scheme of education, designed to impart to the student theoretical and practical instruction in horticulture, is in active operation in the main centres, where a number of students are taking the course.

The Honey Industry.

New Zealand honey continues to maintain its high reputation in Great Britain and the Continent of Europe, where a highly creditable business has been established.

As a result of unfavourable climatic conditions a considerable reduction in the quantity of honey exported during the year has taken place. It is contended, however, that this will have at least one beneficial effect, in as far as it will enable accumulated surpluses in London to be cleared off, thus reducing storage costs, and at the same time placing the question of receipt and disposal of supplies in a more satisfactory position.

The Chairman of the Honey Control Board, Mr. Rentoul, is at present visiting England, Ireland, and Scotland, also the Continent of Europe, for the purpose of further organizing the industry and extending the honey-market. It is expected that the industry will benefit materially from his investigations.

Inspection of Meat for Export.

The volume of meat frozen for export shows a considerable increase over last year, this being doubtless due to the increased carrying-capacity of sheep pastures, brought about by the extension of fertilizer top-dressing practice and the increase in the flocks of the Dominion.

Condemnations on account of disease have remained at a low level. In consequence of the action of the British authorities in connection with lymphadenitis in sheep, special arrangements were made for strengthening the inspection staff, and also for checking the results of the inspection work by incising the glands of many thousands of sheep and lambs after their examination in the usual way by the Inspectors immediately after slaughter. The results were satisfactory. The cost of this was borne partly by the freezing companies, and their co-operation is greatly appreciated.

The boneless-veal trade showed improvement in the class of calves coming forward for slaughter. Statistical figures and other general information regarding meat-inspection will be found in the report of the Director of the Live-stock Division.

Bush Sickness.

A review of the present position regarding "bush sickness" indicates that the existence of this trouble as a distinct deterrent to the successful carrying of live-stock in certain areas has become a far less serious matter than used to be the case. This applies more particularly to dairy stock perhaps than to sheep. The fact that dosing with citrate of iron and ammonia will cure bush sickness when an animal is suffering from it, while periodical dosing with the same preparation will effectively prevent its onset, is now much more generally recognized by farmers in affected areas, and it may be definitely stated that the actual position is that dairy herds can be carried successfully on bush-sick country under ordinary dairy-farming conditions, with the use of suitable fertilizers, and a proper use of citrate of iron and ammonia as a medicinal agent. Not only does this hold good with adult cattle, but calves can be reared successfully by administering the same medicinal agent with hand-fed milk or other food.

The question of administering citrate of iron and ammonia to sheep presents more practical difficulties to the farmer, as mustering the sheep and dosing them individually for several days, during which the periodic application of the medicine is carried out, means a great deal of labour and resultant expense. A good deal of experimental work has already been done in the direction of making the preparation available for sheep by incorporating it into small pellets which, if the sheep can be induced to take them, enable them to attain the necessary protection. This, however, is not always easy to bring about; but once sheep can be got to accustom themselves to take the pellets, they continue to do so without difficulty, the only trouble being that it is impossible to regulate the quantity taken by each animal. Any excess taken, however, does not seem to do any harm.

Not only is citrate of iron found an absolute specific in the prevention or cure of bush sickness, but a number of farmers in the districts bordering on the bush-sick area or farming on land only affected to a sufficient extent to cause sheep or lambs to develop the trouble, while adult cattle remain apparently unaffected, have found by practical experience that the periodical administration of citrate of iron considerably improves the milk-yield of their cows, and some even go so far as to say that they believe it has been a factor in lessening trouble through temporary sterility. Whether this last is actually the case, however, remains yet to be proved. Since May, 1929, 2 tons of the material has been obtained by the Department for resale to farmers, and an additional ton has

been ordered, whereas in 1926 the quantity obtained was only 3 cwt. As each pound will provide from 60 to 120 doses, according to age and circumstances, the extent to which the material is now being used will be realized. It may be noted here that it is supplied at cost price, plus only the expenses of carriage and distribution.

Thus the development of citrate-of-iron treatment can justifiably be stated to have solved the main issue in the question of satisfactorily farming bush-sick land so far as dairying is concerned, at any rate. Apart from this medicinal treatment of cows to prevent bush sickness, it is necessary that attention be given to good farming practice and the use of fertilizers—which, for that matter, is necessary on dairy-farms in any district. For bush-sick country phosphatic manures—in the form of basic slag or a mixture of superphosphate and basic slag—give best results, and the iron content of the slag can be regarded as assisting to improve the soil from the point of view of rendering it able to produce herbage containing sufficient iron to enable stock raised upon it to maintain normal health. Another factor which operates when dairying is carried out on well-farmed, well-manured land is that the humus content of the soil is rapidly increased, and heavier stocking assists in soil-consolidation. Our experimental work, and observations generally, have shown that where the soil is thus improved the mineral content of the pasture, including that of iron, is appreciably increased. Further experimental work is being done in connection with bringing about a more rapid increase of humus, this including the ploughing-in of crops of lupin and other plants, which will be followed by sowing down in pasture and controlled grazing in order to ascertain the results. Other methods of soil-treatment are also being experimented with.

The work done on the Mamaku Demonstration Farm demonstrates very effectively the improvement in the soil and pastures which is brought about by ploughing, sowing down with good pasture, regular applications of suitable fertilizers, moderately heavy stocking, and good farming generally. On the portion of this farm which was first taken in hand, and which was then exceedingly sick, the pastures are now practically healthy for grown cattle, and a permanent dairy herd is being milked there with no ill effects, and without it being necessary even to dose the adult animals with iron.

The Poultry Industry.

The conditions at present ruling in the poultry industry have been given special attention. While production has been at a good level, marketing results have not been satisfactory, and in order to obtain a basis upon which to endeavour to work out methods of general improvement a full inquiry into the industry was made by Mr. Fawcett, Farm Economist, who furnished a comprehensive and valuable report, which has since been published for general information. Following on this a conference was arranged with representatives of the poultry industry, of merchants, and of the Grocers' Association, at which a scheme for voluntary egg-grading and improved marketing methods was elaborated. This is now being dealt with, and it is hoped that it may shortly be brought into effect.

The export of eggs was continued under a guarantee from the Government of a minimum return to shippers, and with a limit of £10,000 liability on the Government, but it is regretted that export again proved unprofitable, and the call on the guarantee, which it was at first hoped would only slightly exceed £4,000, now appears likely to reach £5,000. The outlook for a paying export trade under present conditions is not good, and, whatever course may be adopted regarding a continuation of it, poultrymen evidently need meanwhile to do their best to get their voluntary Dominion grading and marketing scheme established on a solid footing, in the anticipation that it will prove valuable as a means of placing the industry upon a more stable basis.

Phosphate-supplies.

The year's operations of shipping phosphate from Nauru and Ocean Islands have been hampered considerably by exceptional severity of weather conditions, the result of this being that three out of four sets of deep-sea moorings at the two Islands were carried away, and delay and considerable expense incurred in replacing them, shipments having to be partially suspended meanwhile. No shortage of supplies to New Zealand occurred, owing to the operation of the arrangement under which phosphates of high quality, derived from other sources, are supplied by the Commissioners to make up any shortage in supplies from Nauru and Ocean Islands. Fortunately a new cantilever loading-stage at Nauru is just about completed, and a new-style jetty of the cantilever type has now been put into operation at Ocean Island. These two structures will materially help to overcome the difficulties existing in connection with the use of special moorings.

The whole of the output of the two islands was absorbed by Australia and New Zealand, neither Great Britain nor any other country taking any. It is anticipated that with the improved loading facilities the annual output of the two islands can be considerably increased.

The question of endeavouring to secure for Australia and New Zealand a further source of supply as a safeguard for the future has been kept in mind, and negotiations were initiated with a view to a possible purchase, but these did not prove successful. The desirableness of safeguarding the position as regards future supplies will be kept definitely in view, and advantage taken of every possibility arising in this direction.

The report of Mr. A. F. Ellis, C.M.G., New Zealand representative on the Phosphate Commission, will be found appended hereto. It deals with the operations of the Commission in regard to supplies to New Zealand and Australia for the year ending 30th June, 1930.

Land-development Work.

The Department has now become associated with the Lands Department in work under the Land Laws Amendment Act, 1929, and two blocks of land, one near Rotorua and the other at Te Kauwhata, are being dealt with by the Department of Agriculture on the lines of preparing them for settlement by having a portion of each section cultivated, grassed, and fenced prior to their occupation by settlers. The necessary finance is provided through the Land Development Board, except as regards the pay and travelling-expenses of the officers controlling the work. It is proposed that one of the sections in the block near Rotorua shall be farmed by this Department for a short time by way of providing an observational and instructional area for the surrounding settlers when they commence their own operations.

Ruakura Farm and Farm Training College.

The Ruakura Farm experienced a good season, the volume of production showing a distinct increase. Every effort is made to conduct the farm on lines which will afford a good object lesson in farm-management and animal husbandry. The total earnings of the farm on its year's operations were £11,262. This includes fees from students, also an item of £1,165 for lambs consigned to London and sold, the cash for which was not available before the 31st March. The dairy herd has produced well, and during last year eighteen young cows, including eight heifers, were under C.O.R. test, giving an average yield of 510 lb. of butterfat. The pastures on the farm have been improved, and at the present time the farm (total area, 898 acres) is carrying approximately 370 cattle (including 112 yearlings), 2,000 sheep, and 150 pigs, besides farm horses. The annual sale held in August, 1929, was a successful one, eighteen yearling Shorthorn bulls realizing an average price of 59 guineas, sixteen yearling Jersey bulls 47 guineas, and twelve Ayrshire yearling bulls 29 guineas. Pigs also sold well. Altogether the farm is doing well, and the Manager, Mr. H. Munro, merits commendation for its continued progress.

Experimental grass plots have been established on the farm, and these are proving of great interest to visiting farmers, and are also of value for instructional purposes with the students. Experimental feeding trials with pigs have been carried out in connection with complaints made regarding " fishy " flavours in exported bacon carcasses. All the results of these have not yet come to hand.

The Farm Training College.—The full number of students (forty-nine) which can be accommodated are in residence, and more are desirous of entering when space permits. This school, providing as it does a combination of study and practical farm-work, evidently meets a requirement of the Dominion, and when financial conditions permit it could well be enlarged, or, what would probably be better, supplemented by an establishment in another part of the Dominion conducted on approximately similar lines. The instructional work has been greatly facilitated by the homestead building being made available for the uses of the school, the class-room and other necessary accommodation having previously been too restricted.

General.

In view of the fact that a great volume of more or less detailed information regarding the work of the Department is contained in the divisional reports appended hereto, it is unnecessary to here cover the whole range of the Department's activities, but a few additional points may be mentioned.

In addition to the reference already made to the Plant Research Station, I must express appreciation of the excellent work being done at the Wallaceville Veterinary Laboratory and at the Chemical Laboratory, at both of which establishments research and routine activities have been prosecuted energetically and skilfully by their respective staffs.

Inspection work in connection with meat, milk, plants, orchards, apiaries, fertilizers, rabbits, noxious weeds, &c., has been maintained efficiently and satisfactorily. As regards noxious weeds, the adoption of sodium-chlorate spraying for the purpose of eradicating ragwort has given such good results under field-trial conditions that it is coming into extensive use during the coming season, and there seems every reason to anticipate that the ragwort menace, on closely settled lands, will soon become comparatively negligible. This preparation is also being tested with Californian thistle and other weeds. Rabbits are still far less troublesome, but constant vigilance is being exercised in keeping them down.

The flax-milling (hemp) industry is passing through a difficult period, owing to low selling values coupled with high cost of production. It is hoped that modern cultivation and manufacturing methods will help to bring about improvement.

Work of particular interest now in hand is that of experimenting with methods of bringing into profitable use at reasonable cost the "pakihi" lands on the west coast of the South Island, this being done in association with the Cawthron Institute. Also, in association with the Research Department a considerable volume of experimental and demonstration work is being done on soil-deficiency areas in the King-country, particularly at Mairoa, where the results of research have shown that top-dressing with lime in conjunction with phosphate quickly brings about profitable improvement. Experiments in bringing in the so-called ironstone-pan country in the far north of Auckland Province are also in progress.

The publications service of the Department has been carried on efficiently by means of the *Journal of Agriculture*, bulletins, and other printed matter. Radio broadcast lecturettes covering a wide range of agricultural subjects were also continued.

Staff Matters.

During the year Mr. A. H. Cockayne, who had for some time previously held the position of Director of the Fields Division, was appointed Assistant Director-General of the Department, in succession to Mr. F. S. Pope, whose retirement on superannuation was mentioned in my report for 1928–29. I desire to record my appreciation of Mr. Cockayne's effective co-operation since his appointment. It may be mentioned that he is retaining in the meantime the Directorship of the Plant Research Station, in addition to his head-office function. In existing circumstances this arrangement is of considerable advantage. The vacant directorship of the Fields Division was filled by the appointment of Mr. J. W. Deem, previously Fields Superintendent at Palmerston North.

In concluding, I must also express my appreciation of the great assistance rendered by the Divisional Directors and heads of Sections, who have throughout exhibited a keen desire to do their best towards rendering the work of the Department efficient and of real value to the community. This has been supplemented by good work by the staff generally.

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

NAURU AND OCEAN ISLANDS PHOSPHATE.

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

PARTICULARS are supplied herewith regarding the tenth year of operations at Nauru and Ocean Islands since the phosphate business came under Government ownership. The year ended at 30th June. Shipments as compared with the two previous years are as follows:—

	Eighth Year (1927–28). Tons.	Ninth Year (1928–29). Tons.	Tenth Year (1929–30). Tons.
Nauru	310,990	342,770	296,310
Ocean	190,925	233,820	207,863
	501,915	576,590	504,173

In each case bill-of-lading figures are taken. It will be noted that there is a decrease of 72,417 tons on the previous year. As compared with the other nine years of operations, the shipments for the tenth year come third, having been exceeded on the seventh (593,340 tons) and ninth (576,590 tons).

The cause of the decreased shipments for the tenth year was the severity of the weather experienced during the westerly monsoon season, which was considerably worse than usual, with the result that three out of the four sets of deep-sea moorings at the two islands were carried away. Re-laying these moorings was a difficult and expensive operation. As an instance of the effect of these adverse conditions on shipping operations, it may be noted that the best month for the year was August, 1929 (59,121 tons), and the worst month January, 1930 (14,672 tons).

Labour and health conditions at both islands for the year under review were practically normal, except that an epidemic of influenza at Ocean Island occasioned a good deal of delay.

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

	Eighth Year. Tons.	Ninth Year. Tons.	Tenth Year. Tons.
Nauru/Ocean	136,718	138,053	117,826
Outside	42,946	29,288	49,983
	179,664	167,341	167,809

The above quantity of outside phosphate brought in by the Commission for the fertilizer-manufacturers was from Morocco and Makatea Island. In practice, the manufacturers use Nauru/Ocean and Makatea almost entirely for superphosphate-production, and Morocco is finely ground at the various mills in the Dominion for use in the raw state.

Regarding the proportion of the Nauru/Ocean output which comes to the Dominion, the figures as compared with the two previous years are as follows: Eighth year, 24·76 per cent.; ninth year, 24·66 per cent.; tenth year, 25·21 per cent.

Following is a detailed statement of shipments from Nauru and Ocean Islands for the past year:—

	Totals.		Australia.		New Zealand.	
	Tons.	Percentage.	Tons.	Percentage.	Tons.	Percentage.
Nauru.						
July–December, 1929	148,860	100	104,460	70·17	44,400	29·83
January–June, 1930	147,450	100	116,610	79·08	30,840	20·92
1929–30	296,310	100	221,070	74·61	75,240	25·39
Ocean.						
July–December, 1929	117,007	100	88,447	75·59	28,560	24·41
January–June, 1930	90,856	100	67,556	74·36	23,300	25·64
1929–30	207,863	100	156,003	75·05	51,860	24·95
Nauru and Ocean Islands.						
July–December, 1929	265,867	100	192,907	72·56	72,960	27·44
January–June, 1930	238,306	100	184,166	77·28	54,140	22·72
1929–30	504,173	100	377,073	74·79	127,100	25·21

NOTE.—No shipments were made to other countries during the year.

Constructional developments at the islands which may be noted are as follows: (1) Completion of a steel cantilever-type jetty at Ocean Island, with band conveyer delivering phosphate to the outer end. This plant is giving very satisfactory service. (2) The cantilever at Nauru for mechanical loading will, it is anticipated, be ready for preliminary trials in October. (3) A new steamer is under construction for the Commission, to be fitted with special appliances for laying or lifting the deep-sea moorings which constitute such an important part of the operations. The vessel's cargo-carrying capacity will be 6,500 tons. She is being built by Messrs. Harland and Wolff, Ltd., at Govan, and should be completed by the end of March next.

LIVE-STOCK DIVISION.

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

Stock Conditions Generally.

The winter of 1929 was a mild one, with rainfall above the average in many parts, and this excess of moisture was maintained right up into the new year. The abundant rainfall, while being advantageous for bringing dairy stock up to their productive period in good condition and in maintaining that condition right through the season, had the opposite effect on sheep. Owing to the rank slushy feed produced through excessive rainfall and mild conditions, large numbers of hoggets, particularly in the southern and middle portion of the North Island, went off in condition during autumn and early winter of last year and became a prey to internal parasites. Consequently heavy mortality has to be recorded in many flocks in these areas.

