1947

NEW ZEALAND

DEPARTMENT OF AGRICULTURE

ANNUAL REPORT FOR YEAR 1946–47

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

SIR,—

I have the honour to forward for Your Excellency's information the report of the Department of Agriculture for the financial year ended 31st March, 1947.

The report provides a summary of the principal farming activities of the year and outlines the comprehensive and numerous functions of the Department in its work of developing the Dominion's primary industry.

I have, &c.,

EDWARD CULLEN,

Minister of Agriculture.

His Excellency the Governor-General.

ANNUAL REPORT OF THE ACTING-DIRECTOR-GENERAL

THE world food shortage is expected to be critical throughout the greater part of 1947, and although cereal-supplies may become adequate in 1948, shortages of dairy-produce and meat are likely to continue for a further two or three years. The Dominion's interest in securing an expanding market for primary produce and in fulfilling her obligations to the United Kingdom should serve to stimulate the farming industry to produce as much food as possible. A market for all our exportable produce is assured for the next few years, and, with the prospect of international agreement on the development of world trade based on the foundation of the maintenance by all countries of policies of full employment, there should be an expanding market for food for many years to come. If the great industrial countries can maintain full employment, there should be no difficulty in selling all the high-quality meat and dairy products New Zealand can produce.

Production during the 1945–46 and 1946–47 seasons has been adversely affected by the weather. Dairy production in 1945–46 was severely curtailed over a large part of the North Island by summer drought conditions and consequent lack of winter feed, and further dry weather has similarly affected 1946–47 production. Meat-production

in 1945–46 was high, but again it was the dry summer weather which was the chief factor leading to increased slaughterings. The production of meat, butterfat, and wool during the immediate pre-war years, the war years, and for the past and present seasons is set out in the following table :—

LIVE-STOCK PRODUCTION

(In long tons)

—	Butterfat : Year ended 31st July.	Meat : Year ended 30th September.	Wool : Year ended 30th June.
Average of five seasons, 1934–39 ..	189,900	470,000* (Three seasons only)	134,000
Average of six seasons, 1939–45 ..	191,600	528,000	151,000
1945–46 season	164,400 (Interim)	540,800†	163,200
1946–47 season (forecast)	175,000	520,000	155,000

* Years ended 30th June. † Farm killings collected by Government Statistician for first time since 1942 show considerable decrease. Had killings been allowed at the same level as in 1944–45, the 1945–46 total would have been 547,100 tons.

Cereal-production has declined during the past two seasons, and the present shortage is one of our most pressing problems. The 140,000 acres of wheat sown in 1946–47 is the lowest since the 1919–20 season and was chiefly caused by unfavourable weather at seeding-time. The areas under the chief cash crops for periods similar to that shown for live-stock products are set out in the following table :—

CASH CROPS : AREAS IN CROP

—	Areas threshed.					Commercial Areas outside Boroughs.		
	Wheat.	Oats.	Barley.	Maize.	Peas and Beans.	Potatoes.	Onions.	Total.
Average of five seasons, 1935–39	211,200	63,400	22,400	6,900	19,100	21,900	800	348,700
Average of six seasons, 1939–45	243,900	61,000	31,200	8,200	35,100	22,200	1,100	402,700
1945–46 season ..	161,000	57,300	48,600	7,000	34,800	23,200	1,400	333,300

PROGRAMME FOR THE 1947–48 SEASON

As world cereal-supplies are expected to be adequate in 1948, the Dominion should aim at increasing meat and butterfat production to the maximum, for it is in live-stock farming that New Zealand possesses very definite natural advantages.

Dairy and meat production should be assisted by increased fertilizer-supplies during the coming season. New Zealand's allocation of rock phosphate for the manufacture of superphosphate has been raised from 300,000 tons to 420,000 tons for the 1947–48 rationing year, and arrangements have been made to import approximately 50,000 tons of basic slag and North African phosphate.

The increased fertilizer-supplies will be most effective in improving production if their application for top-dressing is accompanied by closer attention to the provision of greater supplies of hay, silage, and fodder crops for winter feeding. More adequate winter feeding is the one single factor which would most rapidly increase butterfat-production, and in meat-production more winter feed would greatly lessen the frequently high winter mortality rate, especially of breeding-ewes.

The obligation of New Zealand to produce the greatest possible quantities of meat and dairy-produce during the coming seasons can only be fulfilled if adequate provision is made for the winter feeding of breeding-animals. Any increase in production must be obtained by the more intensive farming of the improved lands of the Dominion. Shortages of some essential imports such as fencing-wire preclude, for the coming season or two, any major effort at extending the production area through land-development or land-reclamation works.

A special tribute is merited by the British Phosphate Commission for the manner in which they have undertaken the rehabilitation of Nauru and Ocean Islands, our main source of raw-phosphate supplies. Despite adverse weather conditions for the first eight months and extreme difficulty in maintaining essential supplies of material and equipment, the Commission commenced shipping at the end of July, 1946, and to date approximately 180,000 tons of phosphate rock has been shipped to New Zealand. By the end of June, 1947, it is anticipated this will have been increased to 210,000 tons. The Commission forecasts that by 1949–50 the total output of the two islands will reach 1,000,000 tons to 1,200,000 tons. The rapidity with which work recommenced after the islands had been recovered from the Japanese deserves the highest commendation and reflects the efficiency of the Commission and its staff.

Farming Efficiency

A constantly improving farm efficiency in terms of output per man and per acre is our objective, for only by such means can we secure any immediate increase in production and withstand future competition in overseas markets when food-supplies are more abundant than to-day.

Possibly the most important measure of farm efficiency is the amount of human effort required to produce a bushel of wheat or a pound of meat, butterfat, or wool, and while New Zealand, thanks to its favourable climate and the ability of its farmers, holds pride of place in output per man, it must be admitted that our efficiency could be greatly increased and we must not rest complacent with our present achievements. I consider that greater attention should be paid to the following important factors leading to increased efficiency.

(1) Reduction of live-stock mortality and improvement of meat and dairy production through better feeding.

(2) Reduction of loss through plant and animal diseases.

(3) Improvement of pasture and crop production through the use of improved plant strains, fertilizers, and lime.

(4) Increased mechanization of farming.

Improvement of production through attention to the above factors could be attained fairly rapidly if the farm-management methods of the average farmer were raised to those of the best farmers, and the Department of Agriculture is fully alive to its responsibility in raising the general level of farm practice through its research and extension services.

The recent extension of the Department's animal research stations at Ruakura and Wallaceville, and the establishment of a soil fertility station at Hamilton and an irrigation farm at Ashburton, will widen the Department's research activities and provide the basic information for the improvement of live-stock, pasture, and crop production methods. Increased attention is being given to mechanization by the establishment of the Farm Engineering Section of the Rural Development Division. The research institutions of the Department of Agriculture and the Department of Scientific and Industrial Research can, however, only form the pattern of the lines on which farm efficiency can be increased. The extension services must carry the information to the working farmer, and it is in the extension services of the Department that the staffing difficulties are most acute.