In many districts, too, the meteorological conditions prevailing were unsatisfactory for haymaking, consequently the quantity saved is below the average, both as regards quantity and quality As against this, however, a large quantity of ensilage was saved, so that in the dairying districts, given normal seasonable weather, one can look forward to the stock coming through the coming winter in good condition.

Health of Stock.

The principal diseases and troubles affecting stock are dealt with under the respective headings as follows :—

HORSES.

The health and condition of horses has been good in all parts of the country, although there were a few cases of strangles, influenza, and colds, which recovered under treatment. There have been no untoward circumstances amongst equines that require special mention.

Prices for horses have been good—in fact, quite up to the average of recent seasons ; nevertheless, the breeding of all classes of horses, with the exception of thoroughbreds, seems to be in abeyance and more or less neglected. There are still a few enthusiasts amongst Clydesdale breeders who take an interest in this class of stock. It is doubtful, however, whether enough are being bred to meet even the present demands, and if the present indifference continues it is a question whether sufficient will be reared to meet the demand for farm-work. On account of the limited number of mares being put to breeding purposes, the keeping of an entire horse has become an unprofitable proposition in many districts. Thus, because of no satisfactory sire being available, many farmers who would otherwise rear a foal or two each season are debarred from doing so. Should this condition extend it will mean that there will not be enough horses reared to meet the demand for farming purposes and, as a certain number will still be required, those available may reach prohibitive prices.

CATTLE.

Tuberculosis.—The total number of cattle slaughtered in the field as the result of clinical examination and the tuberculin test amounted to 5,137, an increase of 514 over last year. Increases have to be recorded in the following districts : Auckland, 238 ; Wellington, 154 ; Dunedin, 134. Christchurch showed a decrease of 12. This increase over last year must not be regarded as indicating an increase in the incidence of tubercular disease in our herds, but rather as an indication of increased activity among inspecting officers. As will be noted later, the over-all percentage of animals found affected with tuberculosis when inspected on slaughter shows some decrease.

The number of cattle inspected at the various abattoirs and meat-export slaughterhouses was 284,517, a decrease of 36,428 from last year. Of these, 14,539, or 5·11 per cent., a decrease of 0·11 per cent. from last year, were found affected with tuberculosis in varying degrees, a large percentage of those affected being found to be only slightly so. The total number of swine examined was 497,454, an increase of 6,665 from last year. Of these, 48,484, or 9·74 per cent., were found affected on examination, a decrease of 0·40 per cent. from last year.

Actinomycosis.—The animals condemned for this disease and for which compensation was paid show an increase over last year's figures. The number condemned was 718, as against 685 last year. The district totals were as follows : Canterbury, 53 ; Dunedin, 70 ; Wellington, 211 ; Auckland, 384. Only those cases showing open lesions were condemned and destroyed, because from previous experience treatment in such cases has proved ineffective. It is to be regretted that owners of stock affected with this disease do not seek advice and apply curative treatment in the earlier stages, and thus save the lives of many valuable animals.

Mammitis.—Generally speaking, the position with regard to this disease remains much the same as in former years. The number culled for this complaint alone is far too high, and in the aggregate the loss to the country amounts to thousands of pounds annually. I feel confident in stating, however, that the number culled could be considerably reduced were more care used in the milking and management of our herds. The dairy-farmers in this country—and, I may state, in every other country where dairying is extensively carried on—are looking for a remedy which will control the incidence of this disease. So far, however, scientific investigation has failed in this respect. To

those fully acquainted with the history of the disease this is not a matter for surprise. The causative agent is a well-known organism which on gaining entrance becomes embedded in the sensitive secreting tissues of the gland, from which it cannot be removed by medicinal agents without injury to the tissues. For the above reason, medicinal agents having proved unsatisfactory, vaccination was given an extensive trial, with the result that it also proved unsatisfactory, and at the present time, in spite of the research work carried out, we have got to fall back on the former methods of treatment—viz., frequent stripping and massaging the udder at frequent intervals, followed by a stimulating liniment. To assist in the prevention of the disease milking operations should be carried out in a satisfactory manner; undue haste should be avoided. The machines should be run at an even pressure and not too high, thorough hand stripping should be in evidence, and the surroundings, milking-machines, and other appliances, together with the hands of the milker, should at all times be kept in a satisfactory condition.

Contagious Abortion.—This disease, while in evidence in almost every dairying district throughout New Zealand, is not so prevalent as in former years. A few cases may be seen on various farms in almost any dairying district, but of late years it has seldom assumed epidemic propensities. Experiments have been carried out in certain districts with anti-abortion vaccine without any satisfactory results having been obtained. Experiments carried out in other countries show unsatisfactory results when vaccines were used as a method of controlling the disease. The only method of obtaining a clean herd is by segregation, and for any one wishing to put this into effect the advice of the Field Veterinarians are always available. Taking into account the wide distribution of the disease and the extra trouble incurred in segregation, it is doubtful whether farmers would think themselves repaid for the extra trouble taken, but the matter is well worth their consideration. A precaution that every farmer should take is to have the blood from each cow subjected to the agglutination test. This will afford the owner information which will enable him to isolate all affected animals whenever his conditions permit, the necessity for this being that an affected animal, after calving, is able to spread the disease whether she has carried her calf the full time or otherwise.

Temporary Sterility.—This trouble is still strongly in evidence in all districts where dairying is carried on, and is a source of anxiety and trouble to farmers, although not to such an extent as in previous seasons. Research work in this and other countries, although carried on extensively, has not been the means of bringing out any definite new knowledge on this subject, though progress is being made here. The present-day literature written by those best qualified to give an opinion is most confusing. Authors disagree as to the cause or as to the seat of the trouble. In the circumstances we must continue to push forward our own research.

Parturient Eclampsia.—The incidence of this malady during the past season was considerably less than in previous years. With the exception of a few cases, the complaint was practically confined to the Waikato, in which district a fairly large number of cases were seen. The origin of this complaint is obscure. Strictly speaking, there is no organic disease, and one is forced to the conclusion that it is due to the absorption of toxins. During the past season in the Waikato a very early spring was observed, with a corresponding growth of young luscious grasses, and it was on those farms where abundant green feed was in evidence that the trouble was most in evidence, and more particularly where no hay had been fed during the late winter and early spring. I personally visited a number of farms where cows were affected and saw a fair number of cases. In doing so one is struck by the lack of knowledge amongst the farming community in regard to diagnosing and treating diseases affecting farm animals. At this period the constitutional disturbances from which our dairy cows suffer are many and varied, and are more in evidence than during any other season. Each case requires to be treated on its merits. Amongst many farmers there is a preconceived idea that there is only one malady affecting dairy cows in the spring of the year, whether the trouble be parturient or dietetic in its origin. All cases of sickness are treated alike, with the result that the mortality is far greater than it should be. Through circumstances the dairy-farmer looks to the Government Veterinarian for help and assistance in such cases, and numerous complaints are heard and indignation is shown when such assistance is not immediately forthcoming. Farmers should consider the circumstances in this respect. Here is an officer with a large district to cover. In many instances outlying parts are fifty miles and over from his headquarters, and it is an impossibility for him to see one quarter of the cases of sickness in his district. Eclampsia, like many other diseases to which our dairy herds are susceptible, is amenable to treatment, but the dairy-farmer has not the training to enable him to diagnose or treat all such cases successfully. It is therefore an urgent necessity that organized veterinary services for diagnosing and treating the ailments of animals be established in the dairying districts.

Blackleg.—The position in regard to this disease remains about the same as last season. A number of deaths were reported from this cause from the Taranaki, Waikato, and North Auckland districts. There is no doubt that early and successful vaccination is an important factor in lessening the incidence of blackleg on those farms where it is known to exist.

Cattle-tick.—Area A, Auckland District: In the North Auckland district (where ticks were originally seen), with the exception of the Dargaville district, where it remains about the same, cattle-ticks were less in evidence than in former seasons. In the Coromandel Peninsula and Tauranga district no improvement is reported, while in the Opotiki district a definite increase is reported.

Auckland District, Area B: There is a decided improvement in this area. With the exception of one holding at Matamata, where a single tick was found, no fresh outbreaks occurred, and a decided improvement has taken place on those farms where ticks had previously been seen. Last season an outbreak was reported from Taumarunui. The farm on which the outbreak occurred was cleared and burned, and although a close watch was kept no further ticks were seen this season.

Wellington District, Area A: An increase is reported from the northern part of the Poverty Bay district, and during the season several ticks were found in B area, also in clean country just outside the B boundary. In this district it will be somewhat difficult to control the cattle-tick, owing to the movement of sheep, which takes place in very large numbers. Already there is considerable dissatisfaction with the boundaries and the dip at Tolaga Bay, and, I understand, representations will be made in order to get the boundaries altered.

In the New Plymouth district a close supervision this season over all properties in the previously infested Waitara area failed to reveal the presence of cattle-tick. Unfortunately, however, two fresh outbreaks occurred during the latter part of December and early in January—twenty-five miles south-west of the town, and between it and Opunake. These farms were close to the coast, and altogether six ticks were found.

In the Nelson District one tick was found on a farm near Collingwood and another was found in the Takaka district. Our suspicions that ticks were being carried by the agency of sea-birds was strengthened by a cattle-tick being found on a gull on D'Urville Island.

In all cases where cattle-tick are found in fresh areas the cattle are sprayed, and, if possible, all roughage burned, and a close watch is kept on all neighbouring stock. This has been the means of preventing the spread, as on many farms so affected no further ticks have since been found.

I would again like to urge upon the farmers in affected areas the necessity of making more use of their dips, the burning, where possible, of all cover and roughage, which ticks are known to use as harbourage. By this means the cattle-tick could be reduced on those farms where they are known to exist.

Ragwort Poisoning.—A considerable number of deaths have been reported from all districts where the weed is prevalent. The matter of control with regard to this plant is one which has given a considerable amount of worry both to the farming community and to the departmental officers alike. To those settlers situated in rough unstumped areas the control gave rise to no small amount of worry and difficulty, and, while sympathizing with those individuals, it was necessary in the interests of the country as a whole that seed from such areas should not be allowed to spread. Now, however, that in sodium chlorate a reliable agent has been found for the control of this weed it should not in the future be difficult to keep under control. If, when supplies of the material are available, farmers will only take the initiative and spray the plants at the proper season of the year, and thus prevent their growth, less will be heard of its injurious effect on live-stock.

Foul-in-the-foot.—A considerable number of cases were reported from all dairying districts. As the complaint is one which can be prevented by better herd-management, it is the duty of owners to see that such measures are put into force as will prevent a recurrence. As pointed out in my last annual report, the disease is caused by an organism which gains entrance through a wound in the region of the hoof. This being so, dairy-farmers should eliminate all conditions in the yards and surroundings that are likely to cause such injuries, and also keep the yards as free as possible from contamination.

Dietetic Troubles.—A considerable amount of trouble has been experienced throughout the Dominion on account of dietetic troubles. In all cases reported attention and advice was given by the field officers of this Division.

Bush Sickness.—As stated in my last year's report, the experimental work carried out in affected areas has not yielded any important knowledge regarding simple methods of soil-treatment which will render the pastures in themselves in every way fit to maintain cattle and sheep in full health and vigour. Further experimental work is desirable in this direction in order, if possible, to place the settlers in these regions on the same footing as settlers in other localities. At the same time, much good work has been accomplished by way of keeping stock in these areas in better health and condition, and also in regard to bringing stock that become affected back again to normal. Settlers in the affected regions have now come to a better understanding in the use of iron ammonium citrate and through actual practice know what it will do for their stock. Larger quantities are being used year by year. At the present time another fresh order has to be placed over and above the ordinary quantity, which was an increase on the previous year's supply. Many settlers are testifying as to its value, stating that in these areas dairying would be an unprofitable business if this preparation was unobtainable. There is no doubt but that this remedy has revolutionized the industry in those affected areas.

SHEEP.

Parasitic Gastritis.—Again a heavy mortality in the late autumn and early winter of last year has to be reported as due to this trouble, particularly in the Wanganui and surrounding districts, where the mortality was higher than it has been for years. Other parts of the North Island also suffered severely, although not to such an extent as the districts mentioned. In the South Island very little trouble occurred.

In regard to this trouble climatic conditions play an important part in determining its incidence. When a wet season, with a resultant rank growth of innutritious feed, has been experienced sheep-farmers must take every precaution against the ravages of internal parasites amongst their flocks, particularly their hogget flocks. The lambs should be weaned as early as possible, drenched, and turned on to pastures or catch-crops specially prepared for them. If possible, dry feed, such as oats or bran, good lucerne hay, &c., should be fed in addition. If lambs are allowed to go off at weaning-time through feeding on coarse innutritious grasses or through any other cause, they are liable to become a prey to internal parasites, with a resultant heavy mortality in spite of any treatment that can be given later. Wet seasons are also favourable to the life of parasites on the pastures; therefore in such seasons additional precautions have to be taken.

Liver-fluke.—This has been very little in evidence during the season.

Lice.—I am pleased to report that a considerable reduction has taken place in the number of sheep found in saleyards affected with lice.

Renal Congestion in Lambs.—Although a few cases of this disease may be found in most districts where sheep are reared, the disease is confined principally to certain parts of the Otago District, and to a lesser extent to South Canterbury. Research in connection with this disease has been carried on for a number of years, and, although considerable knowledge has been gained, we are very little further forward from a practical point of view. Further information on this matter is contained in the report of the officer in charge of the Wallaceville Laboratory.

Maggot-fly Infestation.—This pest is seen in every district in New Zealand. In those districts where it is already established there are indications that it is becoming more numerous. The ravages of this fly largely depends on seasonal conditions. In muggy weather it is strongly in evidence amongst the flocks, whereas in dry seasons it is scarcely noticeable. The early portion of the season just past was ideal for this pest, and on this account the increase reported may only be due to seasonal conditions. The natural enemy to the blow-fly, *Alysia manducator*, was liberated in several districts in New Zealand, but so far it has not had time to prove whether it has established itself or not. In the meantime sheep-farmers should not neglect those methods hitherto in use to keep the pest in check—viz., keeping the flock as free as possible from dags and dirt, careful inspection, and dressing when necessary. The destruction of all dead carcasses, offal, sheep-dagging, &c., should receive attention, as these are the main breeding-places for the next season's crop of flies.

Lymphadenitis.—It has been found this season that the disease, although still more prevalent in Canterbury and parts of the Otago District, was not by any means confined to these districts, and that stricter methods of meat-inspection showed that a small percentage of sheep and lambs were affected in almost every other district. This more thorough inspection was brought about in order to meet the requirements of the British authorities. While this additional inspection operates in the direction of preventing affected carcasses reaching the home market, it in no wise assists the sheep-farmer in lessening the incidence of the disease amongst his flock, a matter that should be the aim of every flockowner throughout the Dominion. Departmental officers are notifying all farmers whose sheep and lambs are found to be affected when passing through the works, and with the notification is a leaflet giving advice in the control of the disease. It is the duty of every farmer, when notified that his flock is affected, to do all in his power to comply with the instruction, in order to lessen the incidence of the disease, and get rid of it where possible.

General.—A number of other minor complaints were seen in several districts, but in no instance were they prevalent. In all cases the advice and assistance of the field officers were available to the settlers.

PIGS.

The number slaughtered for the season 1929–30 was 524,753, as compared with 516,471 for the previous season—*i.e.*, an increase of 8,282. Although the total number slaughtered was in excess of the 1928–29 figures, the amount exported was less, being 155,288 cwt., as compared with 165,163 cwt. exported the previous season—*i.e.*, a decrease of 9,875 cwt. In spite of the fact that the quantity exported was less than for the previous season, the actual value was £542,127, as compared with £495,910, an increase of £46,217.

These figures show that the consumption within New Zealand is increasing. At the same time, if the requirements within the Dominion are to be met and we wish to maintain and increase our export, then an increase in production is essential. As shown above, our slaughtering for the past season amounted to 524,735. Taking into consideration the numbers carried over for breeding purposes and those that could not be fattened, it will be seen that statistically it takes the milk or whey of two cows to produce one pig. If, with the addition of a little barley or meat-meal, dairy by-products were fed under such conditions as would enable the animals to derive the greatest benefit out of the materials provided the output in bacon pigs and porkers could be increased far in excess of the cost of the extra feed provided. Climatic and other conditions are favourable to the raising of this commodity, and it is worthy of more serious consideration than it receives at present. More systematic inspection-work has been laid down for the winter season.

Pasteurellosis.—A few cases of this were seen in several districts, particularly in the North Island. Attention was given in all cases. By isolating affected animals, cleaning up and disinfecting infected places the trouble was soon overcome.

Bacterial Necrosis.—A number of cases were seen in the Auckland District, due to the filthy conditions under which the pigs were kept. Several deaths occurred. Improved conditions and better feeding brought the trouble to an end.

A number of small mortalities due to other causes have been investigated. In most cases insanitary conditions, improper feeding, and want of shelter having been at the root of the troubles. I would again like to impress upon the pig-farmers of this country the absolute necessity for paying more attention to the conditions mentioned.

Live-stock Statistics.