During the past decade there has been a shortage of graduates in agricultural science suitable for extension work. The few graduates available have generally been more interested in research than extension work. It is hoped that this diffidence of taking up extension work can be overcome, or the value of much of the research work being undertaken will be lost to the farming community. So great has been the shortage of agricultural graduates suitable for instructional work that the Department has had to plan part of its future recruitment through the rural cadet scheme, which provides for a thorough practical training in farming as well as academic instruction to diploma standard.

Although the recruitment of agricultural graduates for the extension services has not been quite satisfactory during recent years, the Department has succeeded in securing a number of competent field officers, thereby maintaining the extension services at a high level of efficiency.

The *New Zealand Journal of Agriculture* is now taking a very important place in the Department's extension work. The monthly circulation now exceeds 70,000 copies, and should soon reach 90,000 a month, thus attaining the Department's objective that practically every farmer is a subscriber to the *Journal*.

Food and Agriculture Organization

Mr. E. J. Fawcett, Director-General of Agriculture, will be absent from New Zealand during the greater part of 1947 attending to the business of the Department and assisting in the deliberations of the Food and Agriculture Organization, of which he is a member of the Executive Committee.

The present important work of FAO is to develop a World Food Council charged with securing international co-operation in the production and distribution of food. This proposal, together with the discussions now taking place on setting up the International Organization for Trade and Employment, may have very great effects on the future of New Zealand farming. Both aim at increasing international trade and employment, which, if secured, would be of great advantage in expanding our export markets.

R. B. Tennent, Acting-Director-General.

ACCOUNTS DIVISION

REPORT OF L. C. SCOTT, ACCOUNTANT

As from 1st April, 1946, recoveries (credits-in-aid) are not directly associated with payments. Accordingly, payments and receipts are reviewed separately.

Payments

Vote.—Certain items of the vote payments series, being directly related to stabilization projects, were provided for under vote "Stabilization." Thus vote "Agriculture" was relieved of £535,000. The remaining provisions in the vote gave an appropriation of £1,803,979, but £489,543 of this amount was for the purposes of the Milk Marketing Division of the Marketing Department. Against this appropriation of £1,314,436, the year's payments totalled £1,187,772. This omits £262,570 relating to the Milk Marketing Division. The payments were thus £126,664 below the appropriated total. Lack of necessary labour and supplies contributed substantially to this saving. Other savings related to advances and assistance to industry, to lower outgoings for condemned live-stock compensation, and weeds, rabbits, and wild pigs destruction projects. Savings arising from shortage of labour and supplies seldom prove to be other than a postponement of expenditure.

Other Transactions.—The sum of £3,583,476 was paid under vote "Stabilization." The payments were mainly for purposes relative to fertilizers.

Receipts

Vote.—Departmental receipts were estimated at £759,175. This total included £337,500 relative to the Milk Marketing Division and £71,000 expected under "Special Acts." Thus the estimated balance to be obtained from items of the vote was £350,675. The sum of £391,228 was received. The increased amount came mainly from calf vaccination, seed-testing, and seed certification.

Other Transactions.—Under vote "Stabilization," £3,033,935 was derived from pool accounts in set-off against the assistance (mainly relating to fertilizers) to farmers in the year ended 31st July, 1946.

Under "Special Acts," £71,274 was received and was derived mainly by way of fees, particularly under the Meat Act.

The clearances of redundant assets of the Services vegetable-production war activity realized £67,461 to the War Assets Realization Board. Of this sum, £29,221 passed through the Department's cash-books, the balance being received through other Departments.

Summary

A summary of the vote, with 1945–46 figures in parentheses for comparative purposes, is given below :—

	Expenditure.				Revenue.			
	Appropriated.		Paid out.		Appropriated.		Received.	
	£	£	£	£	£	£	£	£
Administrative services ..	1,034,890	(851,492)	955,569	(818,157)	180,505	(169,055)	219,190	(190,568)
Miscellaneous advances ..	160,546	(590,727)	123,795	(575,486)	167,170	(327,250)	167,398	(234,571)
Payments under statutes	119,000	(91,732)	108,408	(93,426)	3,000	(2,500)	4,653	(2,245)
Milk Marketing Division ..	489,543	(24,000)	262,570	(7,994)	337,500	(..)	..	(217)
Totals ..	1,803,979	(1,557,951)	1,450,342	(1,495,063)	688,175	(498,805)	391,241	(427,601)

Administrative Services

Personal services, together with locomotion, transfer expenses, office accommodation, and office expenses, represent a substantial proportion of the expenditure. Two large farms and many small areas, research laboratories, the seed-testing station, field crops

and experimental work, the provision of publicity, and publications are other main activities. Production from farms and fees for services rendered are major sources of revenue.

Miscellaneous Advances, Grants, Subsidies, etc.

Eradication of weeds, Services vegetable-production, flax-production subsidy, and cow-testing-organization subsidy are major items of expenditure. Other subsidies and grants cover a wide range of projects. Recoveries normally arise from noxious-weeds work and from advances made against funds held on deposit for the pig industry. This year, however, the greater part of the receipts came from accounts due for vegetable-production; the projects are all now closed.

Payments under Statutes

Compensation for diseased live-stock and subsidies to Rabbit Boards constitute the payments. A small amount is recovered from carcass disposals arising from live-stock condemnations.

Milk Marketing Division

This is a temporary provision under vote, "Agriculture."

LIVE-STOCK DIVISION

REPORT OF W. C. BARRY, DIRECTOR

Climatic Conditions

Owing to the very dry summer in 1946, it was anticipated that the autumn and winter would prove a difficult period for stock, particularly in regard to the feed-supply. It was fortunate, however, that the winter turned out to be mild, and the drought-stricken areas recovered very well and provided some feed throughout the winter.

The climatic conditions in Otago and Southland were particularly favourable, and stock wintered better than they had done for some seasons.

The spring was cold and wet in all districts, and production was very backward compared with that of other years. Dairy production did not reach its usual peak, and the cold, wet conditions retarded fattening of lambs. The lamb-fattening season and other aspects of primary production were generally about a month later than in a normal season.

Improved weather conditions from December onward were reflected in the stock fattening better, with large drafts of lambs available for slaughter, and a general improvement in dairy production. The summer was satisfactory, if rather dry in some districts, but autumn rains have proved beneficial, and the autumn and winter prospects are now quite good.

A large quantity of hay has been saved in the South Island, and the North Island production of hay and silage is considered satisfactory for winter needs.

Health of Live-stock

HORSES

The health of horses has remained good during the year, although some small outbreaks of strangles took place.

There is practically no interest in the breeding of draught horses, and very few stallions have been examined under the Stallions Act. There appears to be an increasing interest in saddle-horses and in the breeding of children's ponies. The classes at the agricultural shows show increased entries in this field.

The breeding of thoroughbred horses is being actively pursued, and many good prices were obtained at the last sale of young stock.

CATTLE

Diseases scheduled under the Stock Act

Tuberculosis.—The number of cattle condemned under the Stock Act for tuberculosis during the year amounted to 6,397; 5,177 were condemned on clinical symptoms and 1,220 as reactors to the tuberculin test. In each case compensation was paid in accordance with the provisions of the Act. The tuberculin test was applied to 22,061 cattle, of which 1,220 reacted, giving a percentage of 5·5.