Sheep.—A substantial increase in the numbers of sheep held in the Dominion was again revealed in the returns collected as at the 30th April, 1929. The returns show an increase of 1,917,572 in the total sheep. Of this number, the increase in breeding-ewes was 1,074,104, bringing the total number of sheep to 29,051,382 and breeding-ewes to 16,608,155. Of the increase shown, the South Island is responsible for 811,233 and the North Island for 1,106,339. It is also of interest to note that the number of owners of sheep have increased by 730. The number of lambs slaughtered at freezing-works for the year under review was 6,462,783, an increase of 431,772. For the same period sheep slaughtered showed an increase of 442,476. Cattle show an increase in all classes compared with the previous year's figures. The total for 1929 is 3,445,790 head, including 1,371,063 dairy cows. A decrease of 30,166 in swine has taken place, the total number at 31st January, 1929, being 556,732. A decrease of 8,174 horses has taken place compared with the figures for the previous year, the figures being 298,980.

Slaughter of Stock.

A very satisfactory lambing season was experienced, and, contrary to earlier expectations, weather conditions eventually turned out to be quite excellent, and resulted in a heavy slaughtering season for both sheep and lambs. The number of sheep and lambs slaughtered for the year ended 31st March, 1930, both for export and local consumption, easily constituted a record, resulting in a total of 10,014,917, made up of 3,420,282 sheep and 6,594,635 lambs, being an increase of 440,216 sheep and 445,153 lambs when compared with the previous year. The number of cattle slaughtered show a decrease of 40,362, but swine show a recorded increased slaughtering of 8,282 and calves an increase of 45,387. The following table shows the stock slaughtered during the past year at freezing-works only, the previous year's figures being shown for comparison :—

Stock.	Year ending 31st March, 1930.	Year ending 31st March, 1929.	Increase.	Decrease.
Cattle	138,467	165,643	..	27,176
Calves	393,513	342,582	50,931	..
Sheep	2,598,510	2,156,034	442,476	..
Lambs	6,462,783	6,031,011	431,772	..
Swine	279,230	270,084	9,146	..

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.	1926–27.	1927–28.	1928–29.	1929–30.
Sheep	1,729,963	1,580,024	1,421,741	1,982,550
Lambs	3,806,498	4,093,750	4,093,332	4,431,424

As will be seen, these figures show an increase in slaughtering of sheep and lambs of 898,901 for the period 1st October, 1929, to 31st March, 1930, compared with the same period for the year 1928–29, and from indications the close of the slaughtering season should disclose a record increase compared with any previous year.

Following are the numbers of each class of animal slaughtered under direct inspection during the year ended 31st March, 1930 : Cattle, 284,517 ; calves, 438,678 ; sheep, 3,178,625 ; lambs, 6,570,316 ; swine, 458,608.

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

Stock.	Abattoirs.	Meat-export Slaughterhouses.	Bacon-factories.
Cattle	146,050	138,467	..
Calves	45,165	393,513	..
Sheep	580,115	2,598,510	..
Lambs	107,533	6,462,783	..
Swine	141,208	279,230	38,170

Stock slaughtered at ordinary slaughterhouses during the year ended 31st March, 1930, was as follows : Cattle, 78,451 ; calves, 1,696 ; sheep, 241,657 ; lambs, 24,319 ; swine, 27,299.

In addition to the stock slaughtered at meat-export slaughterhouses, abattoirs, and ordinary slaughterhouses, 38,846 carcasses of pork killed and dressed by farmers and sent into butchers' shops were examined by departmental officers.

In connection with the animals shown in the above table as slaughtered at meat-export slaughterhouses, the following numbers of the respective classes are returned as having gone into consumption within the Dominion: Cattle, 35,710; calves, 5,912; sheep, 213,862; lambs, 65,260; swine, 27,902.

Compensation paid for Stock and Meat condemned.

Compensation to the amount of £18,183 0s. 6d. was paid out during the year for animals condemned in the field for disease under the provisions of the Stock Act, and £13,383 19s. 6d. for carcasses or parts of carcasses condemned for disease on examination at the time of slaughter at abattoirs, meat-export slaughterhouses, &c., under the provisions of the Slaughtering and Inspection Act.

Importation of Stud Stock from Abroad.

Owing to conditions regarding foot-and-mouth disease in Great Britain, a prohibition still exists on the importation of cattle, sheep, and swine from there, and up to the present it has not been possible to take steps to lift the embargo. At present the only countries from which cattle may be imported into New Zealand are Tasmania, Canada, and the United States (with the exception of the State of California); while swine may be introduced only from Tasmania and Canada. Cattle and swine from these countries must be quarantined on arrival in the Dominion. The following imported animals were placed in quarantine during the year for the prescribed period: Horses, 1; cattle, 41; sheep, 7; swine, 4; dogs, 44.

Exportation of Stud Stock.

During the year under review the following stud stock was exported: Sheep, 3,358; cattle, 128; swine, 28; horses (draught), 9. In addition to these draught-horses several shipments of trotters and thoroughbreds were made to Australia for racing purposes, but many of these returned at the conclusion of their engagements.

Dairy Inspection.

At the present time there are approximately four thousand registered dairies supplying the cities, boroughs, and townships throughout the Dominion, and of these over two thousand are supplying the four larger centres. As most of these dairies are supplying milk that has not been pasteurized, essentials demanded by the Inspectors are that the utmost care and cleanliness is maintained so that the product may reach the consumer in a satisfactory condition. To ensure this the surroundings are required to be kept in a sanitary condition, and the hands and wearing-apparel of the milker kept clean. Special attention is paid to the milking-machines and milk-tubes, so that no sediment of milk is allowed to accumulate at the joints or other parts. The udders of the cows are required to be kept clean, and milk-sediment tests are taken at frequent intervals to determine the condition of the milk and demonstrate the same to the farmer. In addition to this the animals comprising the herd are examined for disease.

Many owners of dairy herds are now asking that the tuberculin test be applied to their herds, so that the milk supplied may be above suspicion. Over and above this, composite samples of milk are taken from many herds and subjected to a laboratory test at the Department's Laboratory at Wallaceville, and should disease be found the whole herd is subjected to the tuberculin test. When one is acquainted with the enormous amount of work required to produce a sound wholesome milk, it is to the credit of those concerned that our milk-supply is on so high a standard. Year by year sees a steady improvement, brought about by better sanitation, improvement in the cleanliness of machines and attendants, better cooling methods, and better and more up-to-date buildings. The ramshackle building and slipshod method of registered dairying is now a thing of the past. In the dairies supplying Christchurch last season some three thousand cows were subjected to the tuberculin test, and out of this number only 2·355 per cent. reacted. When one considers that many of these cows were tested on suspicion, this is a very satisfactory record.

Poultry Industry.

It is much to be regretted that the past two season's experiments with New Zealand eggs on the London market have not been more encouraging in respect to price prospects.

The eggs themselves have opened up in good condition on the whole, and the quality has been reported on as quite satisfactory, demonstrating that if a payable price was obtainable there is nothing in the way of establishing an export trade in eggs. Unfortunately, however, the margin of loss is considerable, and unless production-costs and costs connected with the export can be reduced by at least 4d. per dozen there is little likelihood of a payable export trade in eggs developing. The question of disposing of the surplus eggs in the flush season is therefore one that must be given consideration, and it is hoped that by co-operation between the respective interests a system will be evolved that will put the marketing of eggs locally on a better footing and assist in the consumption of increased quantities of eggs. There is ample evidence that given a guaranteed article, the demand will increase, and if the local market can be so encouraged the present apparent surplus will pass away and at least consolidate the present standard of production.

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

In reviewing the economic condition of the poultry industry for the past year it has to be considered that from the point of view of producers the season's operations have not been highly remunerative, and this state of affairs is due chiefly to the low prices ruling for eggs during the spring and summer months. Although 7,952 cases containing thirty dozen eggs each, together with 20,000 lb. of egg-pulp, were exported to the London market during the flush season, under Government guarantee, the export of this surplus over and above local requirements did not have the effect of raising the price of eggs to a really paying point to the producer. The position as disclosed shows the necessity for better organization amongst producers in the disposal of their eggs. For example, the Government guarantee for large-sized eggs (2 oz. and over) returned to the producer from 1s. 3d. to 1s. 4d. per dozen net, whereas at the same time in many parts of the Dominion for eggs of similar quality producers were receiving in the region of 1s. to 1s. 1d. per dozen, and even less, on the local market. While the producer suffered, the consuming public reaped a benefit in being able to secure eggs at a low price, which in many cases was below the cost of production.

That egg-pulp is a big factor in connection with the marketing side of the industry is borne out by the fact that on the 31st December, 1928, various freezing-works in the Dominion were holding 423 tons of this commodity, equal to about 23,721 cases of eggs of thirty dozen each, and 312 tons on the corresponding date in 1929, representing about 17,469 cases of thirty dozen eggs in shell.

New Zealand has gained a particularly good name for eggs exported to the London market, but it is to be regretted that the price now obtainable in London does not allow a reasonable margin of profit for the New Zealand poultry-farmer. The 7,952 cases exported last year under Government guarantee will probably fall short of a profitable return by about 10s. per case. Account sales to hand again indicate the fallacy of exporting small eggs, for in the case of one shipper's return there was a difference in price of 9s. a case —*i.e.*, practically the cost of freight—between the maximum and minimum-sized eggs shipped.

In looking to the future prospect of the industry, taking into consideration the lower price for eggs in London compared with previous years, and considering, too, the present high cost of wheat (the recognized staple grain food for poultry), the prospect of exporting eggs to the overseas market at payable prices is by no means encouraging. In summarizing thus the present crisis it should not be inferred from my remarks that the poultry industry is not capable of further expansion. The local market, which is at least one of the best in the world for eggs and for table poultry, is very badly catered for, and as a result the demand by local consumers is by no means what it should be. The difference between the amount received by the producer and the price paid by the consumer, particularly in regard to table poultry, is far too great; while another weakness in connection with the marketing side of the industry is the difference between the summer and the winter prices of eggs. During the former period it is common for fresh eggs to be retailed at about 1s. 2d. per dozen or even lower, whereas during winter they realize up to 3s. per dozen. As a means of levelling up market prices whereby a more uniform price would be maintained throughout the year, the cool storage of the summer surplus should be availed of to a much greater extent than it is at the present time.

During the year a small consignment of eggs—viz., 500 cases—was sent from Canada to the Auckland market under the cool-storage process. These, I understand, realized profitable returns. No doubt the extension of the cool-storage system in this country would tend to check such importations.

With regard to the local marketing of eggs, it is pleasing to report that a keener interest is now being taken by those concerned in the industry to raise the standard of eggs. An endeavour is being made—and rightly so—to have eggs sold according to their quality and weight. Indeed, in some quarters they are already being disposed of under these conditions. In this connection, however, it is questionable whether any system of grading will give permanent satisfaction unless it is adopted in the chief marketing centres under Government regulations.

The Wallaceville Poultry Station now possesses a flock of high-class laying fowls and ducks, while the demand on this plant for sittings of eggs and stock for breeding purposes showed a considerable increase during the past year. This farm is serving a valuable purpose, in that it enables the instructional staff to acquire first-hand knowledge as a result of practical investigation of the various details connected with poultry work. In co-operation with the officers attached to the Veterinary Laboratory much investigation work on diseases and parasitic life which affect poultry has been carried out, and in order that this branch of the work may be extended arrangements are in train for one of the Poultry Instructors to take charge of the Station.

A large amount of practical instructional work was carried out among poultry-keepers during the year, and many other services were rendered to the industry.

Wool.

The wool-sales season did not open up at all promisingly, and as the season advanced prices still further declined, with the result that passings became frequent, and large quantities of wool were not sent to the sales and are still held in the Dominion in the hope of better prospects materializing. The total quantity thus held over in the Dominion has been estimated at from 140,000 to 150,000 bales.

The following extracts are taken from the report of Mr. J. G. Cook, Wool Instructor:—

Sheep throughout the Dominion commenced the winter of 1929 in good condition, and the weather conditions experienced during this period were varied with spells of very broken weather, also during the spring and early summer months, thus delaying shearing operations for the 1929–30 season. The bulk of the wool did not open up very clean, and a large percentage of it was tender when compared with the quality of that of previous years. At the opening of the first wool-sale, held in Wellington on the 14th November, 1929, there was a full attendance of buyers, and pieces and belly-wool were in keen demand by a number of French buyers, which demand was maintained at each following sale. Prices for wool at the first sale were fair, but at later sales prices declined rapidly, with the result that a large number of farmers withdrew their wool from sale, and a considerable number are still holding their wool in their sheds. The bulk of the wool sold was shipped to the United Kingdom, but France, Germany, Australia, United States, Belgium, and Japan all took fair quantities. The woollen-mills operating in the Dominion were able to secure wool suitable for their purposes, while Dominion wool-scourers were more to the fore in their purchases than has been the case for some years past.

During October, 1929, the Department received from the High Commissioner, London, samples of two new varieties of woolpacks for trial purposes, and these packs were to be filled with wool by some of the sheep-farmers in the Dominion. Each lot consisted of twenty-five woolpacks, one lot being manufactured from paper, and the other from wire and paper, the paper being twisted round the wire. One each of the sample packs was retained at headquarters, while the balance were sent to Christchurch, where they were divided into eight lots of six packs each, and were then distributed among seven different sheep-farmers and one wool-scourer. Arrangements were made with each of these farmers to supply the Department with full information regarding the quality of these packs. The material contained in the all-paper woolpacks is too hard and makes the sewing of the cap to the pack a very tedious and slow process; in addition, the material cuts through both wool twine and cord twine during the process of sewing. When the pack is full of wool the outside surface is very smooth, and consequently the stacking of these packs is very difficult. These packs, however, stood the pressing, dumping, and handling very well. The material in the wire-and-paper woolpacks stood up very well under the pressing and dumping, but tore badly when being moved with the hooks, leaving broken ends of wire protruding which are liable to tear the clothes and hands of persons handling them. This material is also inclined to be too stiff, making it hard to sew the cap to the pack. As a result of the tests neither of these woolpacks appealed to the farmers, who still prefer the jute packs.

During the past year practical demonstrations on live sheep have been given, showing desirable points and the points to avoid; in addition, practical demonstrations were given in various shearing-sheds on handling the wool-clip for the market. Lantern lectures, with suitable slides, have been delivered, and all lectures and demonstrations were well attended by the farmers.

Microscopic examination of wool-samples: A considerable amount of this work has been carried out during the year, and reports thereon sent to each farmer concerned, as a guide in avoiding the use of faulty rams in the ewe flocks.

Rabbit Nuisance.

The position of the country in respect to the rabbit pest has continued to be satisfactory, and on the whole the favourable position has been maintained and in some districts improved. There have been indications of a tendency to slacken off in the work of destruction in some parts, owing, no doubt, to the fall in the price of skins; but this position has been closely watched in order that any tendency in that direction may be as quickly as possible stayed.

The Otago-Southland District shows a more marked tendency in this direction than that of any other district, but, taking into consideration the condition of that district in respect to rabbits previous to the last few years, it is perhaps not altogether surprising under the circumstances now existing that they have shown up in slightly increased numbers in parts.

The export of rabbit-skins, which is a good index of the condition of the pest within the Dominion, has shown a decrease of 2,981,155 compared with the same period last year.

The Rabbit Boards have continued to do good work, and further demonstrated the value of local control. A sum of £13,155 was paid out by way of subsidy to Boards under the provisions of the Rabbit Nuisance Act.

Noxious Weeds.

Despite the earnest and active efforts of the Department and its officers, the area infested with noxious weeds does not, as a whole, appear to show any great improvement. This is specially the case as regards Californian thistle in Canterbury, blackberry in Westland, and ragwort in parts of the central portion of the North Island. Of course, in many localities these weeds are spread over either inaccessible areas or such poor lands that clearing is impracticable, and consequently enforcement of the Act is not possible. Nevertheless, in those localities that are fairly clear the Inspectors are making every endeavour to induce owners to do satisfactory work. While admitting that there are large areas of absolutely poor country badly infested with noxious weeds, and that the cost of clearing would, with the means at our disposal up to the present, amount to more than the value of the land, there is also this fact to take into consideration: that some fairly good land, potentially productive, is practically out of use owing to the growth of weeds.

The experiments on parasitic control of weeds, commenced by the Cawthron Institute, have not so far shown marked results, but probably the time has been too short, and landowners have had to depend on other means of control—namely, the methods that have proved most efficacious in the past. Unfortunately, cutting is merely a palliative and does not ensure eradication. Goats continue to give good results in regard to blackberry, and so far are the most effective means in use for the control of this plant. Ragwort has been largely controlled by the use of sheep where practicable.

The Department is anticipating great things from the use of sodium chlorate in respect to ragwort and perhaps some other weeds, and results already obtained from carefully conducted experiments are inspiring a cheerful outlook for the future.

Shearers' Accommodation.

The inspection of shearers' accommodation, carried out on behalf of the Department of Labour, has been attended to as far as the other official duties of Stock Inspectors would allow. However, the inspection is carried out as well as possible in the circumstances, and shearers' accommodation is being gradually improved. On the whole, the accommodation provided is fairly good, and during the year under review a number of improvements, including new buildings, have been arranged between Inspectors and employers without any trouble.

REPORT ON WALLACEVILLE LABORATORY BY C. S. M. HOPKIRK, B.V.Sc., OFFICER IN CHARGE.

The year has seen considerable changes in both staff and buildings at Wallaceville. There is now in sight a team of workers for release on the problems presented by animal diseases as they occur season by season in cattle, sheep, pigs, poultry, and dogs, and there is also more accommodation for workers in their various spheres of activity. The new division of labour is based on the work of bacteriology, pathology and blood chemistry, and nutrition and dietetics. Field-work is in the hands of the Divisional Field Veterinarians and Stock Inspectors, and chemical analyses in those of the Chemistry Section. A new policy has also been inaugurated in the form of a permanent diagnostic laboratory at Hamilton for material from the Auckland Province, and in fitting up a room in New Plymouth for the use of officers on special investigational duties in Taranaki. The method of taking temporary fittings from Wallaceville into the field when necessary is also of great use, and will gradually be built up until such time as a motor laboratory can be financed.

Staff.

Mr. D. A. Gill spent nine months abroad, travelling through America to Great Britain, where he was greatly assisted by the Empire Marketing Board, and was able to visit the principal institutions in Great Britain and the Continent. He returned via South Africa and Australia, and in those countries also met the principal workers, so that the latest work from most parts of the world has been seen on the spot, and made known to the Wallaceville staff. The visits to big institutions in other countries has placed Wallaceville in direct touch with them, and the personal touch will no doubt prove very useful and beneficial to New Zealand workers in animal diseases. Increases in staff have been made as follows: Mr. T. A. Blake was appointed in place of Mr. C. V. Dayus (who became a District Superintendent) for investigation into dairy-cow diseases. Mr. J. Hill Motion was chosen in Britain to join the staff as Animal Bacteriologist. He was given six months travelling through the principal British and Continental laboratories before coming to New Zealand, so that he might obtain the latest information on cattle-diseases and on technique from older countries. Mr. Josland was employed as a Bacteriological Assistant, but owing to his knowledge of biochemistry he has since been given work in the new biochemical laboratory. The Officer in Charge has been appointed official correspondent to the Bureaux of Animal Health and Agricultural Parasitology.

Building Operations.

Four laboratory rooms and a library museum were added during the year. At the same time a storeroom was arranged and a photographic room built from two small converted storerooms. The acetylene plant was also extended.

Diagnostic Work.

Wallaceville Laboratory examined 6,457 samples and specimens during the year; Hamilton Laboratory, since its commencement in November, 2,073; and New Plymouth, 808—making a total of 9,338, against 9,347 for last year. Excluding milk and blood samples, 1,532 specimens have been examined in the three laboratories. 663 of these were received in sterility work in dairy cows.

Cattle-diseases.

Contagious Mammitis.—The greatest number of samples were, of course, received in connection with mastitis. This disease does not seem to increase or decrease to any great extent, being always present in all herds, but differing in virulence and amount in each herd. It is noticeable that in hand-milked herds there are fewer cases than in those herds milked by machine. Of the 5,332 milk-samples received for examination 2,318 were reported upon as being positive, while 3,014 were to all appearances normal. The examination of all samples of milk from herds for those owners who can appreciate the help which must be derived by this method of attack upon the disease is not being taken advantage of by farmers to the extent it might be at the Central Laboratory, but it is made much more use of at Hamilton, where many of the farmers can and do make an effort to visit the Laboratory and see for themselves how they stand from month to month.

Some doubt is exercising the minds of workers in mastitis as to the correct interpretation of a slight catarrhal condition of the udder. Is it the result of past streptococcal invasion or invasion by *B. abortus*, or is it due to continuous injury at milking? The problem being undertaken is one bearing largely on correct diagnosis where farmers are attempting to cull cows acting as carriers of the mastitis streptococcus.

Experimental work during the year was conducted on—

(1) Methods of diagnosis by skin test. Results negative.

(2) The effect of injections into the udder of (*a*) acid solutions, (*b*) specific dye, (*c*) treated culture of streptococci, (*d*) the streptococcus causing souring of milk.

(3) An attempt to raise the virulence of *Streptococcus lactis*, the result being entirely negative.

Contagious Abortion.—2,085 blood-samples were put through the agglutination test during the year. Of these, 1,404 were negative and 681 positive. A number of instances have been found where the blood-samples sent in just after the act of abortion have yielded a negative reaction, whereas those sent in some weeks later have been definitely positive. It is just such experiences which throw a test with known limitation into disrepute. It has been disappointing also to find how few owners will contemplate eradication of abortion from their herds. One must agree that prevention and eradication are somewhat difficult, but in breeding from pedigree animals it would seem to be a necessity where competition is so keen. With increasing undulant fever in man the time may come when eradication will be demanded, and it would seem advisable to attempt to organize some scheme of eradication in suitable districts to see just how practicable the scheme would be.

Experimental work has been continued. Abortion was produced on two occasions by introducing the organism of the disease into the udder of cows. Acute mastitis occurs without the streptococci usually seen in such cases, and abortion itself occurs two months later. This suggests that in all possibility abortion is spread by way of milking-machines, as in the case of streptococcic mastitis. Vaccination with killed culture tried for a third year has again proved without benefit as a preventive.

Sterility in Bovines.—Extensive work on sterility in laboratory and field has been carried out, particularly in Taranaki, but also in the Waikato. Results suggest that varying factors may be responsible for temporary sterility, as, for instance:—

(1) Where there is a large amount of sterility in a herd in any one season the bull is at fault. The question of possible infectivity is being studied, and it may be that the bull becomes infected from certain carrier cows, and his genital organs do not recover for several months if at all. Cows become infected possibly in the cervix and pass infection on to clean bulls. The whole condition appears to clean up in varying times.

(2) Where only a small percentage is showing sterility it is usual to find that the affected cows are the heaviest producers, that the farm is not the best, and the lime and phosphorus ratio in the pasture is wide.

(3) To some extent as an after result of abortion.

Experimental feeding with the anti-sterility vitamine was unsuccessful. This work continues, and full proof should be obtained before long.

Examination of Composite Milk-samples for Town Supplies for Tuberculosis Contamination.—The total number of these samples examined during the last five years is 1,540, of which only 0·779 per cent. gave a positive result.

Tumours.—Tumours from stock sent in for identification numbered 122. A classification of these tumours is now being made annually for general comparative purposes.

Blackleg.—A number of recent cases of suspected blackleg have been proved to be due to the bacillus of malignant œdema. As such cases crop up in districts outside blackleg areas, some uneasiness has been experienced by farmers. However, a laboratory test is always available to discriminate between the two diseases.

Vaccination with a formalinized vaccine is being arranged for in place of the old powdered-muscle vaccine used for so many years.

Coccidiosis was identified in blood scours in calves in several districts.

Johne's disease was encountered on two separate occasions during the year.

Vaccination of calves with the tubercle bacillus of Calmette and Guerin was again practised, and several of these calves were fed on natural tuberculous milk. Vaccination in such cases was not protective. The vaccine also failed to protect animals against virulent culture.

Sheep-diseases.

Sheep-diseases as a whole are becoming better known, and our knowledge concerning them is increasing annually. The following report will show the volume of work performed, and with the biochemical aid which we may now command our knowledge should increase even more quickly. Deficiencies of minerals also come largely into sheep research work, and must always be guarded against. Work during this year has paved the way for a drive on ante-partum paralysis, rye-grass staggers, so-called circling of sheep, and also mortality in fat lambs.

Lamb Mortality.—This took premier position. The previous year's work had suggested a possible bacterial agent in the intestines setting up a toxæmic condition which killed the lamb. Consequently a trial was made with a Welchii toxoid to protect lambs by vaccination of ewes two months before lambing and lambs at birth. No good resulted from this, however. A laboratory was fitted up in Ranfurly, and material taken from Wallaceville to furnish it. In a report forwarded to the Director of Live-stock in March the main points noted were:—

(1) Lambs affected could show a varying number of symptoms not always ending in death, but depending largely upon the position of congestion or hæmorrhage into tissue from blood-capillaries.

(2) Analysis of ewes' milk was inclined to show increase in fat where deaths occurred.

(3) Analysis and examination for iodine deficiency proved that there was quite sufficient iodine for the requirements of the animals.

(4) Sections of organs gave a picture of capillary congestion similar to poisoning with histamine, and also showed that there was some degree of erosion of the mucosa of the intestines, with growth of a Welchii-like organism in that position.

(5) Work with intestinal bacteria showed that the Welchii type of organism was able to produce a toxin in ewes' milk media which set up active peristalsis, and to a large extent prevented circulation of blood from stasis of blood in capillaries.

(6) Pasture-analysis and a detailed history of each farm were appended. Death-rate for all causes approximated 8 per cent.

(7) Tailing proved valueless. Yarding was effective in controlling the disease.

Caseous Lymphadenitis.—Work with sheep ticks as a possible carrying agent was negative, the sheep being in good condition and free from disease when killed. Glands from lambs killed at the works showed that in some cases the lambs were not affected with the usual causative organisms, but with other pus-producing groups. A small flock of affected sheep is now on the Laboratory farm for observation and for experimental purposes.

Deformity in Lambs formed an interesting investigation during the work on pulpy kidney. Lambs are borne dead with "seagull" heads—*i.e.*, the lower jaws were missing. Six flocks where this occurred in Central Otago were visited, and it was found that in each case Chewings fescue or blue tussock were the main

winter feed. Breeding, lethal factors, and ergot feeding were considered to be possibilities at various times; but, from the diverse histories of rams, breeding can scarcely be considered seriously. Nevertheless twenty breeding-ewes and one ram of irreproachable history have been placed on one of the affected paddocks to winter and lamb to watch effects. Ergot has not been generally noticed on the country, and deformity does not occur generally on rye-grass where ergot is prevalent. Impaction of the rumen may be a possibility, but more possibly mineral deficiency and poor feeding may be the chief factors arresting development. Pastures are particularly low in sodium chloride, lime, and phosphorus. In conjunction with this work, two ewes were thyroidectomized, and will lamb on the Laboratory farm.

Parasitic Gastro-enteritis.—Feeding trials were carried out with hoggets already becoming anæmic and scouring. It was found practically impossible to get the lambs to take many of the dry foods, even with extensive starving; neither would they take licks or medicinal agents of any kind except by hand. Several parasitic drenches and supposed vermicides were tried, but were without effect. Change of diet, with, if possible, the addition of citrate of iron and ammonia to overcome the anæmia and act as a tonic, proved the only method of control.

Discoloration of wool has been noted on three occasions, probably following the warmer and damper weather conditions.

Ante-partum Paralysis.—Glucose injection in such cases was found to be unsatisfactory. Biochemical methods of attacking the disease are ready for the coming season.

Swine.

Vitamine B deficiency feeding trials mentioned in last year's annual report failed to produce paraplegia. The rice diet was changed to one of flour and casein. Spirochætosis has been seen frequently, and a Kahn test for syphilis on one pig proved positive.

Dogs.

Prophylaxis in Canine Distemper.—A method of immunizing dogs against distemper has recently been devised by the Medical Research Council of Great Britain, following on the successful researches of Messrs. Dunkin and Laidlaw at Millhill, London. This preventive measure, which can in no way inhibit or cure distemper when the disease has made its appearance, may be summarized as follows: The material is obtained from dogs and ferrets, the spleen in each case being used for the production of a vaccine (dead) and a virus (living) respectively. The vaccine is first injected into healthy puppies, and seven to fourteen days later, when the animal has developed a short-lived immunity, the virus is given and the immunity is consolidated so that the dog possesses a lifelong resistance to infection with distemper. Good results have been recorded in both Britain and America, and the manufacture of those prophylatics is now being carried out on commercial basis. Unfortunately, the protecting-power of the vaccine and the potency of the virus is so short-lived under ordinary conditions that material must be used immediately after preparation. This of necessity does not permit of the immunizing material being sent long distances, even in cold storage, for a satisfactory method of preserving the potency of the virus has yet to be found. Investigational work at Wallaceville during the last nine months of the year has consisted in testing out various types of material sent out by Messrs. Dunkin and Laidlaw from Millhill, and also the commercial vaccine and virus as now used in Britain, in order to find the most reliable type of virus for use in New Zealand which could be imported from Britain, and thus obviate the necessity of manufacture, since the process and control are both difficult and expensive. The work, which was nearing completion at the end of the year, is not very encouraging, and unless a new method of preparing the virus is found or the suggestion that two injections of vaccine at fortnightly intervals will protect dogs for six months can be relied upon the importation of prophylatic material from Great Britain will be impossible, and reliance will have to be placed on similar material made in this country. Attention of the staff at Wallaceville has already been focused in this direction.

Poultry.

A number of interesting conditions have been received during the year. Those of most interest were outbreaks of coccidiosis—the one in ten-day-old chicks, the other in six-months-old pullets which had not been fed correctly. Cases of spontaneous bleeding are receiving attention.

Miscellaneous Material.

Several miscellaneous materials, such as disinfectants, water-samples, &c., were put through for other Departments and Divisions. Those of most interest were a number of fermented honeys, which will form the subject of considerable investigation. Four different yeasts were found to be responsible for the fermentation, and these have to be classified and the reason for their presence and action found out.

FIELDS DIVISION.

REPORT OF J. W. DEEM, DIRECTOR.

Arable Crops.

The season's cereal harvest has been below average, mainly on account of the unseasonable weather in the spring and early summer, and yields generally per acre show a decline in comparison with the previous season, particularly in respect of wheat. Actual figures are not yet available, but it is estimated that 234,500 acres of wheat were sown, as against an actual sowing of 257,873 acres in the previous season. Of this latter acreage 255,312 acres were actually harvested for threshing and yielded a total of 8,832,864 bushels, or 34·60 bushels per acre. The estimated Dominion average yield per acre for 1929–30 season is 30·56 bushels for approximately 7,100,000 bushels total yield. Actual threshings so far show that the yield per acre is 31·10 bushels, and at this yield 4,352,068 bushels have been secured up to the present. It is possible that the crop still remaining in stack will yield slightly above the estimated yield of 30·56 bushels per acre, and if such is the case the total estimated yield of 7,100,000 bushels will be exceeded by about 117,000 bushels.

So far as the oat crop is concerned, it was estimated that for 1929–30 275,000 acres were sown, as compared with 267,739 acres actually harvested in 1928–29. Threshings so far average 41·76 bushels per acre. This is approximately the same yield as was obtained the previous season. The position generally in respect of oats and oaten chaff is quite satisfactory.

In respect of barley, the percentage threshed for the five seasons ended 1928–29 was 98·23 of the total area under that crop. The estimated area sown in 1929–30 was 20,500 acres, and, assuming that a similar proportion is threshed this year, there should be ample barley to meet Dominion requirements.

The area in potatoes in 1929–30 was estimated at 22,600 acres, as against an actual area in the previous season of 21,304 acres. Basing the yield on the average yield per acre for the last five years, the total yield from the estimated area sown for 1929–30 should approximate 124,000 tons, as against 123,607 tons in the 1928–29 season. The quantity available will provide more than ample potatoes for the Dominion's requirements.

Artificial Fertilizers and Farm Management.

Top-dressing continues to be looked upon as the main feature in pasture-production, and the practice has become standardized throughout the Dominion generally. The most important factor in this connection is the proper utilization of the increased herbage produced. This calls for improved methods of grassland-management—a subject which is being given very great attention by farmers and officers of the Division.

Now that the use of artificial fertilizers is a recognized part of cultivation routine it is interesting to note the extent to which farmers are utilizing this aid to production. From information available it is ascertained that for the 1929–30 season 71·08 per cent. of the area in wheat, 60·17 per cent. of that in oats, 56·38 per cent. of that in barley, and 56·84 per cent. of that in potatoes have been treated with artificial fertilizers. These figures show an increase on the corresponding figures for the previous season. It seems reasonable to assume that the progressive movement shown in this instance is indicative of a trend which will be maintained in the future.

Second-growth Country.

Experimental work on hill country, particularly in the Whangamomona County, which has been reverting to secondary growth, has been carried on, and the excellent results secured are being made use of over a wide area of country wherein the conditions are similar to those existing there. The demonstration farm being conducted in the Whangamomona County under the provisions of the Deteriorated Lands Act has been carried on throughout the year, and notwithstanding that it is being run partly on experimental lines the good work done by those responsible on the place has resulted in quite excellent returns being shown. The instructional officers of this Division continue to co-operate with the officers of the Lands Department in the work necessitated in connection with advances under the Deteriorated Lands Act, particularly in the back country of Taranaki and the King-country, and great improvement is shown. This is brought about chiefly by the use of fertilizers and subdivision. There are still 871 farms under supervision.

Instruction in Agriculture.

The instruction service has been strengthened by the appointment of several additional Instructors, but the demand for instruction and advice, coupled with the experimental work in progress, is now even more than the increased staff can satisfactorily cope with, and it is evident that the staff will have to be further strengthened from time to time as circumstances permit.

Experimental Farms and Areas.

Puwera.—During the year this farm has been conducted as an ordinary dairy-farm, and experimental work has been restricted to investigations regarding the value of nitrogenous manures, observational phosphatic top-dressing plots, and rotational grazing.

Marton.—The growing of root and cereal crops has been discontinued at Marton, and the area has been converted into a grassland research farm, where work is conducted in connection with grasses, particularly rye-grass and clovers, and the application of different fertilizers at different periods to study the effect on growth with a view to increasing production at the most necessary periods of the year. At the present time this area can undoubtedly be considered the most valuable grassland research and demonstration area in the Dominion.

Ashburton.—A great deal of work in connection with the improvement of the potato crop has been carried out on this area. Some 320 different lines of potatoes which were entered for certification were tried out on this farm. In addition, a large number of selections and imported lines of potatoes were grown. Trials of improved lines of wheat, barley, linseed, peas, and onions were also carried out. Activities generally at Ashburton have entailed a great deal of very careful work.

Gore.—The Gore Experimental Area, previously utilized largely in connection with experimental work for the control of disease in crops, particularly swedes and potatoes, has during the last year also been utilized largely as a grassland experimental area, and some interesting and important experiments are in progress there.