The total number of cattle, exclusive of calves, examined at the various abattoirs and meat-export slaughterhouses was 602,755, a decrease of 72,193 on last year's figures. Of these, 42,145, or 7·0 per cent., were found to be affected with tuberculosis in varying degree, a large percentage being only slightly affected. This indicates an increase of 0·7 per cent. infection among cattle slaughtered in these premises.

The testing of herds is mainly carried out on a voluntary basis, but during the year an amendment to the Stock Act requiring the testing of dairy herds supplying milk for town supply came into operation on the 1st May, but owing to various reasons a smaller number of herds has been tested than was visualized. Under the amendment to the Act a total of 9,305 cattle were subjected to the tuberculin test, when 524 reactors were found. This gives a percentage of 5·6, the majority of this testing being carried out in

the Wellington and Canterbury districts. In addition, 10,719 cattle were tested at the owners' request, while 1,394 head of stock were tested at the various Government farms under the control of several Departments.

Actinomycosis (and Actinobacillosis).—During the year, 604 animals were condemned for this disease, while about the same number of animals were treated with iodides. Many animals were dosed with potassium-iodide tablets, as supplied by the Department, while others were treated by injections of sodium iodide.

A rather extensive outbreak of actinobacillosis occurred among young cattle grazing on peat country previously burnt over. A number recovered spontaneously, while others responded well to iodide treatment.

Malignant Growth.—The number of stock condemned was 230, an increase of 34 on the figure recorded the previous year. Compensation was paid in accordance with the Stock Act.

Johne's Disease.—A total of 151 animals were condemned for this disease under the Stock Act, the majority of the animals being in the Taranaki district. The total number of farms where this disease has been reported is increasing from year to year. The control of spread of the disease presents a difficult problem. Some consideration has been given to the possibility of vaccination of young calves on the more severely affected farms.

Anthrax.—No cases of anthrax were recorded during the year. The vaccination of herds is still being carried out on those farms where the disease occurred a few years ago.

Blackleg.—The numbers of calves vaccinated against this disease in the affected areas were : Taranaki, 19,489, and Auckland, 31,031 ; making a total of 50,520. There is an increase of 8,589 in the number of calves vaccinated in Taranaki, whereas the Auckland figures show a decrease of 8,289 compared with the figures for last year.

There were 334 outbreaks in the Auckland district, compared with 313 the previous year. This involved the vaccination of 5,658 calves on 334 farms. In addition, 25,373 calves were vaccinated on 1,272 farms as a preventive measure.

Non-scheduled Diseases

Mastitis.—This disease continues to give concern to dairy-farmers. The modern tendency is to treat the disease by intra-mammary therapy. The use of sulphanilamide in oil for intra-mammary infusion is becoming more general. The field results obtained are encouraging, although some cases fail to respond to the treatment. In one instance it was noted that the disease recurred within three months.

A field trial on a small scale was carried out, when an infusion of the sodium salt of penicillin was used. In the acutely affected quarters the response was good, whereas in quarters infected for some weeks, although the quarter was rendered sterile, the secretion was still far from normal. If the efficacy of the treatment could be established, however, it might prove very useful in preventing the spread of infection through a herd in those cases where a few members are found to be infected in the early part of the season.

Many aspects of the mastitis problem are being investigated by the Animal Research Division.

Contagious Abortion.—The vaccination of heifer calves against this disease is now an established practice. The volume of work involved in carrying out the vaccination of the large numbers requiring vaccination is increasing from year to year. A considerable amount of organization is required to ensure the arrival of the vaccine when required and to co-ordinate the work of vaccination in the intensive dairying districts. The facilities available on many farms leave much to be desired. The field staff are working under difficulties in some districts owing to transport problems, but

if the farmers co-operated to the fullest extent, much unnecessary motor travelling could be avoided. All owners of young dairy heifers should realize that this vaccination work is now practically on a Dominion basis, and the magnitude of the task of the field officers will thus be more readily appreciated. During one month the field officers in the Auckland district vaccinated 12,319 calves against abortion disease.

Temporary Sterility.—This phase of disease in dairy herds continues to cause trouble to some dairy-farmers, and farmers in the Manawatu district have experienced more than their share of it. It was also noted that many herds in the district were in very low condition in the early spring. This, and similar experiences in past years, would make it appear that this type of sterility is a functional one. In seasons when feed is plentiful, particularly during the winter and spring, less breeding trouble is experienced among dairy herds. Adequate nutrition and improved husbandry methods in the handling of herds will assist in overcoming some of the trouble, which is undoubtedly accentuated through our system of seasonal production.

Grass-staggers.—Last spring, calving and after-calving diseases were not so serious as in some other years. The incidence of grass-staggers in dairy cows was much lower than in other years. The cold, wet spring and the absence of any flush of feed for many weeks after calving had a direct bearing on the lowered incidence. Although the cows were in low condition following the previous season's dry summer and autumn, the cows could only gradually reach peak production, on account of adverse climatic and pasture conditions. Although many animals suffered from weakness and debility leading to paralysis, the incidence of both milk-fever and grass staggers was below what might have been expected under favourable spring flush feed conditions.

Milk-fever.—As already recorded, the season did not favour a high incidence of this disease. The cattle were in low condition at calving-time, and no flush of feed was experienced until the danger period had passed. The cold, wet spring had an inhibiting influence on this disease. As might be expected under the seasonal conditions, the number of dairy cows affected with that nutritional disease known as acetonæmia, or ketosis, was comparatively large.

The mild autumn this year should have assisted in the conservation of winter feed, and dairy herds should enter the winter in good physical condition.

Mortalities due to Poisoning.—A number of mortalities of stock occurred and were investigated during the year. Quite a variety of toxic agents were involved in these cases.

In Hawke's Bay a mortality in stock was shown to be due to nitrite poisoning, following the consumption of rapidly growing young variegated and winged thistle, in addition to a mortality due to eating mangels. The danger of nitrite poisoning due to mangels was shown some years ago, and the investigation was given full publicity in the *Journal of Agriculture.*

Ngaio poisoning, which was referred to in last year's report, occurred again this year following the severe storm in February.

Other accidental poisonings took place due to stock having access to such dangerous poisons as arsenic and lead. Where arsenic is used for dips and other farm needs, great care is necessary to dispose of used containers or any surplus fluid dips. Similarly, when arsenical preparations are used as weedicides, stock should not be allowed access to treated areas.

The chewing of old dip packets by young cattle caused one mortality from arsenical poisoning, whereas in another case an arsenical foot-rot dressing was responsible, and a considerable number of mortalities were recorded following the grazing of areas treated with arsenical weedicide.

In nearly all cases lead poisoning is due to access to paint, painted buildings, or discarded paint containers.

Access to clippings from a yew tree (*Taxus japonica*) accounted for another mortality in cattle. Cases of poisoning from fern and tutu were reported during the year.

Investigations and findings of poisoning of stock from these causes demonstrate a certain amount of carelessness on farms in the handling and disposal of these poisonous substances. The causes of poisoning in all these inquiries are well known to all stockmen, and owners should exercise more care to prevent stock losses from this cause.

Parasitic Disease in Young Cattle.—The use of phenothiazine in the treatment of young stock infested with worms is increasing. Stock-owners require to exercise due care in administering the appropriate dose to calves, according to their age. In a few instances where owners have been too generous in their dosage rates the treated calves have shown the effects of this worm medicine.

Eye symptoms have been recorded, with rapid loss of condition in some cases. The eyes are affected with discharge, and later sometimes covered with a white film. If an excessive dose is given, death may result.

Owners are advised to use the correct dosage rates, so that this valuable worm medicine is not brought into disrepute. Risks should not be taken of increasing the dosage with this preparation. Many such risks were taken in the past with bluestone solution, but it is generally accepted that phenothiazine is superior to other worm medicines, so that if it is used judiciously and a good standard of feeding and calf husbandry is practised, farmers should have no difficulty in rearing young stock for replacement purposes.

SHEEP

A mild winter was experienced in 1946, and generally all ewe flocks wintered well. As was anticipated, owing to the drought conditions affecting many parts of the North Island, the lambing percentage was not up to the high record of the previous year. Although the spring was cold and wet and lambs did not fatten early, the summer has been good and large numbers of good-quality lambs of good weights have been killed. The killing season in the South Island was practically a month later than usual, owing to the cold, wet spring. Arrears are now being overcome.

Owing to the mild winter, the incidence of ewe losses due to disease was low. Very little bearing trouble in ewes was experienced, and with the exception of some losses in country affected by snow there were few outbreaks of pregnancy toxæmia.

There was some increase in the shearing of ewes before lambing in the Otago district. This practice is not without risk of loss if unseasonable weather is experienced, and some losses of ewes were recorded.

The wool clip for 1946–47 has been more attractive than that for last year, due to the better seasonal conditions over the Dominion as a whole.

Shearing and dipping operations were carried out satisfactorily, and generally all dipping preparations have proved effective in the control of parasites. Dipping losses were not numerous, but a new experience with some dipping fluids was the occurrence of lameness, frequently affecting a good percentage of the dipped sheep. The nature of the lameness is obscure, as it frequently affects one limb only, and affected sheep recover in about twelve to fourteen days.

Infectious Entero-toxæmia (Pulpy Kidney).—The Live stock Superintendent, Dunedin, reports :—

Losses among lambs were widespread over the district, but the individual incidence was low. Some further losses occurred in lambs about four months old, and were the subject of several inquiries. The vaccination of ewes is extensively carried out, with reasonably satisfactory results.

Lymphadenitis.—The inspection of carcasses for this disease is a routine procedure at all freezing-works. Owing to labour difficulties, inspection methods have been

confined mainly to palpation at many works. The incidence of the disease in North Island lamb and mutton carcasses is low, being definitely higher in South Island works.

Pregnancy Toxæmia.—The Live-stock Superintendent, Christchurch, reports:—

Owing to the mild weather experienced during the winter and early spring, and the green feed available for in-lamb ewes, the incidence of this disease throughout most parts of the district has been comparatively low. The Mackenzie country was an exception, as heavy snows and a severe spring were experienced, and some owners lost considerable numbers of ewes.

The mild season at present being experienced augurs well for next season's lambing.

Loss of New-born Lambs.—In Gisborne, Hawke's Bay, and Marlborough a considerable loss of new-born lambs was experienced last spring. In some cases what appeared to be full-time lambs were born dead, or died immediately after birth. In some instances up to 10 per cent. of the lambs failed to get on their feet. A preliminary investigation failed to reveal the cause.

Parasitic Gastro-enteritis.—The losses from this cause were below normal. Many owners are now using phenothiazine very successfully in the control of parasites in young stock. The judicious use of this worm medicine, combined with good nutrition and management of lambs and hoggets, appears to give good results. The nutritional aspect of worm control is still of paramount importance, and much can be done by giving the young susceptible animals the best of the grazing available to enable a natural immunity to be built up.

In an inquiry carried out into lamb unthriftiness in Southland and parts of Otago, the importance and nutritive properties of the type of pasture, and its proper control by suitable grazing, are clearly brought out as factors in the cause of the trouble. Lambs did quite well on the mothers up to about shearing-time, when they commenced to go off. The lambs began to scour, appeared sluggish, and were generally unthrifty. The problem was examined from three angles—the deficiency angle, the parasitic angle, and the nutritional angle.

Examinations showed no known deficiency, while nothing significant was revealed in the parasitic inquiry. Certain peculiar grazing and pasture conditions exist in the affected districts, owing to other farming projects being carried on simultaneously. Proper grazing control of pastures is not maintained, and the quality of the pasture consumed by the young stock is low. A high plane of nutrition in the growing animal is not being maintained under the existing conditions, and more attention will require to be paid to the state of the pastures if fat-lamb raising is to be carried on simultaneously with the other farm operations in the affected areas.

This investigation is a confirmation of the recommendations made over many years regarding the rearing of lambs and hoggets where special stress has always been placed on nutrition and management as major factors in the control of parasites in young stock.

Contagious Ecthyma.—Many farmers are using the vaccine against this disease. A high degree of protection is effected in the preventive field. There was an increase in the incidence of this disease in parts of the North Island, where vaccination is now used more extensively, with good results.

Facial Eczema.—No serious disease of this nature was seen during the year.

Liver-fluke and Black Disease.—These diseases are showing a tendency to spread in Hawke's Bay, and farmers in the affected areas would be well advised to take active steps to deal with the liver-fluke menace. Advice on the control of this parasite is readily available from officers of the Live-stock Division in the district.

Blackleg in Sheep.—Vaccination against this disease in sheep is now extensively practised in many parts of the Wellington district. The disease has been diagnosed in many other districts—in Auckland Province, in parts of Canterbury, and in parts of Otago. The vaccination of a small number of flocks has been carried out in Canterbury.

Cutaneous Myiasis (Sheep Blow-fly).—Owing to the excessive amount of wet weather from November to January, blow-fly strike was more serious in Canterbury than it has been for some years. The majority of sheep were affected with "body strike," with withers and rump being common sites. The strikes followed fleece rot, the latter being accentuated by the prolonged wet weather. Lambs, two-tooth ewes, and aged ewes were infested by the maggots, but the mortality from the strike was low. In practically all cases where the wool was shorn from the struck area recovery followed and restrike was exceptional. The fly was more active in North Canterbury than in other districts.

Foot-rot.—This disease was reported in many parts of Canterbury throughout the year. In other districts the incidence was lower than in other years.

Lice and Ticks.—The inspection of sheep at sales and fairs has been carried out during the year. The reports show that although a few small lines of lousy sheep have been detected at these centres, there has been a big improvement in the control of the sheep-tick. It appears as if satisfactory dipping has been carried out in most instances, and the control of tick has been effective.

PIGS

The number of pigs slaughtered for the season 1946–47 at premises under inspection was 579,638, a decrease of 127,439 over last year's figures.