Galloway.—This area continues to be purely a dairy-farm of the commercial type, where farming operations are being successfully carried out under irrigation.

Waimaunga.—Dairying has been conducted on this farm during the year, but if it is intended to retain this area as an experimental farm the work being conducted thereon will have to be completely reorganized. This will entail an appreciable expenditure, and a recommendation in this connection has already been submitted.

Subsidized Farms.—The subsidized farms at Stratford, Manaia, Dargaville, and Winton have continued to do useful demonstration work during the year.

Winter Lectures.

The holding of winter lectures, or, as they were previously called, "farm schools," was continued in certain districts during the winter of 1929, but not nearly to the same extent as during the years 1925–27, inclusive. In every case the classes were limited to one day in each centre, and attendance at all lectures and the interest shown by those attending was gratifying to the lecturers.

Ruakura Farm Training College.

The Training College established at Ruakura in 1923 continues to meet a popular demand, and about fifty students are at present in residence. At the present moment more than sufficient students are offering to fill all vacancies that are likely to become available at the end of the June 1930 term.

Boys' and Girls' Agricultural Clubs.

The year 1929–30 recorded another very successful season in the Boys' and Girls' Agricultural Club work, with a further increase in entries and an extension in the area covered. In the past the Government has supplied all seeds and manures required, but during 1929 a rearrangement so far as Government assistance is concerned was made, and the Government, in addition to supplying seeds and manures, now subsidizes funds for prizes, &c., up to an amount of £40 per annum collected by any approved district organization set up to develop the club movement, not more than two such organizations in any one Education Board district to be subsidized.

Farmers' Field Competitions.

Farmers' field competitions continue very actively, mainly in the provinces of Taranaki and Wellington. For the season 1929–30 a very large increase in entries was experienced, the figures for the past three years being 268, 370, and 503 respectively. These competitions are varied in character, and embrace mangolds, carrots, swedes, soft turnips, chou moellier, ensilage, hay, and pastures. In addition to undertaking the actual judging of these competitions, the Department associates itself with the movement by giving certificates of merit for the first, second, and third prize winners.

Land-development Schemes.

In connection with the Government's land-settlement policy the Fields Division has been entrusted with the work of breaking in a large tract of pumice land. The area selected for a commencement of this work in 1929 is situated twelve miles from Rotorua. The aim is to bring in and sow in grass 1,000 acres in 1930. The position at the time of writing is well in hand, and it is fully expected that 500 acres of the area will be sown in the spring of 1930 and 500 acres in the following autumn. A further development scheme entrusted to the Division in connection with the Government's land-settlement policy is the breaking-in of an area of pakihi land on the west coast of the South Island. A start has been made on an area of 250 acres near Westport, and the aim is to deal with 50 acres during 1930.

Chemical Control of Noxious Weeds.

During 1929 comparatively small quantities of sodium chlorate and calcium chlorate were procured from overseas for experimental work in the chemical control of noxious weeds. The use of these two chemicals for the control of ragwort, from the testing already done, has given very gratifying results. Where properly applied, both chemicals mentioned gave 100 per cent. of kills, and stand out head and shoulders above any other sprays for the control of ragwort that have come under our notice. In addition to the control of ragwort, both chemicals appear equally efficient in the control of pennyroyal, St. John's wort, ox-eye daisy, and many of the other soft-leaved weeds, while there are indications that they will considerably help in the control of Californian thistle and similar weeds.

Various firms in the Dominion interested in farmers' requisites are taking the necessary steps to have commercial supplies of sodium chlorate available by the early spring of this year.

Field Experiments.

The experiments to determine the value of nitrogenous top-dressing at different times of the year have been continued. These nitrogenous experiments are conducted on private farms in co-operation with the owners, and also on the Manaia, Stratford, Dargaville, and Winton subsidized demonstration farms. There has also been considerable extension in connection with the manuring of rye-grass to determine its effect on seed-production. Additional to the above there are in operation approximately six hundred experiments of various kinds under the direction of the Crop Experimentalist.

Crop-certification.

The object of crop-certification is to supply information that will enable merchants and growers to obtain seed that is true to name and reasonably free from seed-borne diseases. This certification business, which was commenced in the 1927–28 season, has been greatly extended, and now includes certification of rye-grass, white clover, and brown-top.

Ensilage.

During the 1929–30 season a definite drive to encourage ensilage-making was carried out by the instructional staff of the Fields Division, and the results have been very gratifying. There are still a few districts lagging behind, but special attention will be paid to these during next season with a view to bringing them into line with the more progressive districts. An article relating to the feeding of sheep on ensilage was published in the Department's *Journal*, and it is anticipated that the information contained in that article will be of assistance in the extension of ensilage-making in sheep-farming districts.

Insect Control of Noxious Weeds.

Distributions of cinnabar moth for ragwort-control were made during 1929 at fifty centres throughout the Dominion. These distributions have been done by officers of the Fields Division, working in co-operation with the Cawthron Institute. It yet remains to be seen what effect the cinnabar moth will finally have on ragwort.

Ironstone Land in North Auckland.

In the far north of Auckland is a considerable tract of country of ironstone formation which at the present time is not being utilized. Arrangements have recently been made for a small area to be taken in hand by the Department with a view to discovering whether this land can be economically broken in, and, if so, at what cost.

Reports for other Departments.

During the year an increased number of reports and investigations on land propositions have been made for the Lands and Survey and Forestry Departments. This work has occupied a considerable amount of time on the part of the officers concerned.

The Hemp Industry.

Two instructors in the milling of phormium (New Zealand flax) have continued to visit the various mills throughout the country and tender advice with a view to improving the milling practice. The services of these instructors have been largely availed of, and some improvement in the quality of the fibre coming forward from the mills for grading is apparent.

There has been a general increase in the quantity of hemp and other phormium products graded during the year. On account of the low price offering for phormium products, however, the hemp industry is in anything but a flourishing condition. Generally speaking, the leaf available for milling throughout the Dominion during the year was of fairly good average quality.

The quantity of hemp graded for the year ended 31st March, 1930, was 65,813 bales, as compared with 58,622 bales for the previous year, an increase of 7,191 bales. The quantity of tow graded was 20,070 bales, as compared with 17,534 bales for the previous year, an increase of 2,536 bales. Of stripper-tow, 1,280 bales were graded, as compared with 928 for the previous year, an increase of 352 bales. The number of bales of stripper-slips graded was 1,435, as against 1,344, an increase of 91 bales. Of the hemp graded 6·36 per cent. was good-fair, 45·19 per cent. high-fair, and 33·91 per cent. was low-fair grade. The percentage of good-fair shows a decline when compared with the corresponding figure for 1928–29, which was 8·25 per cent., but the percentage figures in respect of high-fair and low-fair show a slight increase on the corresponding figures for the previous season.

Departmental Photography.

The photographic work carried out for all branches of the Department, and occasionally for other Departments, has increased considerably.

Staff.

Owing to the increasing demands by farmers for advice on general farming subjects, and the extension of experimental and other investigational work, the whole of the staff, both field and office, have been working at high pressure, and I desire to place on record my appreciation of the loyal service rendered during a particularly busy year.

REPORT OF THE PLANT RESEARCH STATION.

A. H. COCKAYNE, Director.

A great volume of work has been performed by the Plant Research Station (Palmerston North) during the past year, and a brief account is appended of the main research activities of the various sections into which the station is divided.

Agronomy Section.

The work of this section falls into three closely associated divisions :—

1. The production, by selection, of pure and superior strains of farm seeds other than herbage-plant seeds :
2. The multiplication and distribution of these and of imported seeds by the Department or in co-operation with farmers :
3. The certification of the produce of farm crops conforming to certain standards of purity and freedom from disease.

1. Plant-selection Work.

Wheat.—This work is undertaken in co-operation with the Wheat Research Institute, and embraces the production of pure and smut-free lines of the standard commercial varieties. The following varieties are under selection : Solid-straw Tuscan, Solid-straw Velvet, Major, Pearl, Marquis, Velvet, Dreadnought, Hunter's, Sensation, White-straw Tuscan. Selection of the following varieties has reached the stage where selected seed is available for distribution : Velvet, Solid-straw Velvet, Dreadnought, Major.

Potatoes.—Potato-selection has as its objective varietal purity and freedom from disease with particular reference to virus disease. The search for virus-free tubers became so difficult that a number of varieties have been imported from Scotland and Ireland. These proved far superior to anything obtainable in this country. Of the material imported during 1928–29 we planted some 450 tuber units and thirty increase blocks in 1929–30. This work is likely to render available this season and next lines of seed potatoes superior to anything that is available at the present time. Constant rogueing for disease and efficient isolation to prevent reinfection are the main difficulties that have to be overcome.

Barley.—As a result of work commenced in 1926–27 we have four smut-free selections of each of the standard malting varieties—Plumage, Archer-Spratt, Plumage-Archer, Chevalier, Goldthorpe-Spratt—and selections are being made of "Gisborne."

Peas.—A large number of very promising strains are under trial.

2. Multiplication and Distribution of Selected and Imported Lines of Seed.

The stage has now been reached when it becomes necessary to organize the most important aspect of the work. Several lines were distributed last year, and further lots of wheat and potatoes will be available again this season. Several areas have been sown with Montgomery red clover, and further supplies of this and also a quantity of Kentish wild white clover are being imported for next season's sowing.

3. Certification.

During the past season we have undertaken certification in connection with potatoes, wheat, perennial rye-grass, white clover, and brown-top.

Potato-certification.—This is the third year of operation, and there has been an increase from 180 crops last season to 420 for this season. The necessary field inspections and sample trials have entailed a great deal of work for the officers of the Fields Division.

We consider that "cropping-power" is a far more reliable guide in determining relative values at this stage of our work than would be a statement as to the percentage of virus disease present, and accordingly great stress is laid on cropping-power in determining certification.

Wheat-certification.—Wheat-certification is undertaken in close co-operation with the Wheat Research Institute. During the past season over 14,000 bushels of certified wheat-seed has been sold to merchants. Some 2,000 bushels of smut-free Solid-straw Tuscan seed grown under departmental supervision has been made available.

Perennial Rye-grass Certification.—This has been confined almost entirely to Hawke's Bay and Poverty Bay Districts. A total area of 2,447 acres has been inspected and passed in the field. The economic value of the persistent strains of rye is of great importance, and certification affords a means of controlling with a considerable degree of accuracy the distribution and production of these strains.

White Clover.—The certification of old-pasture white-clover seed has been extended considerably, and a very desirable feature has been the inclusion of a fair quantity of seed from Hawke's Bay. The standard adopted so far has been one of age, and all certified seed is the produce of pastures five years old or over. A small amount of seed was accepted last season, and under trial has given sufficiently encouraging results to warrant continuation of this standard till a better technique has been evolved by the Agrostologist.

Brown-top.—Very extensive areas are being harvested under certification for export. Our certification amounts to a statement that the seed is free from red-top, which is an undesirable species for lawns and golf-courses.

Crop Experiments Section.

FIELD EXPERIMENTS.

The programme of field experimental work is now very comprehensive, and about 750 experiments of various kinds are under way in New Zealand.

Records of Experiments.—A system of reporting and recording has been introduced and is working satisfactorily. The system enables each fields officer to keep a complete record of all work in his district, and provides for equally complete records being kept by the Crop Experimentalist at Palmerston North. The records of every experiment are reviewed from time to time and kept up to date, so that no experiment can be allowed to lapse for want of attention or interest. Transfers or resignations of officers will not interfere with the continuity of investigations, as the records will enable new officers to get full details of the previous history of each trial.

Classification of Experiments—

A. Research into fundamental grassland problems being carried out at (1) Experimental Farm, Marton; (2) Farm of Instruction, Ruakura; (3) Experimental Farm, Winton; (4) Technical College, Christchurch (co-operation with).

B. Grassland investigations and demonstrations being carried out by fields officers of the Fields Division.

C. Annual crop experiments being carried out by fields officers.

A. *Research into Fundamental Grassland Problems.*

The following work is being carried out at Marton Experimental Farm:—

(i) Trial of effect of applying super and slag as winter, spring, summer, and autumn applications, respectively: This trial has been under way since August, 1928 (twenty months). The main features are (1) that super shows a consistent superiority over slag, expecially during low-production periods; (2) that summer application of superphosphate has the greatest effect in increasing growth during low-production periods from February to August; (3) that fluctuation in production is enormous, ranging from about 10 lb. per acre per day to 300 lb. per acre per day of green material.

(ii) Trial to determine effect of three distributed applications per annum of super, super + sulphate of ammonia, and super + sulphate of ammonia + potash, and to compare ammonium phosphate and nitrophoska with the appropriate mixtures above.

(iii) Trial to determine whether a heavy application of super at infrequent intervals is as effective as smaller applications at more frequent intervals.

(iv) Study of effect of applying sulphate of ammonia at intervals of two months on different plots.

(v) Trial to determine the effect on production of utilizing herbage at 2 in.–3 in. stage and 4 in.–5 in. stage.

(vi) Trial to determine whether any loss of nitrogen occurs when sulphate of ammonia is mixed with carbonate of lime.

(vii) Sheep-grazing trials to determine the economic returns from top-dressing with nitrogen.

B. *Grassland Investigation and Demonstration carried out by Officers of the Fields Division.*

(1) Grazing trials on dairy-farms: Most of the eighty trials being conducted in the North Island were continued, and about fifteen were inaugurated in the South Island, principally in Southland. Each of these trials consists of the trial of one paddock receiving phosphate against another paddock receiving phosphate plus nitrogen. This series of trials is providing much valuable information on rotational grazing.

(2) Grazing trials to determine the relative merits of Hawke's Bay perennial rye-grass and so-called Canterbury perennial rye-grass in Canterbury: The work of the Agrostologist has demonstrated very clearly the advantages of true perennial rye-grass so far as persistence is concerned. The work is being done in collaboration with the Agrostologist. Two trials have already been laid down, and others will be sown in the spring. The fields will be managed under the intensive system, and records of stocking kept for several years.

(3) Observational top-dressing of pasture: About 430 trials of this nature are under way. About 140 of these are in the North Island, and represent the trial and demonstration of the effect of manures according to district requirements. In Canterbury-Marlborough 240, and in Otago-Southland 50 trials are in progress. These are mainly experiments in which lime, phosphate, potash, and nitrogen are used. Most of the Canterbury series were laid down in the winter of 1928, and constitute a survey of the country to determine the chief limiting factors in pasture production. These trials have been highly successful in indicating several important features, the chief of which are—

(*a*) Lime is of extreme importance in something like 90 per cent. of the areas under trial. There can be no doubt regarding its economic value, even at the present unreasonable price, on the majority of Canterbury lands. The light lands of low rainfall have responded to an unexpected extent. The efficient production of ground carbonate of lime which would result in its being available to the farmers at about 12s. per ton (as in Southland) is urgently needed in Canterbury.

(*b*) Superphosphate has given good results (except on some of the very light lands) especially on limed ground.

(*c*) Potash appears to be of little general value. In a few cases it has shown slight improvement of the pasture on limed ground. It has practically no effect on unlimed ground.

(*d*) Nitrogen is of extreme importance, and has generally improved the sole of grass where used in conjunction with lime and phosphate. Its economic value must be the object of further investigation in the near future.

C. *Experiments on Annual Crops carried out by Fields Officers.*

(1) *Wheat.*—(*a*) Manuring: A comprehensive series of manuring trials, consisting of twenty-five experiments in Canterbury and Marlborough and six in Otago, was laid down. The trial of superphosphate, muriate of potash, and nitrate of soda was continued. In addition, a number of trials with 1 cwt. and 2 cwt. of super with and without nitrate of soda were sown. The general results are as for previous years so far as the first-mentioned manures are concerned. The dry spring represented a condition under which nitrogen had not been tried previously. The results were quite satisfactory, and the Department is now in a position to recommend the spring application of soluble nitrogen to the wheat crops. On an average, a 5-bushel increase is to be expected from the use of 1 cwt. of nitrate of soda or sulphate of ammonia. This, on top of an average 5-bushel increase from super, means a 10-bushel increase over no manure. Potash is of little use, and is likely to depress the yield. The increased rate of sowing of super to 2 cwt. per acre does not give very good promise in the main.

(*b*) Wheat-variety trials: Three of these were carried out in Canterbury, and indicate the necessity of the trial of varieties on different soil-types. In one trial Major was 6 bushels better than Tuscan, while on another soil-type, it was several bushels poorer. A programme is arranged for the coming season in collaboration with the Wheat Research Institute.

(*c*) Effect of hot-water treatment for control of disease on yield: The trials of last season were continued, with very promising results. Three treated varieties were under test. The treated Tuscan yielded about 4 bushels per acre better than untreated; Hunter's treated was 2 bushels better than untreated; there was no effect with Pearl.

(2) *Barley.*—(*a*) Manuring: Three manuring trials were conducted in Canterbury and Otago. The results have shown extremely high response.

(*b*) Hot-water treatment: As for wheat. In 1928–29 the treatment had no effect, in 1929–30 the treatment gave a remarkable increase of about 7 bushels per acre.

(3) *Potatoes.*—(*a*) Manuring early potatoes, Pukekohe district (Auckland): Three experiments were conducted in early-potato manuring and results have been published in the *Journal of Agriculture*.

(*b*) South Island manuring experiments on main crop of potatoes: The 1928–29 experiments showed a fairly consistent response to superphosphate and also to sulphate of ammonia. As an addition to phosphate, potash had little effect, except in South Canterbury and Southland. About twenty experiments were sown in 1929. The results of the experiments covering a period of three years will be summarized for publication this winter.