Inspection of the carcasses at time of slaughter revealed that 78,589 carcasses were found to be affected in varying degree with tuberculosis, the percentage being 13·56 per cent. This is a decrease of 0·4 per cent. as compared with last year.

Diseases of Pigs

Tuberculosis.—This is one of the chief causes of condemnation of pigs on inspection. The incidence of this disease is naturally somewhat higher in North Island dairying districts, where milk by-products form such a large part of the diet of the pig. On the other hand, although large numbers of pigs are not raised in Canterbury, it is interesting to note that the incidence of tuberculosis in pigs in this area is distinctly lower. Grain-fed pigs are not so subject to infection.

Suipestifer Infection.—This infection is fairly widespread and at times causes a very serious mortality.

Sarcoptic Mange.—One case of sarcoptic mange in pigs was recorded during the year, the number of pigs affected being three.

Kidney-worm Infestation (Stephanurus Dentatus).—Two sows were found to be infested with this parasite at time of slaughter. The history of these pigs is being inquired into, with a view to tracing the infestation to its source, to prevent any spread.

Swine Husbandry

A review of the activities of the Department in relation to the pig industry is as follows:—

Production figures for the season ended September, 1946, are the lowest on record for the past *twelve years*, and killings for the year ended March, 1947, show every indication of being 150,000 carcasses below those of March, 1946. With the termination of hostilities it was envisaged that production of pig-meats would increase, particularly as the lifting of restrictions on the sale of pork for local consumption would permit a return to normal practice, that of producing more light-weight pigs giving more scope and incentive to pig-producers.

Holdings of sows and production per sow have continued to fall over the past six years; the number of pigs per sow has been reduced from 10·7 to 9·0 per annum. It takes just one year for the effect to be shown, and the following figures show the trend of production :—

ANALYSIS FOR THE SIX YEARS ENDED SEPTEMBER, 1946

Year.	Breeding-sows.	Total Pigs slaughtered.	Pigs per Sow.	Slaughtered as—			Total Weight of Pig-meat (as Carcasses).
				Porkers, 40–120 lb.	Baconers, 121–200 lb.	Choppers, Over 200 lb.	
							Tons.
1941	100,378	1,006,686	10·7	488,973	474,329	43,384	52,623
1942	91,338	925,982	10·1	494,126	397,717	34,139	47,987
1943	81,882	772,744	9·4	321,049	418,943	32,752	44,320
1944	77,300	740,913	9·6	254,126	464,558	22,229	43,251
1945	77,200	681,280	8·8	170,852	489,220	21,208	42,378
1946	72,000	664,275	9·0	256,821	385,782	21,672	38,437

In spite of the continuance of the £5-per-acre crop-subsidy scheme and progressive increases in the price schedule for pig-meats, production has continued to fall. Killings at all export and rural slaughterhouses, abattoirs, and on farms have decreased annually, and show a drop, by comparison with the year ended September, 1941, of 342,411 carcasses as at September, 1946.

The falling-off in production is bound up in some measure with the reduction in cows milked, the increase in the amount of milk-powder produced, lack of efficient labour on farms, and the absence of imported grains and concentrates as supplements to farm-grown crops for wintering pigs; the two major factors are lack of labour and an inadequate winter feed-supply.

Crop-subsidy Scheme.—Introduced in 1944, the £5-per-acre crop-subsidy scheme has not received from farmers the support expected. As a means of making producers self-sufficient and independent of imported feed-supplies for wintering pigs, it cannot be claimed to have given satisfactory results. This is borne out by the fact that in any year since its inception only just over 5,000 of 40,000 pig-producers have taken advantage of the scheme. That the subsidy on crops grown for pigs has not given incentive to greater production of pig-meats is shown by the claims made since the scheme has been in operation :—

Year.	Number of Claims.	Area of Crops.	Subsidy paid.	Pigs produced.
		Acres.	£	
1945	5,023	19,664	98,330	681,280
1946	5,088	25,419	113,000	664,275
1947*	5,860	29,503	..	620,000

* Estimated.

Instructional.—The National Pig Industry Council has again given great service in the instructional field. Lectures, demonstrations, and field-days have been carried out by all District Pig Councils, and many new and improved piggeries have been erected.

Publicity schemes have been operative in all Council areas, and the National Pig Industry Council launched a drive for increased production of pig-meats early in 1947.

Grading standards for baconer pigs have been revised to include differential prices for pigs in the various weight ranges, and it is anticipated that these will be put into operation with the lifting of meat rationing.

MEAT INSPECTION AND SLAUGHTER OF STOCK

The standard of meat inspection has been maintained at a satisfactory level during the year. Many works have found it difficult to obtain labour to carry out the incision of glands in mutton carcasses. Inspection for evidence of lymphadenitis has included palpation, together with whatever amount of incision work could be carried out.

A lowering of the standard of dressing of lamb and mutton carcasses has been noted in several works. The standard of hygiene at some works has been difficult to maintain, mainly owing to difficulty in obtaining labour.

The grading of meat intended for local consumption has been carried out at abattoirs and freezing-works. Although some difficulties have been experienced, the work of grading is generally satisfactory to the trade.

The total numbers of stock slaughtered at registered premises (rural slaughterhouses included) for the year ended 31st March, 1947, were: sheep, 4,726,167; lambs, 11,775,144; cattle, 661,918; calves, 1,037,302; swine, 593,474.

The table below shows the numbers of stock slaughtered during the past year at freezing-works only:—

Class of Stock.	Year ended 31st March, 1947.	Year ended 31st March, 1946.	Increase or Decrease.
Cattle	438,095	507,440	69,345 (decrease).
Calves	999,526	941,660	57,866 (increase).
Sheep	3,659,296	3,939,750	280,454 (decrease).
Lambs	11,620,861	12,518,554	897,693 ,,
Swine	481,545	628,047	146,502 ,,

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

Stock.	1943–44.	1944–45.	1945–46.	1946–47.
Sheep	1,937,477	1,894,985	2,594,571	2,348,620
Of which were ewes ..	1,499,798	1,349,074	1,967,187	1,729,109
Lambs	7,407,317	7,119,633	8,735,367	8,246,064

The following table shows the number of stock slaughtered under direct inspection during the year ended 31st March, 1947, at abattoirs and meat-export slaughterhouses:—

Class of Stock.	Abattoirs.	Meat-export Slaughterhouses.	Total Slaughterings under Inspection.
Cattle	164,660	438,095	602,755
Calves	36,831	999,526	1,036,357
Sheep	831,723	3,659,296	4,491,019
Lambs	132,615	11,620,861	11,753,476
Swine	98,093	481,545	579,638

Slaughterings at rural slaughterhouses during the year were as follows: cattle, 59,163; calves, 945; sheep, 235,148; lambs, 21,668; swine, 13,836.

Of the animals shown in the table above as slaughtered at meat-export slaughterhouses, the following have gone into consumption within the Dominion: cattle, 51,536; calves, 26,397; sheep, 343,727; lambs, 173,849; swine, 185,120.