(*c*) Certified *versus* non-certified seed potatoes: Eight trials were laid down in the South Island to test the differences between a mixture of lines of certified potatoes and a mixture of lines of uncertified potatoes with each of four varieties. The superiority of certified seed has been most marked.

(4) *Swede and Turnip Manuring.*—Twenty-four experiments were carried to a successful conclusion in the South Island. Mixing equal parts of super and carbonate of lime eliminated the injury to germination, and this practice can be safely recommended to farmers. In the trials it usually gave a considerable increase in yield over super. Mixing can be done from several weeks to a day before sowing, and providing weather conditions are suitable for growth a good germination is assured.

(5) *Rape-manuring.*—Four experiments were conducted. As a result of adverse weather conditions the yield was poor. Germination of rape is affected by super, but not to the same extent as turnips and swedes. Where manuring at more than 1 cwt. per acre is practised it is advantageous to use a mixture of super + lime, or super + a slow-acting phosphate. Nitrate of soda applied about four to six weeks after sowing will increase the yield by 15 cwt. to 1 ton.

Agrostology Section.

The research work of this section may be divided into two main branches: (1) Intensive critical research at the Plant Research Station; (2) field research in co-ordination with the Fields Extension Service of the Division and other specialist officers of the Plant Research Station.

Work at the Plant Research Station.—This concerns itself largely up to the present with strain trials in relation to grasses and clovers.

Perennial rye-grass: Approximately two thousand lines of rye-grass of commercial origin are under trial. The rye-grass strain work of 1929 can almost be regarded as an epoch in the rye-grass seed trade of New Zealand, and the elimination of the poor types and perpetuation of the good types will have a far-reaching effect on the swards of the Dominion.

Cocksfoot: One hundred and seventeen lots laid down in the spring of 1928 have been regularly mown and responses of the different types noted. Akaroa cocksfoot still maintains superiority over the Danish, both in total growth and persistency under weekly cutting.

Brown-top: One hundred and four lots laid down in spring, 1928, have been regularly mown all year. The type from the poorer and drier soil-types of Canterbury still continues to make an excellent turf, and it would appear that there is little danger of this type proving undesirable from a lawn-seed export trade point of view. For hill-country work, however, steps should be taken through certification to ensure that this form is not sold for secondary burns of hill country. Certainly for this purpose it is a less desirable type than the true *Agrostis tenuis* type.

Yorkshire fog: It has long been felt that this grass has a place for the grassing of second-quality lands, and a preliminary type study is being undertaken this coming year. Ninety-three lines from various habitats and sources have been sown in rows, and these will be used as material for preliminary single-plant-study work.

White clover: One hundred and four lines sown in spring, 1928, have been regularly mown throughout the year. Owing to volunteer white clover appearing everywhere throughout this area, there was little difference to note for the first year of the trial. After January of this year, however, the volunteer type, together with many poor-recovery and low persistent lines, failed badly, and at the time of writing there are marked contrasting types showing up. A small percentage of lines, many from Hawke's Bay, are outstanding. These showed good summer production and very rapid recovery after autumn rains. It would appear we are on the verge of important disclosures in regard to white-clover types from varying sources of origin. A further 800 commercial lines from all over New Zealand were sown out during the year.

Red clover: One hundred and four lots sown in spring, 1928, have been regularly cut. The weekly cut has eliminated virtually all the broad red and other non-persistent types, and the outstanding success of the Montgomery red-clover type in persisting under this treatment offers great hope in the possibility of ultimately working up a good persistent grazing type of red clover.

Field Research.—3,590 plots of perennial rye-grass, 216 cocksfoot, 393 white clover, 401 red clover, 200 connected with rates of seeding, and 1,220 of miscellaneous grasses and clovers are now sown down. These are sown on the main leading soil-types throughout New Zealand and extend from North Auckland to Southland. A special area at Gore, and one at Lincoln, in Canterbury, have been chosen for particular trials of rye-grass strains to study the particular behaviour of the different rye-grass types when grown in Southland and Canterbury respectively, and to compare these with the same lines grown at the central research area at Palmerston North.

Regrassing experiments on secondary-growth country: (*a*) The experiments on regrassing secondary-growth country have been continued, and some additional 25 acres have been sown. Brown-top, crested dogstail, Lotus major, white clover, and Danthonia pilosa still show up clearly as the most suitable species for all classes of secondary-growth country.

(*b*) Hard-fern control by spraying has been continued, but the wet summer made extensive operations difficult. The originally sprayed areas (approximately 100 acres) are comparatively free of hard-fern. An additional 50 acres have been treated.

(*c*) Comparative manurial trials are being continued, and some 50 acres were dressed during the year.

Mycology Section.

(1) *Cereal Diseases.*—(*a*) Smuts: Work during the year has been confined to bulk treatments by the hot-water process for elimination of loose and covered smuts of barley, wheat, and oats. An investigation was carried out to determine whether loose smut was more prevalent in plants grown from apparently healthy seed taken from smutted plants than from those developed from seed taken from contiguous, non-smutted plants. Results showed no appreciable differences in percentages of infection between the two lines. Several new seed-disinfectants were tried out during the year, but none showed promise of being better than any of those in general use.

(*b*) Wheat-scab: Twenty-two different seed-treatments were conducted during the year to determine whether this disease (which preliminary laboratory work showed to be seed-carried) could be controlled. All failed owing to secondary infections occurring in the plots.

(*c*) Stripe disease: Forty-eight experiments on control of this disease were conducted on the Plant Research Station farm. Although several of these treatments prevented seedling-infection, all plots became infected subsequently from air-borne spores. Further studies in dissemination are therefore necessary before attempts at control on a field scale become possible.

(*d*) Black-end: Experiments to determine the cause of this condition, whether it was seed-carried, and a possible control by seed-treatment, were carried out at the Station farm and at Ashburton. The cause is still under investigation, pathogenicity studies being under way in the laboratory; the disease has been proved to be carried with seed; control experiments failed in that only partial success was met with, owing to only a few possible treatments being tried.

(*e*) Rusts: Preliminary field studies have been commenced with a view to determining whether any races of oats grown in the Dominion show promising indications of being resistant to physiologic forms of black rust and crown-rust, thirty-two plots being sown on the farm. Certain of these show varying degrees of resistance, but little work can be carried out until the rusts have been studied from a physiological form viewpoint.

The present position with regard to cereal diseases is that smut-elimination on a field scale has proved practicable. With all other diseases under investigation, it has been found that a detailed study of each under laboratory conditions is necessary before field experiments on control can be undertaken with any degree of confidence. Such work is only possible when an officer is detailed for this series of investigations.

(2) *Brassica-diseases.*—(*a*) Dry-rot: In the past four seasons seed-treatments have proved satisfactory in the laboratory, yet apparently failed when applied on a field scale. The reasons for this have been the subject of considerable investigation during the past twelve months. It was thought that possibly the technique for testing the presence of the dry-rot organism in the seed was faulty. Consequently, three different tests were utilized—the standard method, which consists of sowing seeds in lots of 100 on culture media in petri dishes; the "Copenhagen" germinator method, which consists of sowing seeds in lots of twenty-five on sterile blotting-paper covered by glass cloches and kept moist in this germinator; sowing seeds in lots of 100 in sterilized soil kept in sterilized tins in the glasshouse. In testing the standard method 500,000 seeds were tested, in the soil method 60,000 seeds were tested, and in Copenhagen germinators 20,000 seeds were tested. All were from

one line of seed, known to carry the dry-rot organism. Results showed that the standard method was much more reliable than either of the other two. A second point under investigation was the possible spread in the field by insects. A field survey showed that certain insects were invariably associated with infected roots. These have been isolated and are at present being tested with a view to determining whether any insect is a carrier, and, if so, the methods by which the disease is conveyed under field conditions. A third point under investigation was to determine the manner in which seed became infected in the field. Swede roots were grown to seed under controlled conditions (in insect-proof cases) and inoculated at various times. As a result a quantity of heavily infected seed was obtained, the method demonstrating that, if the seed-pods became infected, infected seed results. Attempts at producing small lines of dry-rot-free seed are being undertaken on Hautu Prison Farm, Tokaanu. Seed of a few selected commercial lines have been treated and sown on land never before in swedes, and miles away from other root crops in that locality.

(*b*) Club-root: An intensive series of investigations covering this disease has been carried out during the year, one officer occupying his whole time with this work. Preliminary work of a technical nature was required to work out a method for testing the presence of the disease in the soil; effects of soil conditions, temperature, moisture, spore-load, time of infection, &c. Following this the following major points were investigated: Firstly, the possibility of there being definite biological strains had to be determined, to know whether one type of brassica (as rape) could or could not be grown on land previously under another type of brassica (as swede). No significant results were obtained, indicating that defined biological races do not exist in the New Zealand form of this disease. Secondly, the host range of the organism had to be ascertained in order to determine whether brassica weeds could carry the disease over in grassland for an indefinite period. Seeds of thirty-three species of weeds were collected and sown in specially prepared boxes of sterialized soil, to which viable spores of the club-root organism had been added. Infection was obtained on nine species, only one of which, *Capsella bursa-pastoris*, has any economic significance, in that it is an abundant weed in cultivated areas. Thirdly, an intensive series of investigations were conducted to determine whether the disease was carried with the seed. This work has as yet been negative; but this is to be expected, since preliminary investigations showed that infections were directly correlated with spore-load—in other words, that infection could be obtained artifically only when numerous spores were present in the inoculum. Fourthly, a series of experiments has been conducted with a view to determining whether any varieties of swedes or turnips are markedly resistant to club-root. Of all those tried, Herning swede showed distinct promise, in several of the plots remaining quite free from the disease. Work now in hand is concerned with determining how long the organism may remain in a viable condition in the soil, and whether any manurial, cultural practice, or rotation will affect this period.

(3) *Collar-rot of Peas.*—An intensive series of seed disinfectant experiments has been undertaken with a view to combating this serious disease, but with indifferent results. It has been found that experiments in control along these lines have been deleteriously affected by secondary infections coming from outside sources. Consequently, until this disease has been more fully studied under laboratory conditions, control experiments have been discontinued.

(4) *Potato-diseases.*—(*a*) Virus diseases: These, the most important diseases of potatoes in the Dominion, have been made the subject of a special investigation. Disease surveys of the potato areas have been made, to determine the extent of virus infection, and ascertain, if possible, areas free from this group of diseases. Of all areas examined, Pukekohe alone shows comparative freedom from virus diseases. All types of virus have been studied in the field, and collections of typical material made. These have been planted at the Farm and have been under constant observation, with the result that we are now familiar with the field symptoms. Incidentally, all other diseases of the potato have been collected and are being studied on similar lines. Studies on pathogenicity are being conducted in the laboratory and glasshouse to determine certain points of the life history, &c., with a view to working out methods of control. Commercial virus-free potatoes have been imported from Scotland, England, Ireland, and Canada, and grown under controlled conditions. Some of this material, especially Scottish seed, shows marked superiority to any lines grown commercially in New Zealand. Nucleus lines of completely virus-free tubers have been obtained from the Cambridge Virus Research Station during the past two years. Part of this material is being used in experimental work; the remainder is being bulked under controlled conditions for ultimate distribution. In this way it is hoped gradually to eliminate virus diseases from the potato crops of the Dominion.

(*b*) Corticium-disease: Experiments on control of this disease have now reached a stage where we can obtain clean lines of seed. In the field, however, other factors, as soil-contamination, have made it difficult to apply this treatment on a commercial scale. It is believed that in conjunction with a certification system now in use more use will be made of this method of ridding crops of this disease. One point affecting the use of this treatment by the farmer was the possibility of damaging seed and thus reducing the yield. Experiments have shown that this is governed by time of treatment, for if tubers are treated some time prior to planting no damage results.

(*c*) Blackleg, mattery-eye, and wilt: Potato-disease surveys during the past three years have shown that considerable losses are experienced through a group of diseases commonly termed "wilts." Consequently, investigations covering these diseases are being conducted this season. For this purpose material has been collected and grown on the farm. Incidentally, one disease previously unrecorded has been collected by Mr. Chamberlain, who records it as being prevalent in Pukekohe district. This is black-dot disease, due to the fungus *Colletotrichum atramentarium*, recorded abroad as being the cause of a stem-wilt.

(5) *Lucerne Nodule Organism.*—Inoculation of lucerne with the nitrogen-forming organism has proved such a success that during the season material sufficient to inoculate 18,000 lb. of lucerne seed has been sent out of the laboratory.

Entomology Section.

For convenience, entomological work for the year 1929-30 is dealt with under the two separate headings—" Routine " and " Research."

ROUTINE.

This involves (1) the identification of numerous insects sent in, and supplying all available information as to their economic significance and methods of control where known ; (2) The investigation of minor problems in the field as they are brought under notice from time to time ; (3) attention to and care of entomological collection and literature ; (4) observing and reporting on progress of cinnabar moth (*Tyria jacobaea*). The results of these observations have already been sent to the Director of the Plant Research Station at Wellington.

RESEARCH.

Diamond-backed Moth (Plutella maculipennis).—A good deal of investigation has been carried out during the past year relating to this pest, and the results will be published at an early date.

Pear-midge (Perrisia pyri).—The pear-midge parasite (*Mysocyclops marchali*) introduced from Europe for the control of the pear-midge has not come up to expectations.

Field-cricket (Gryllus servillei).—This insect has been the cause of occasional serious attacks on pastures on the Hauraki Plains and in parts of Northern Wairoa. During the past season, however, the crickets were not in sufficient abundance as to constitute a pest. A broad outline of their life-history has nevertheless been obtained.

Potato Virus Diseases.—This work includes—(*a*) a survey of potato crops to determine characteristic insects. This phase is now completed, and the following characteristic insects have been found : (1) *Macrosiphum gei ;* (2) *Myzus persicae ;* (3) *Myzus pseudosolani ;* (4) *Melanophtalma gibbosa ;* (5) *Thrips tabaci ;* (6) *Erythroneura* sp. ; (7) *Collembola*—(i) Fam. Sminthuridæ. (ii) Fam. Entomobryidæ. The dipteron *Lauxania bilineata* is also fairly common on the foliage. The aphid predators *Coccinella 11-punctatae* and *Melanostoma fasciatum* are present wherever the plant lice are sufficiently abundant. (*b*) Under laboratory conditions rearing and determining which of the characteristic fauna is a virus vector. Everything is now in readiness for the prosecution of this work, and it will be commenced as soon as the mycological section can supply us with the so-called virus-free potatoes. It is proposed to experiment with insects 1, 2, 3, 5, and 6, named under section (*a*).

Dry-rot in Swedes.—Laboratory experiments are in progress to determine whether the normal spread of dry-rot in a crop can be attributed to insects. Two insects are being used for this work : (1) a beetle of the family Staphylinidæ. These insects are present in comparatively large numbers on infested swedes. (2) A dipteron which breeds freely in the rotting bulbs.

Seed-testing Section.

During the calendar year 1929, 9,153 seed-samples were received for testing purposes, representing a decrease of 996 on the number tested for the previous year. With, however, the increase in the number of purity analyses made, the actual number of tests put through during the year amounted to 12,244, or 3 per cent. less than the number for 1928. The reduction in the number of samples received is accounted for by the fact that the 1928 seed harvest was generally smaller than is usual.

Generally the quality of most species of grass and clover seed was very satisfactory. A distinct improvement was shown in the growth of perennial rye-grass, the growth of which for several seasons past has been unsatisfactory. Nearly one-third of the samples germinated 90 per cent. or over, as compared with only one-tenth for the previous year.

Most of the low-germinating samples were received from Hawke's Bay and Poverty Bay, and, although an improvement was evident in the general average, the seed from this district is still failing to reach the high standard in growth always associated with Hawke's Bay rye-grass a few years ago.

Farm Economics Section.

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

(1) *Survey of the Poultry Industry.*—This work was undertaken at the request of the Hon. the Minister for Agriculture, and was published in book form in February of this year.

(2) *Survey of Dairy-farms in North Auckland.*—A large number of farms in Dargaville, Ruawai, and Whangarei were surveyed for the season 1927-28. This material has been analysed during the current year, and two articles are now in course of publication, one dealing with sixty-nine farms at Ruawai and the other with 110 farms near Dargaville.

(3) *Hill-country Sheep-farming on the East Coast, North Island.*—The results of this investigation were published in the *Journal of Agriculture* for January, 1930.

DAIRY DIVISION.

REPORT OF W. M. SINGLETON, DIRECTOR.

Production.

During the year 94,054 tons of butter and 87,962 tons of cheese were forwarded to the grading-stores for grading, as compared with 80,932 tons of butter and 84,627 tons of cheese for the previous year. This represents an increase equal to 16·21 per cent. of butter and 3·94 per cent. of cheese. Converted to butterfat equivalent they represent an increase of 11,202 tons, or 11·2 per cent. A more general desire to improve the producing-capacity of dairy herds and the accumulative effects of top-dressing are factors which have contributed largely towards this high record production, although favourable climatic conditions are probably the main factors.

Quality of Creamery Butter.

Despite the large increase in production, the quality of creamery butter has probably never previously reached so high a uniform standard of excellence, the average grade for the year being 92·96, as compared with 92·84 for the previous year. Butters scoring "Finest" exceeded last year's figures by 4·5 per cent., the totals being 74·41 and 69·91 per cent. respectively. The percentage of "First" grade was 24·09, as compared with the previous year's total of 27·82 per cent., and "Under Firsts" 1·5 and 2·27 per cent. respectively.