Compensation paid for Stock and Meat condemned

Compensation amounting to £21,305 15s. was paid out during the year for animals condemned in the field under the provisions of the Stock Act, and £19,906 11s. 7d. for carcasses or parts of carcasses condemned for disease on slaughter for human consumption at abattoirs, meat-export slaughterhouses, &c., under the provisions of the Meat Act.

Importation of Stock

The following stock were imported during the year: cattle, 28; sheep, 199; pigs, 12; horses, 80 (including the movement of thoroughbreds between here and Australia). Of the above animals, the following were placed in quarantine for the respective periods required: cattle, 28; pigs, 12; sheep, 14.

Exportation of Stock

During the year under review the following animals were exported: cattle, 470; sheep, 2,842; pigs, 20; horses, 184. Of this total of 184 horses, the movement of thoroughbred horses to Australia accounted for 169 animals.

Dairy Inspection

Dairy inspection has been maintained on all premises registered for the supply of milk and cream, with a view to ensuring the production of high-grade milk for human consumption. Producers have endeavoured to place a high-grade article on the market, and welcome advice when some temporary trouble is met with.

Very little building or improvments have been effected, owing to the extreme shortage of labour and material.

The standard of milk-production has been good, and premises and milking plants have been maintained in a satisfactory condition. It has been a practice to take samples of milk for sediment and other tests, in addition to samples taken by the Health Department. Wherever any sample has failed to stand up to test, the farm is visited, the faulty technique is traced down, and remedial measures are suggested to prevent a recurrence. Instruction in methods of clean-milk production is necessary at all seasons of the year, but particularly during the winter months of production, when sanitary conditions are more difficult to maintain. The various tests tend to show that the holders of temporary licences are the worst offenders during the winter months, when surroundings may not be good.

Many minor improvements have been effected in all districts. Better heating facilities have been provided to ensure adequate hot water for washing up and sterilization of machines and utensils. Improved water-supplies have been provided to assist in the cooling of milk, and many new and better cooling systems have been installed. All these factors tend to assist in placing a high-grade milk of good keeping-quality on the market.

Poultry

A review of the activities of the Department in relation to the poultry industry is as follows:—

In the annual report for 1945–46 attention was drawn to two factors—namely, supplies of poultry-foods and building-materials—which were then limiting any expansion of poultry flocks, and the statement was made that no appreciable improvement in the egg-supply position could be anticipated until these two shortages ceased. Unfortunately for the consuming public and the poultry-producer alike, the shortage in essential poultry-foods has become intensified during the past twelve months. In consequence, there has been a marked shortage of eggs, particularly in the main cities, while poultry-producers have experienced one of the most difficult periods in the history of the poultry industry. There were, indeed, one or two occasions when it appeared that large and immediate reductions in the poultry population of the Dominion could not be avoided.

The poultry-food situation during the period under review, before which supplies of food were already limited, may be summarized as follows: in the spring of 1946 a decision was taken to raise the extraction rate of flour to 80 per cent., and immediately this was put into effect the poultry industry faced a loss of not less than 13,000 tons per annum of wheaten offals, principally pollard. Pollard manufactured after the change in the extraction rate of flour was also lowered appreciably in feeding-value. Immediately on top of this loss in food within the Dominion came news of the drought in the wheat-growing areas of Australia and the subsequent decision of the Commonwealth to cease the export of stock-meal (or ground wheat) to New Zealand. Substantial quantities of stock-meal were previously used to feed poultry, more particularly in the North Island. Finally, the world shortage of wheat placed limits upon the supplies of this grain from Australia. With knowledge of this train of events, it is not difficult to realize how acute the poultry-food situation became, and, furthermore, at a most critical period of the poultry-farmers' year—the breeding and rearing season.

After a careful survey of the position, and with the approval of the poultry industry through the New Zealand Poultry Board, it was decided to "pool" all available supplies of feeding-meals suitable for poultry and to manufacture standard poultry-mashes. Under the scheme introduced in September, 1946, and operating at present, these mashes are manufactured under licence and to formulæ laid down by the Department. Furthermore, all such mashes are subject to ceiling prices according to district. In composing the formulæ for these mashes, the Department was handicapped considerably by the

limited quantities of the various ingredients available. Thus the best mashes possible in the circumstances were chosen for manufacture, but not necessarily the type of mash which would be recommended if supplies of poultry-foods were normal, which is a point about which some misconceptions appear to exist.

While the scheme in general has worked satisfactorily and has helped to bridge over a critical period, factors other than the actual supplies of raw materials in the Dominion have caused local and temporary breakdowns in a number of districts, principally in the North Island. There have been transport difficulties in moving supplies of bran and pollard from the South to the North Island, and occasional delays have been experienced in obtaining vital supplies of wheat from Australia.

Relief from the present difficult position cannot be anticipated until increased supplies of wheat, maize, and barley again become available to the poultry industry. The situation is also affected by any future decision regarding the present extraction rate of flour. However, everything possible has been done to reserve essential foods for the poultry industry, even to involving losses in supplies to other primary industries.

The poultry industry arranged for a cost of egg-production to be taken out by two economists, and, following representations to the Economic Stabilization Commission, was granted an increase in egg prices in line with the costs shown in the survey. These costs included feeding charges based upon an average of the ceiling prices for standard poultry-mashes delivered at poultry-farms.

Improvement of Stock.—The New Zealand Poultry Flock Improvement Plan, established in 1945, has made the satisfactory progress anticipated in last year's report. It was recorded then that 28 breeding-flocks had been accredited under the plan, while for 1946 the number was increased to 72 flocks. A further increase is anticipated for 1947. Equally important with this increase in actual numbers of flocks accredited is the stable and satisfactory interest generally evinced in the plan. There appear to be sound reasons for believing that this plan will result in an improvement in the breeding-flocks in the Dominion.

Poultry-diseases.—The disease problem among poultry is still one of major importance, and appreciable losses among poultry flocks result in an economic loss to the Dominion. Steps are being taken to combat this problem, and the appointment of two veterinary officers specializing in poultry-disease control for work in the field is anticipated in the near future. This will link up field work with the Animal Research Station, Wallaceville, and subsequently permit of increased research work in poultry pathology at that Station.

Advances have been made in the control of pullorum disease (*Salmonella pullorum*) in chicks by the blood-testing of breeding-stock which may be "carriers" of this disease, and approximately 110,000 birds were tested in 1945 and 135,000 birds in 1946. The comparable figure for 1941 was 700 birds.

Rehabilitation of Returned Servicemen.—During the period under review a further number of returned servicemen were trained in poultry-farming, while others were placed on farms following their period of training. Owing to the poultry-food position, these men were not encouraged to take up poultry-farms immediately following their training, or, alternatively, were encouraged to run other classes of stock with their poultry pending an improvement in the situation. Some have extended their period of training for the same reason. Poultry Instructors have kept in constant touch with those settled on poultry-farms and have given all practical assistance possible. It is apparent that this service from the Department must be continued in future, and, if possible, increased. A period of one year for training is a minimum one, and these men obviously require additional practical guidance when they settle on farms.

The Poultry Demonstration Plant, Upper Hutt.—The past twelve months has seen the complete reorganization of the table-poultry-production plant established at Upper Hutt during the war. This plant has now been taken over by the Department and developed along lines which it is felt will make the unit of interest and service to the poultry industry. The former departmental poultry unit—the Poultry Station, Wallaceville, which was established over twenty years ago—has been dismantled and the stock transferred to the new plant. The year's work has been made up almost entirely of dismantling the Poultry Station and creating modern poultry housing at Upper Hutt with the material salvaged from the old unit.

As it is now organized, the poultry demonstration plant is in a position to—

(*a*) Carry out pedigree breeding and progeny testing;

(*b*) Conduct management and feeding experiments with a commercial flock;

(*c*) Conduct a breeders' egg-laying trial; and

(*d*) Demonstrate and experiment with the production of table poultry.

It should be noted, however, that the size of the flock on this new plant has been substantially reduced temporarily, owing to the present food shortage. Thus the above-mentioned programme is only partially under way, and cannot be fully implemented until the food situation permits of a considerable increase in the size of flock carried.

Delegates from the annual Dominion Poultry Conference held in Wellington in March last visited the plant and expressed appreciation of the progress that has so far been made.

Requests for assistance from Poultry Instructors are still on the increase. Work associated with the present temporary standard poultry-mash scheme is taking up time which will be devoted in the future to increased educational activities as soon as the food-supply position can be rectified. For obvious reasons it will be easier to make progress in production and management efficiency within the industry when conditions return to normal, particularly in regard to food-supplies.

Wool

The Department's activities in relation to the wool industry are as follows:—

This season there has been a return to the auction system of selling wool after seven years of the appraisal method used during the war. The New Zealand Wool Disposals Commission—the local representative of the joint organization in London—which puts a minimum reserve or "floor" under wool prices, has also operated for the first time. At the earlier sales of the series, wool sold freely and the finer sorts in particular brought excellent prices, but as the season has progressed competition for the stronger and plainer types has fallen away, and the Commission has bought in substantial quantities at the reserve prices. It is too early to predict the average price for our clip over the season, but indications are that it will be well in advance of last year's appraisal figure of 14·8d. per pound.

Extension Work.—While the ending of the war has brought to a conclusion lecturing work for the Army Education and Welfare Service, a new avenue has been opened up in the form of lectures and demonstations to rehabilitation trainees. New material is being prepared for use with Young Farmers' clubs, which in pre-war years accounted for the bulk of the Section's lecturing programme.

Experiments and Investigations.—A small portable experimental sheep-dip, with a capacity of 100 gallons, was designed for use at Wallaceville, and has now been completed and proved its worth for experimental dipping with new materials. Further small-scale trials with D.D.T. and Gammexane have been carried out, and in collaboration with the Ruakura Animal Research Station all the sheep on that property have been dipped with a new Gammexane preparation of commercial origin. Results to date are promising.

Some work has been done on the problem of the control of moths in stored wool. A large quantity of low-grade slipe wool stored at freezing-works had become very badly infested with moths, and tests were made with D.D.T. and Gammexane as a means of control. The most practical method was found to be the use of Gammexane smoke generators, by means of which the wool was treated *in situ* with good results and at relatively low cost. Any other method would have involved very considerable expense for labour in shifting and spraying and/or fumigating the bales.

Tests of Wool-marketing Preparations.—Tests have been carried out on further samples of materials submitted for trial. Several of these have been successful, and a total of five marking fluids have been approved for sale. It is noticeable that some of those manufacturers who were given twelve months' grace in which to sell off their old and unsatisfactory products have been making strenuous efforts to improve their formulæ to meet the requirements of the Stock Act, which will come fully into force as from 1st May, 1947. It is anticipated that complaints from overseas or local wool-buyers about deleterious marking-materials found in New Zealand wool will be eliminated.

Testing-house and Wool Standards.—The co-operation of the Wool Disposals Commission has been forthcoming in the institution of these two projects, but progress has been slow to date, on account of difficulty in procuring certain materials and equipment. A core sampling device has been built, similar to the instrument used by the Customs authorities in the United States, by which truly representative samples of wool can be drawn from deep down in the wool-bale. Suitable wool for making up wool count standards is now being procured, and when the collection is complete sets of count standards in suitable containers will be made up and issued at a nominal charge to those sections of the industry which will find them useful for reference purposes.

Corriedale Sheep for China.—A thousand Corriedale sheep selected, purchased, and shipped to China on behalf of UNRRA were accompanied by an officer of the Wool Section, which was responsible for the planning of the pen accommodation aboard ship and the calculation and selection of the necessary rations for the sheep on the voyage.

Visit to Australia.—The Wool Supervisor of the Department, accompanied by an officer from Massey College and one from the Department of Scientific and Industrial Research, visited Australia in 1946 to study the sheep and wool industry, wool research, and extension methods. The trip was financed jointly by the New Zealand Wool Board and the Department of Agriculture. A mass of useful information and data was obtained and a report made to the New Zealand Wool Board and the Department of Agriculture.

The Wool-clip.—The wool-clip for 1946–47 has been more attractive than that for last year, due to the better seasonal conditions over the Dominion as a whole. The South Island, for the most part, seems to have had a fairly good wool season, although Dunedin and Invercargill have suffered slightly from seasonal conditions, which caused tenderness in the wool. Merino and half-bred wools in the Christchurch and Timaru sales have been excellent, and crossbreds, though not so good, are up to standard. The wools appear to have been well grown, and are mostly light in condition and of a good colour. Dunedin and Invercargill wools, apart from slight tenderness, were light in condition and fairly well grown.

The North Island wools vary considerably in most districts. The Auckland and North Auckland wools appear to be light in condition, poorly grown, and off-coloured, though the unshorn hogget wools were excellent. Hawke's Bay wool, on the other hand, is much heavier in condition and well grown, with good staple length. The earlier wools showed traces of seed. Again, as in Auckland, the unshorn hogget wools were excellent. The Wellington wools have been fairly consistent throughout the season, being light in condition, of good staple length, and fairly good colour. There has been

slight seed towards the latter part of the season. Wanganui wools, on the whole, have been poorly grown, the colour has been poor, and the general character of the clip has been uninteresting. Growers here could profit by better classing and preparation.

Season.	Number of Bales sold.	Net Weight.	Gross Value.	Average per Bale.	Average per Pound.
		Lb.	£	£ s. d.	d.
1942–43	950,607	327,321,380	19,916,828	20 19 0	14·60
1943–44	930,694	316,152,540	19,424,253	20 17 5	14·74
1944–45	1,038,019	357,606,520	22,013,258	21 4 1	14·77
1945–46	1,022,124	349,365,289	21,552,153	21 1 9	14·80

Rabbit Nuisance

In spite of labour shortages, the position of the rabbit pest in districts under Rabbit Board control can be regarded as generally satisfactory, in many cases the pest being reduced to a minimum. In Hawke's Bay, however, where a number of "killer" Boards have been recently constituted, a considerable increase in the rabbit pest is recorded and is causing some concern. The rapid and substantial increase in the pest is attributed to particularly favourable breeding seasons, due to dry conditions over the past two years, combined with an acute labour problem. In areas outside of Board Control an increase has been observed. It is obvious that an extension of an active Rabbit Board policy is the solution to the rabbit problem.