"Soda" flavours have been rarely commented upon, and the highly uniform character of the body and texture, together with the even distribution of the moisture content and more attention paid to the better packing and finish of our butters, is a testimonial to the excellent team work of the factory managers.

Whey Butter.

The quantity of this class of butter manufactured during the year shows a slight falling-off as compared with the previous year, the totals being 45,152 boxes and 46,336 respectively. More care has been taken in the handling of the whey cream, which is reflected in the general quality of the produce. There is still room for much improvement in quality, which could be greatly assisted by closer co-ordination between the operator in the cheese-factory and the buttermaker.

Quality of Cheese.

The general quality of cheese manufactured during the year, more particularly in the North Island in districts where "standardized" cheese has been manufactured, has not been entirely satisfactory. Only 24·16 per cent. of all cheese graded was classed as finest, as compared with 29·57 per cent. for the previous year, and 50·16 per cent. for the 1926–27 season, during which the Dairy Produce Board paid a premium for "Finest" over "First." Averages for "First" and "Under First" were 73·85 and 1·98 per cent. respectively, as compared with 69·10 and 1·33 per cent. for the year previous.

Openness in texture has been more in evidence, and this defect has occasioned a great number of complaints from Great Britain. The body of many cheese has been inclined to be weak, suggesting that yield rather than quality has been the object aimed at. A good-quality article will always command the highest price, and cheese-producers are therefore urged to adopt without delay the policy of the butter-manufacturers and concentrate on the production of an article of the highest possible quality.

The finish of cheese has greatly improved, and in accordance with the requirements of the regulations all cheese are now either rimless or with a minimum rim not exceeding $\frac{3}{8}$ in. in depth.

A large number of paraffin-waxing plants are now in use, and approximately 70 per cent. of the cheese graded were waxed.

It is estimated that 90 per cent. of the cheese graded was made from pasteurized milk.

Standardized Cheese.

Standardized cheese, as the term refers to cheese other than "full cream" cheese manufactured in New Zealand, does not by any means mean a cheese which has been reduced to below the standard which usually obtains in cheese made from milk from dairy cattle other than the Jersey and Guernsey breeds. It is the aim of the New Zealand producers of standardized cheese that they shall be maintained at that standard. The change over from full cream to standardized has continued during the year under review, and, with the exception of three factories in the South Island, has been confined to North Island dairy factories. Of all cheese graded during the year some 50·24 per cent. was standardized, while the quantity of North Island cheese standardized represented some 68·4 per cent. of the cheese made in the North Island.

The opinion of the major portion of the importers of New Zealand cheese into London with whom I discussed the position was to the effect that on an upward market the standardized cheese would sell for as much as full-cream cheese, but that on a depressed market the full cream would sell more readily. Certainly the market has gone to lower price-levels this season than for many seasons. Since prices receded more complaint has been forthcoming. Some of this is doubtless incidental to irregularities made inadvertently during the period of change over from full cream to standardized. Defects due to this cause are likely to lessen. There are other defects, due to an endeavour on the part of some companies to work too near to the minimum requirement of fat in the dry matter of the cheese, and there is also a trouble with a certain class of "openness" in cheese-texture which is not altogether understood. It, however, obtains at times irrespective of whether the cheese be standardized or whole milk, or whether the milk be pasteurized or not pasteurized.

Storage of Butter and Cheese.

The cool storage of butter and cheese prior to shipment has been carried out at all grading centres by cool-storage companies with the customary care and attention, and the produce has been loaded on to overseas vessels in good order and condition.

Owing, however, to record quantities of butter, cheese, and fruit being cool-stored at Auckland this season, the cool chambers became overtaxed towards the end of March, and it became necessary to temporarily store some cheese in outside brick stores at ordinary temperatures. Fortunately no excessive heat has since been experienced, and, as it is expected that the congestion will soon be relieved, no damage to the cheese is anticipated.

Quantities of Butter and Cheese forwarded to Grade Stores for Years ended 31st March, 1930, and 31st March, 1929.

Port.	1930.		1929.	
	Butter.	Cheese.	Butter.	Cheese.
	Cwt.	Cwt.	Cwt.	Cwt.
Auckland	1,237,739	289,232	1,054,009	259,499
Gisborne	29,590	..	27,277	..
Napier	43,280	4,365	40,940	5,723
New Plymouth	153,584	338,046	116,422	337,579
Patea	47,221	380,077	28,003	383,074
Wanganui	59,402	125,024	71,873	134,058
Wellington	224,655	259,429	195,808	261,410
Lyttelton	47,391	28,242	44,481	28,543
Timaru	6,268	17,403	7,350	18,495
Dunedin	24,364	49,164	25,552	46,556
Bluff	7,586	248,259	6,944	217,609
Totals	1,881,080	1,739,241	1,618,659	1,692,546

Value of Exports.

Prices for dairy-products during the year have not been at so low a level for many years, and, despite the increased production, values for the year were lower by £2,019,706. According to the Customs figures, values of cheese, dried milk, casein, condensed milk, and milk-sugar totalled £18,842,994, as compared with £20,862,700 for the previous year.

Casein.

The quantity of casein graded during the year totalled 2,040 tons, being 150 tons in excess of the total for the previous year. The major portion of the casein graded—*i.e.*, 90 per cent.—consisted of the lactic variety, the balance of 10 per cent. being "rennet." Quality has been of a uniformly high standard, and is considered equal to the best offering on overseas markets. A charge of 1½d. per hundredweight for grading this produce has been in operation during the whole year, and although this service is optional the majority of the casein shipped has been graded prior to export.

Testing Butter and Cheese for Moisture, etc.

During the year 156,967 churnings of butter were tested for water content, the average percentage of water being 15·32, as compared with 15·29 for the previous year. Churnings over the legal limit of 16 per cent. amounted to 0·5 per cent., and these were returned to the factories to be reworked with drier butter. The standardization of milk for cheesemaking has necessitated the testing of each vat of standardized cheese for moisture, fat, and other solids, and during the year 95,399 vats were tested in order to ensure that no cheese of this class was exported containing less than 50 per cent. of fat in the dry matter. An extra grading fee of 1d. per crate on standardized cheese is payable for this service, to cover the additional cost involved.

Cream-grading.

The compulsory grading of cream has now become firmly established, and cream-graders, on the whole, are endeavouring to closely adhere to the standards set by the Division for "Finest," "First," and "Second" grades. The wisdom of this method of general grading is amply demonstrated by the uniformly high standard of quality of the butter manufactured during the year.

Farm-dairy Instruction.

It is regretted that farm-dairy instruction on a national basis, as generally desired by the majority of dairy companies, has not yet come into operation. The improvement in the quality of the milk and cream supplied during the year to those dairy companies co-operating with the Department in the employment of the 38 Farm Dairy Instructors at present engaged in this service has been freely commented upon, and has been amply reflected in the improved quality of the produce manufactured therefrom. It is to be hoped, therefore, that during the coming session of Parliament the necessary legislation will be enacted to enable the system to be made operative throughout all the dairy districts of the Dominion.

Check Testing of Suppliers' Milk and Cream Samples and Check Testing of Cream at Dairy Factories.

The check testing of milk and cream samples at dairy factories for content of butterfat has been continued during the year by the two officers detailed for this purpose, and their reports indicate that at the majority of the factories visited the testing is carried out in an efficient manner. A few irregularities, due principally to poor equipment, came under notice, but these in most instances have since been rectified. In order that the scope of this work may be extended it has been arranged that the Butter and Cheese Instructors should assist as opportunity offers. The officers have also assisted in the work of check grading of cream supplied to dairy companies.

Inspection of Milking-machines.

Special attention has been given to the inspection of new and renovated milking-plants installed during the year. This service is much appreciated by both the users and the makers and their agents. Little or no difficulty has arisen in connection with the enforcement of the regulations bearing on this matter.

Dairy Bacteriology Section.

The work carried out at Wallaceville Laboratory under the direction of Mr. G. F. V. Morgan, N.D.A., N.D.D., Dairy Bacteriologist, is proving of increasing value and importance in connection with the activities of the instructional staff pertaining to the production of reliable quality milk products. The regular routine work undertaken includes the bacteriological examination of samples of milk, cream, butter, cheese, starters, and waters, and also other materials used in the manufacture of butter and cheese. Attention has also been given to matters referred to the laboratory by instructors, including various types of discoloration found in cheese; peanut flavour in butter, slow acid milk, the steam sterilization of milking-machines and rubberware, and visits have been made to a number of dairy factories for the purpose of making bacteriological examinations of the plants. Visits have also been made to dairy-farms in connection with the working of milking-machines and the supply of milk and cream to factories. Special investigational work has been carried out with respect to types of yeasts in salted and unsalted butter. The facilities installed last year for making small experimental lots of butter and cheese have proved a useful acquisition to the equipment.

Inspection of New Zealand Dairy-produce in Britain.

This work, as in the past, has been carried out by Messrs. W. Wright and A. C. Ross, who have had an exceptionally busy year. The principal duties of these officers is to examine the produce on arrival in Britain and furnish the Division with detailed reports on the quality and condition at time of examination. These reports, which are of great value in checking the grading at this end, are in turn forwarded to the dairy companies concerned for the information of the various directorates. Mr. Ross is returning to the Dominion before the commencement of the coming season, and arrangements are being made to send another officer of the Division in his place.

Visit to United Kingdom.

Inasmuch as the greater proportion of New Zealand butter and cheese is consumed in the United Kingdom, it was deemed advisable that I should visit the United Kingdom and also some of those countries with which New Zealand was competing. I left New Zealand in April, 1929, returning to New Zealand in October last after an absence of some five and one-half months, during which visits were made to the United Kingdom, Ireland, Denmark, Holland, Canada, and the United States of America. Since my return a report has been forwarded to the Department, and after publication has been distributed to dairy companies. Shortly after my return a series of meetings were arranged throughout most of the dairying districts, and at these I discussed impressions received during my trip abroad. Some of the more immediate results have been indicated in draft regulations which have been recommended. Other matters of greater import are still under discussion, and it is expected that further developments will follow.

Certificate-of-record Testing.

The support accorded this system of testing appears to be slightly on the increase, after having shown a steady falling-off each year since 1924. Some 491 cows qualified under the C.O.R. test during the calendar year 1929, as compared with 465 in 1928. That this increase is being sustained will be apparent from the fact that the figures for the peak month of the current season show 864 cows on test on the farms of 272 breeders, as compared with 660 cows and 226 breeders for the highest month of last season.

Official Herd-testing.

The official herd-test, although evidencing slightly decreased support in 1929, still continues to meet with favour. At the height of the season under review official herd-testing was being carried out for 1,365 cows in the hands of 129 of our C.O.R. breeders, as compared with 1,666 cows and 128 breeders for 1928.

Herd-testing.

Herd-testing in New Zealand is extending in a most satisfactory manner. The extension is due to the increasing popularity of the group system, although the Dairy Division's original association method still finds considerable favour in the districts to which it is more particularly adapted. Figures pertaining to the current season (1929–30) are not yet available, but a still higher total for cows tested is anticipated. During 1928–29 some 259,594 cows were tested, 212,480 of these being tested under the group method. The 1927–28 figure was 224,130, of which 164,610 were group tested. The 1928–29 total of 259,594 represents 18·9 per cent. of the total of the Dominion's dairy cows in milk and dry. The Government subsidy to herd-testing has been continued, and a sum not exceeding £10,500 made available for distribution to testing dairy-herd owners.

Staff.

All members of the divisional staff have rendered willing and efficient service during an exceptionally busy year, and their cordial co-operation is highly appreciated.

Appreciation.

During the year the Department's Chief Chemist, and also the Bateriologist have given the Division valuable assistance, which has been much appreciated. The State Forest Service, the various cattle-breeders' associations, and the freezing companies have also willingly co-operated with and assisted the Division, and to all of these our thanks are extended.

HORTICULTURE DIVISION.

REPORT OF J. A. CAMPBELL, DIRECTOR.

The Fruitgrowing Industry.

The fruitgrowing industry has now reached a stage when the prospects are very encouraging. Satisfactory prices ruling on the Home markets during the last two or three seasons have stimulated growers to renewed activity, which is evidenced by the general improvements adopted in orchard-management and the installation of up-to-date appliances.

The horticultural year under review has been a very satisfactory one generally as far as the grower of apples and pears is concerned. In the Canterbury District, however, a severe frost which occurred in October did considerable damage, and practically destroyed the whole of the fruit crop. The Government granted relief in the nature of loans to the worst sufferers, who were in need of urgent financial assistance to enable them to carry on. The stone-fruit crop in Central Otago was considerably reduced by frost damage; otherwise this crop in other localities was a fair average one. Late frosts and unfavourable weather conditions interfered to a large extent with the tomato crop, which was below the average in most localities. Small fruits, such as strawberries, raspberries, &c., yielded fair crops. Citrus-trees were retarded somewhat by frosts in the early spring, but made a good recovery, and a good average crop of fruit is in sight.

Considerable development is taking place in the planting of citrus orchards in the North Auckland district, where several large blocks have already been planted and fresh areas are contemplated. A number of these blocks belong to absentee owners, and are being cared for until such time as they are sufficiently advanced for the owners to take control. The industry is also continuing to make steady headway in the Tauranga district.

Passion-fruit culture on a fairly large scale is receiving attention in the northern districts, the vines being planted between the rows of young citrus-trees as a means of securing some monetary return until the trees come into bearing.

Some 200 acres were planted in commercial orchards during the 1929 planting season. A number of orchards that had been abandoned by the owners were cut out, leaving the total area in commercial orchards for the whole of the Dominion at approximately 27,000 acres.

Orchard pests and diseases, generally speaking, were kept well under control, the majority of growers realizing that one of the first essentials in successful fruit-culture is the production of clean, sound fruit.

A careful watch has been kept on fireblight disease by officers of the Division, and reports to hand indicate that there has been no further spread of the disease during the year. The cutting-out of fireblight cankers and eradication of hawthorn hedges in the commercial fruit areas is keeping the infection well within bounds.

The collection of fireblight-tax in those districts where Fireblight Committees have been set up has been attended to, and the tax, less cost of collection, handed over to the respective committees to be expended in connection with fireblight control.

The matter of establishing a central Fruit Research Station has been receiving the attention of the Department, in co-operation with the Department of Scientific and Industrial Research and the Cawthron Institute. Such a station would be of considerable value in the carrying-out of investigation work on a systematic basis in the interests of the fruitgrowing industry generally and also for instructional purposes.

Export of Fruit.

The examination of all fruit for export was carried out by the Orchard Instructors attached to the Division at the main fruitgrowing centres throughout the Dominion. The work has proceeded smoothly, and growers generally show a keen desire to comply with the requirements of the export regulations.

A total of 992,151 cases of fruit were exported during the 1929 season. Of this quantity, 758,762 cases apples and 55,024 cases pears were shipped to Great Britain, 159,837 cases apples and 4,087 cases pears to South America, 12,000 cases apples to Canada, and some 2,400 cases apples to Honolulu and the Pacific islands. The bulk of the fruit was exported under the Government guarantee of a gross market price of 11s. per case for "Extra Fancy" and "Fancy" grades, and 7s. for "Good" grade. As a whole, the prices realized were satisfactory, and the claims under the guarantee did not exceed £100.

The high standard of New-Zealand-grown fruit is now recognized on the overseas markets, and it is evident that the continued efforts of those concerned with the placing of the export trade on a sound basis are meeting with a considerable degree of success.

Quantities of fruit exported from the Dominion during the last five years are as follows: 1925, 236,870 cases; 1926, 730,308 cases; 1927, 544,233 cases; 1928, 1,026,986 cases; 1929, 992,151 cases.

The Government again renewed the guarantee on apples and pears exported during the 1930 season.

In view of the heavy crop of apples and pears, it is anticipated the 1930 exports will reach 1,250,000 cases, a record in the history of fruit-export.

Local Markets for Fruit and Vegetables.

Close attention has been given to the inspection of locally-grown fruit and vegetables at the main marketing centres. The Inspectors report that a continued improvement is noticeable in the quality and packing, and the number of diseased lines offered for sale is becoming less conspicuous.

Satisfactory returns have been received by growers for all produce of good quality.

The practice of "topping," more particularly in regard to vegetables, is still being indulged in by a few unscrupulous growers, and legal action was taken against a number of such during the year.

Fruit Cool Storage.

The cool storage of fruit is a matter that has made considerable headway during recent years, with the result that at the present time large fruit cool stores with up-to-date equipment are operating in each of the chief commercial fruit-growing districts. Cool-stored fruit placed on the markets is opening up in a much better condition than formerly—a fair indication of improved conditions in cool-store management. Flesh-collapse in apples, which in the past caused considerable loss in cool-stored fruit, is now seldom met with.

During the past season experiments in connection with the carriage of stone-fruit by rail from Central Otago were carried out. These experiments demonstrated that the stage of maturity at which the fruit is picked and temperatures during transit are the essential factors in fruit of this kind keeping in good condition when transported over long distances.

During the year Mr. R. Sutherland was appointed to the position of Cool Storage Officer in the Department. Mr. Sutherland, who is a qualified refrigerating engineer, has had considerable experience in the cool storage of fruit. His services will be utilized in investigating fruit cool-storage conditions in the Dominion, both ashore and on board ship, with the view of effecting further improvements in this connection, for the ultimate betterment of the fruit industry generally.

Instructional and Experimental Work.

The educational work which the Division is carrying on through its Orchard Instructors is having good effect, the number of neglected orchards being gradually reduced.

Those desirous of obtaining the Department's certificate of proficiency in grading and packing fruit were given the opportunity of improving their knowledge on these subjects by attending classes held during the year in the main commercial centres.

Further progress has been made in connection with the various experiments which are being carried out in the field, and a number of these are now reaching an interesting stage. These experiments are being carefully supervised by the Orchard Instructors in their respective districts, who furnish half-yearly reports on the progress made. Some of the main features in connection with this work are: Trying-out of new proprietary spraying compounds under New Zealand conditions; testing various fruit-tree stocks, which include pip, stone, and citrus; control of the more troublesome diseases and pests, such as brown-rot, pear-midge, and earwig; orchard manurial trials with the view of increasing production; growing of subtropical fruits, such as avocados and persimmons, in the warmer districts of the North Island.

A fair number of plants of the tung-oil tree have been raised from the seed imported last season, and small supplies have been distributed to different localities in the North Island for trial purposes. A further supply of seed has recently come to hand, and arrangements have been made for the planting out of a further area at the Te Kauwhata Horticultural Station.

Viticulture and Wine-making.

Steady progress is being made in the growing of grapes, both for wine and table purposes. Taken as a whole, the crop of wine grapes was a good average one, and exceeded that of the previous season. Fungus diseases were prevalent in the earlier stages of growth, and reduced the crops very considerably in a few vineyards in the Henderson and Hawke's Bay districts. Outdoor-grown table grapes yielded satisfactory returns. With further vineyards in the northern districts coming into bearing there has been an increased supply on the market; payable prices, however, are still being maintained. It is estimated that approximately 800 tons of table grapes were marketed, representing a value of £44,800. The wine produced from the year's vintage is estimated at 95,500 gallons, valued at £38,200.

Tests with a number of new varieties of imported vines are being continued at the Te Kauwhata Horticultural Station. A good season has been experienced by growers of grapes under glass, and a further extension in glasshouse-construction is noticeable. The value of hothouse-grown grapes is estimated at £79,500.

Cidermaking.

The annual production of cider stands at approximately 50,000 gallons, of an estimated value of £12,500. The bulk of the cider produced is of first-class quality, and finds a ready market. This industry offers considerable room for further extension on a profitable basis, especially in the main commercial fruitgrowing districts.

Te Kauwhata Horticultural Station (Lower Waikato).

The wet weather experienced in this locality during practically the whole of the year interfered to a considerable extent with the various operations carried out at the Station. The conditions, while favourable to grass-growth, were not suitable for the production of grapes and other fruits. The breeding-ewes kept for utilizing the surplus feed produced a good percentage of lambs.

Plantations: Under the lands-for-settlement scheme a commencement was made during the year with stumping and clearing some 900 acres of wattle land at Te Kauwhata preparatory to laying the areas down in grass, the work being carried out under the direction of the Station Manager. The revenue collected from the sale of posts, firewood, &c., is being credited to the Lands for Settlement Fund. Prior to the commencement of these operations £184 6s. 2d. was received for firewood sold, and credited to the Farm; also £140 10s. 3d. for wattle-bark disposed of.

Vineyard and cellar: Owing to unfavourable conditions the grape crop was considerably below that of the previous year. Several improvements were effected in the cellar, the main feature being the erection of three new concrete fermenting-tanks. Wine-sales for the year were well maintained, a total of 13,921 gallons being sold, which realized £6,492—a substantial increase on the previous year's figures.

Tobacco-culture.

Highly remunerative prices received by tobacco-growers a season or two back led to a considerable interest being taken in the growing of tobacco in the Dominion, and numerous inquiries were received for information on this subject, supplies of seed, &c. Intending planters were advised to proceed slowly in the matter in view of the fact that, although leaf of good marketable quality could be produced, the success of the industry very largely depended on a satisfactory overseas market being available for the surplus not needed for New Zealand requirements. Fairly extensive plantings took place in the Hokianga and Rotorua districts, chiefly by Maoris who had become interested in the growing of tobacco as a means of livelihood. While a quantity of the leaf produced from this source was disposed of to the local manufacturing companies, a fairly large surplus remained on hand. With a view to relieving the situation, arrangements were made for the Government to advance 8d. per pound against a proportion of the leaf considered to be suitable for export, and some forty-two bales were shipped to London. Up to the present time this leaf has not been sold. That considerable faith is manifested in the future of the industry is evidenced by the fact that a number of tobacco-growing companies have been formed in the Auckland District, and several large blocks planted in tobacco, with further extensions to be made next season.

The industry is now well established in Nelson and Marlborough, where some heavy crops are being harvested this season, thus affording a good indication that these districts are well adapted to this class of production. Satisfactory returns are being received by the growers, as the bulk of the crop is sold under contract to the manufacturing companies operating in New Zealand, who provide a good, though distinctly limited, market.

The total area devoted to tobacco-culture for the whole of the Dominion is estimated at some 1,500 acres. Instruction in all phases of tobacco-growing has been given in the different localities during the year by the Instructor attached to the Department. Regulations relating to the grading of tobacco-leaf have been receiving attention, and will no doubt be gazetted at an early date.

Hop-culture.

The hop-growing industry has not made any appreciable progress during the past few years, owing to the difficulty of disposing of the crop at payable prices. In a number of gardens hops have been replaced by tobacco with a view of obtaining better returns. Although the season's crop was a heavy one, the hops did not weigh out as well as in previous seasons, due, no doubt, to the very dry weather experienced prior to picking. The quantity and value of hops exported from the Dominion during the year ended 31st March were 2,402 cwt., valued at £14,378.

New Zealand Institute of Horticulture.

The New Zealand Institute of Horticulture, established in 1923, has carried out a considerable amount of valuable work in relation to the objects for which it was formed. The first Loder Cup competition took place in connection with the Auckland Horticultural Society's rose show held in November last, and was won by Messrs. Duncan and Davies, Ltd., of New Plymouth, with a fine collection of New Zealand native plants. The exhibits made by the other competitors were also highly commended upon by the judges. This cup, which is a valuable one, was presented by Mr. G. Loder, a prominent English horticulturist, for competition throughout the Dominion in a class dealing specially with New Zealand native plants.

Orchard Registration and Orchard-tax.

Under the regulations which came into force on the 1st January last all occupiers of orchards from which fruit is sold or intended to be sold are required to make application for registration. Previously all such orchards required to be registered annually, but under the present regulations registration is permanent. During the year 3,048 taxable and 3,027 non-taxable orchards were registered, the amount payable in tax being approximately £1,413.

Registration and Inspection of Nurseries.

A total of 708 nurseries were registered during the year, being a slight increase on that for the previous period: £708 was collected in registration fees.

Imported Fruit, Plants, etc.

Owing to light crops in Australia, there was a decrease in the quantity of citrus fruits imported from that country. A continued improvement is noticeable in the general condition of Cook Islands fruit, with the exception of a few consignments of oranges, which opened up in more or less wasty condition.

The Beekeeping Industry.

Although the general spring conditions were favourable to the beekeeper, with every promise of a record season, continual rains, low temperatures, and strong winds prevailing during the normal period of the honey-flow resulted in poor yields of honey throughout the North Island. The conditions in the South Island were somewhat better, although the honey crop generally was below the average.

The work of apiary-inspection has been well maintained, and considerable progress made in the stamping-out of disease. Valuable assistance in this connection has again been rendered by the majority of the part-time Inspectors appointed to assist the Apiary Instructors in the Auckland, Wellington, Canterbury, Otago, and Southland districts. It was found necessary, nevertheless, to take Court proceedings during the year against a number of beekeepers for breaches of the Apiaries Act.

The total quantity of honey graded for export at the various grading-stores amounted to 16,388 cases. The bulk of this was of prime quality, the packing, &c., being well up to the requirements of the Honey Export Regulations. Practically the whole of the exportable crop is handled by the New Zealand Co-operative Honey-producers' Association, Ltd., Auckland, the great majority of the honey-producers in New Zealand being members of the association.

Quantities and values of honey exported from the Dominion during the last five years ended 31st March are as follows: 1926, 15,770 cwt., £51,733; 1927, 10,590 cwt., £34,695; 1928, 8,650 cwt., £27,784; 1929, 22,062 cwt., £82,230; 1930, 19,234 cwt., £75,623.

Registration of Apiaries.

To date some 6,925 apiaries have been registered, comprising a total of 104,239 colonies of bees, and certificates of registration have been issued to the respective owners.

Staff.

In conclusion, I have to thank all members of the divisional staff for their loyal co-operation during another busy year. Mr. G. E. Harnett, Fruit Inspector, retired on superannuation at the end of the year. During his long service in the Department Mr. Harnett proved himself a popular and trustworthy officer.

CHEMISTRY SECTION.

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

There has been a notable increase in the work of the Chemistry Section during the year. The number of samples received was 2,039, compared with 1,276 in the previous year. In order to deal with the increased work, additional assistance, both in the laboratory and in the field, has been secured, and two additional rooms in the Medical Stores building, Sydney Street, have been fitted up for pasture-analysis work.

Mineral Content of Pastures.

The principal work of this Section has been the continuation of the investigation into the mineral content of New Zealand pastures, as outlined in previous reports. In addition to the work under the Empire Marketing Board's scheme of research, other lines of investigation are being carried out in co-operation with the officers of the Live-stock Division, including the relation of pasture-composition to incidence of temporary sterility in dairy cattle, and to the occurrence of "pulpy kidney" in lambs in Central Otago.

Rotorua Pumice Lands.—The work in this area has consisted of the extension of the soil survey with the object of delimiting the various soil-types; and experiments in the medicinal treatment of animals, and top-dressing of pastures. A grass garden has been established on the typical coarse pumice soil at Kaharoa, with the object of studying the composition of the different species under known conditions of growth. Experiments in the chemical control of ragwort have been carried out, a report on this work being published in the *Journal* for December, 1929. The extent to which phosphates are leached out of these coarse pumice soils is being investigated. So far it does not appear that there is any material loss of phosphates in the soil drainage water.

Waitomo County.—The investigation of the malnutrition troubles in sheep at Mairoa and at Kopaki has been continued, and further samples of soil and pasture have been analysed. A report on the progress of the top-dressing experiments at Mairoa appeared in the *Journal* for April, 1929.

Poverty Bay.—The occurrence of malnutrition troubles in sheep on certain Poverty Bay back-country pastures has received further attention. Additional samples have been obtained, and the results of analysis show some evidence of correlation between the iron content of the pasture and the health of the stock pastured thereon. A large-scale manurial trial with phosphates is now in progress on this country to determine whether the sheep will still go sick on the top-dressed pasture, as on "bush sick" country.

Wairarapa.—In connection with the occurrence of eclampsia and temporary sterility in parts of the Wairarapa district, the collection and analysis of soils and pastures have been continued, and a progress report was published in the *Journal* for August, 1929. The results confirm the observation made in my previous report—viz., that the poorer pastures of this district are among the lowest in phosphorus-content that have been met with in the course of the pasture research.

Taranaki and Waikato.—In co-operation with officers of the Veterinary Division, an investigation of the composition of pastures where temporary sterility in dairy cattle occurs has been carried out during the year. So far no definite correlation between mineral content of pasture and incidence of disease has been detected, but the work is being carried on and will, in any case, furnish useful data regarding the composition of typical dairying-pastures.

Medicinal Treatment.—The administration of supplementary rations to animals on mineral-deficient areas by means of licks or feeding pellets containing the necessary mineral elements has met with an encouraging measure of success. The use of the double citrate of iron and ammonium in the treatment of cattle on the iron-deficient pumice areas is now an established farming practice, and some 1½ tons of this preparation were imported during the year and sold in small lots at cost price to farmers on affected country. The administration of this remedy to sheep in the form of pellets or cubes containing meals has been attended with success at Mamaku. Here a small flock that was showing signs of bush sickness after twelve months' grazing on unimproved paddocks heavily top-dressed with phosphates was made healthy and kept in good health for another year, and finally sold fat, as the result of the administration of the citrate in pellet form. The best means of accustoming sheep to accept this treatment is still a matter of experiment, but it is anticipated that the difficulties that have been encountered will shortly be overcome.

The experimental use of spathic iron ore (ferrous carbonate) and salt as a lick on iron-deficient country has been extended, and some very encouraging reports have been received regarding its efficacy. The trials are being continued.

Ragwort.—A small experiment at Kaharoa in the treatment of ragwort with sulphate of iron and salt was so successful that it was decided to carry out a more extensive experiment at Mamaku farm and in other ragwort infested districts. A further series of tests was carried out at Mamaku, using sodium chlorate, bleaching-powder, and copper sulphate, in addition to the iron-sulphate - salt mixture (this time applied as a spray). The treatment was applied in February; at the end of March it was reported that the sodium chlorate had been entirely effective, the patch sprayed being as green as before treatment, while no living ragwort-plants could be found. The iron-sulphate - sodium chloride mixture also gave good results.

Iodine Deficiency.—Miss B. W. Simpson, on loan from the Rowett Research Institute, Aberdeen, has been engaged in the determination of the iodine content of soils, pastures, and animal specimens, and in the analysis of thyroid glands. An interesting case of iodine-deficient land was encountered in a low-lying area near Pembroke, Wanaka. The soil and pastures proved to be low in iodine, while lambs were born with greatly enlarged thyroids. The matter is discussed in the *Journal* for April, 1930.

Composition of Lucerne.—Samples taken in connection with the occurrence of pulpy kidney in lambs in Central Otago included a number of specimens of lucerne. The analysis of these samples (published in the *Journal* for June, 1929) indicate that lucerne is a plant that is peculiarly rich in lime. It is suggested that this valuable fodder plant might be particularly useful in soils deficient in lime but overlying calcareous deposits, such as the lime-deficient soils of Mairoa.

Soils.

The work of the soil laboratory at Fairlie Terrace has included a reconnaissance survey of the soils of Tokaanu, with special reference to Native lands, the analysis of further samples from Rotorua County, and the analysis of a large number of soils taken in connection with the investigation into the mineral content of pastures. A number of miscellaneous soil-samples from Fields Division officers and others have also been examined. The results of the Tokaanu soil-analyses appeared in a paper published in the *Journal* for December 1929, together with a map showing the distribution of the various types of soil encountered. A further contribution to the soil survey of Rotorua County was published in the *Journal* for May and June, 1929, where the subsoils of the district are discussed. The article is accompanied by a subsoil map of the northern portion of the county.

Some further analyses were made of the so-called alkali patches occurring in the irrigation areas of Central Otago. The results, which confirm previous analyses showing the presence of toxic amounts of magnesium salts, are embodied in a paper published in the April, 1929, issue of the *Journal*.

In addition to the usual routine work of the soil laboratory, a considerable amount of time has been occupied in the investigation of new and improved methods of soil-analysis, both chemical and mechanical.

Limestones.—Ninety-six samples of limestone were received for analysis during the year.

Fertilizers.

No official samples have been taken under the Fertilizers Act during the year, but many farmers have availed themselves of the Department's offer of analysis of fertilizers purchased by the senders, to ascertain whether the fertilizer is in accordance with the vendor's guaranteed analysis. Unfortunately, in a large proportion of cases it transpired that no invoice certificates were supplied by the vendors, and steps are being taken to impress on the fertilizer trade the duty of vendors in this matter. No instances of serious deficiency were found among the informal samples analysed.

The bringing into force of the Fertilizers Act, 1927, has involved a great amount of correspondence with vendors, and the work of registration of brands has fully occupied the time of the Inspector of Fertilizers during the year. Vendors are now becoming acquainted with the requirements of the Act, and it is hoped that the work of registration will proceed more smoothly in the coming fertilizer year, which commences on the 1st June. The returns of importations of fertilizers have been compiled and published in the *Journal of Agriculture*, as usual.

No deposits of any commercial value were found among the various reputed fertilizers submitted for analysis.

Work for the Departmental Divisions.

An increasing number of samples of a varied character has been submitted for examination and report by the departmental Divisions. For the Live-stock Division the periodical examination of the public cattle-dips of the Auckland and Taranaki Districts has been continued. Several instances of suspected poisoning of stock have been investigated. Analyses of soils, pastures, and animal specimens have been carried out in connection with the veterinary research work of the Division. Officers of the Fields Division have submitted many samples of soils, fertilizers, limestones, fungicides, &c. This work is usually required in connection with the field experimental work of the Division. For the Dairy Division samples of milk, cream, cheese, and casein have been analysed, and advice has been given on chemical matters affecting the dairy industry. Samples of water have been examined to test their suitability for dairy-factory supply, and various stock-licks and reputed tonics, &c., have been reported on. From the Horticultural Division have been received samples of soil, honey, and insecticides and fungicides. A sample of passion-fruit " husks " from North Auckland was submitted for an opinion as to the possible uses of this waste material. The samples contained in the water-free substance 5·23 per cent. of a golden-yellow drying (or semi-drying) oil, with an aroma resembling that of olive-oil. The sample was too small to permit of an extended examination of the oil, but from the small amount present it seemed unlikely that its extraction would be profitable.

Summary of Samples received during the Year.

Soils collected by officers of the Chemistry Section, 510; soils, general, 81; pasture, 491; thyroids, 158; other animal organs and tissues, 22; milk, 146; cheese, 13; cattle and sheep dips, 193; fertilizers, 93; limestone, 96; water, 31; toxicological specimens, 12; stock-licks and medicines, 43; casein, 16; honey, 6; wool, 21; miscellaneous, 107: total, 2,039.

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