Further Boards were constituted during the year under review, while one small Board ceased operating, the administration of this area being assumed by the Hon. Minister. A total of 106 Boards have now been constituted. Subsidies paid to Boards on rates collected amounted to £68,079.

The continued high prices ruling for skins and carcasses have materially assisted in the keeping-down of the pest, but this cannot be regarded as a suitable form of long-term rabbit-destruction policy, the position being entirely governed by the financial aspect.

The payment of a subsidy on milky does and smalls by the Rabbit-skins Levy Committee, which is domiciled in Dunedin, has encouraged effective destruction work during the spring and summer, when, in the ordinary course of events, comparatively little rabbiting is undertaken in areas outside of Board control.

Strychnine is now in full supply, but traps are difficult to obtain. At the Department's Poison-mixing Depot at Frankton Junction considerable trouble has been experienced in manufacturing phosphorized pollard on account of the coarse nature of pollard available. Every effort is being made to surmount this manufacturing problem.

Noxious Weeds

Little progress has been made in coping with the noxious-weeds problem, particularly on second- and third-class lands, and efforts of land-occupiers appear to be confined to keeping the better-class land free from encroachment by weeds. The availability of labour for noxious-weeds work is still a problem in most districts, and this aspect definitely retards progress. Ample supplies of weedicides are now available. Due to favourable germination conditions during the past two years, variegated thistle is assuming alarming proportions in the Hawke's Bay district.

Local authorities continue to do good work, particularly with ragwort, and the Department has continued to render financial assistance. A further two counties have taken over the administration of the Act, making a total of thirty-four counties accepting responsibility.

Weeds on unoccupied Crown and Native lands have been given attention.

The special Noxious Weeds Committee set up by the Hon. Minister has submitted its report, which is being considered by interested parties.

ANIMAL RESEARCH DIVISION

REPORT OF J. F. FILMER, DIRECTOR

Diagnostic Services

The Diagnostic Section at Wallaceville examined the following samples during the year :—

		Total.
Milk samples—		
Mastitis	1,252	
Biological test for tuberculosis	148*	
Br. abortus infection	52	
		1,452
Blood samples (agglutination test)—		
Br. abortus infection—		
Cattle	1,542	
Pigs	20	
Sheep	27	
S. pullorum infection : Poultry	273	
		1,862
Specimens—		
Cattle	519	
Sheep	239	
Pigs	101	
Horses	100	
Dogs	39	
Poultry	2,483	
Bees	177	
Other animals	35	
Miscellaneous	71	
		3,764
		7,078

* Six positive.

Blackleg and "scabby mouth" vaccines were prepared, and the number of doses issued free were—

Blackleg vaccine—	
Cattle doses (1 ml.)	73,900
Sheep doses (2 ml.)	29,510
"Scabby mouth" vaccine : Doses	174,000

Research Work

Facial Eczema.—The summer and autumn temperatures of 1946–47 were several degrees below normal, and this probably accounted for the absence of clinical outbreaks of facial eczema. Following the February and March rains there were short periods of very rapid pasture growth in the Poverty Bay and Hawke's Bay districts. Some slight changes were noted in lambs' livers collected from the meat-works at Hastings and the Facial Eczema Research Station at Manutuke.

Broom-corn Millet Photosensitivity.—Extracts of dried toxic broom-corn millet (*Panicum miliaceum*) have been made by the methods devised for use with facial-eczema grass. Slight photosensitivity, but no liver damage, was seen in a lamb dosed with an alkaline aqueous extract. Photosensitivity has been produced in both rats and guinea-pigs fed ground broom-corn millet, and in rats fed on ether extract of millet. Ether extract of normal grass has also produced photosensitivity in rats, but the dose required is greater than with similar extracts of millet. Other experiments suggest that this

photosensitivity is due to the massive doses of chlorophyll administered in such extracts. It has not been possible, so far, to fractionate the ether extract of millet further.

Broom-corn millet grown at Manutuke has again proved toxic in the 1947 season, and dried millet obtained from this crop has produced severe photosensitivity and icterus in one guinea-pig to which it was fed.

In an attempt to determine whether locality and climatic conditions influence the development of toxicity in this millet, a crop was grown at Wallaceville this season. No photosensitivity or liver dysfunction has been observed in lambs grazing this crop.

Japanese Millet Photosensitivity.—Japanese millet (*Echinochloa crus galli* var. *frumentacea*) was grown at Manutuke for the third time. On the two previous occasions no harmful effects have been noted. This year photosensitization occurred in lambs introduced between 20th and 27th January, 1947. There were no jaundice and no liver lesions. Lambs which were left in the paddock until 18th March, 1947, recovered and made good growth.

Rape Scald.—Fresh green rape collected at Manutuke during an outbreak of rape scald was fed to guinea-pigs, which subsequently became photosensitive. Similar experiments with rape collected a week later were negative, and no results have yet been obtained with dried rape. Chromatographic analysis of extracts of the green rape has not revealed the presence of any pigments not usually found in green plants.

Erodium Photosensitivity.—An outbreak of photosensitization in lambs grazed on *Erodium moschatum* was reported by the Government Veterinarian, Hastings. An examination of the affected animals showed that œdema of ears and eyelids was marked, and that the bare tip of the docked tail was also severely affected. Irritation was much less than in facial eczema, and animals did not suffer any material setback. There was no clinical icterus, the plasma gave no van den Bergh reaction, and contained no phylloerythrin.

Erodium is used regularly in this district as autumn fattening feed for bought-in lambs. Normally, no appreciable number of cases of photosensitization are noted; conditions were apparently favourable to its occurrence this season, and the relatively high incidence is illustrated in one mob of 430, in which there were 130 cases.

Supplies of the *Erodium* have been secured and dried and feeding tests and extraction work will be carried out.

Genetic Photosensitivity of Southdowns.—The breeding experiment has now been concluded, and all evidence supports the hypothesis that the condition is inherited as a simple Mendelian recessive. An attempt is being made to trace the strains responsible for the disease in New Zealand.

Various liver-function tests have been done on a small flock of congenital photosensitive Southdown ewes at Wallaceville. It has been shown that these animals exhibit an abnormal retention of injected brom-sulphthalein similar to that obtained with rose bengal.

The following liver-function tests showed no differences between normal and photosensitive Southdowns: prothrombin time; serum phosphatase; cephalin-cholesterol precipitation test; hippuric acid excretion test.

Small but definite differences between the two groups were found on applying the intravenous glucose tolerance test. The photosensitive sheep showed a slightly greater tolerance to glucose. A similar effect was found in the blood sugar response to intravenous injection of adrenalin, where the photosensitive animals showed a smaller rise of blood sugar and a more rapid return to normal than did the controls. Determinations were made of the levels of blood chloride, serum sodium, and potassium. No significant differences were found between the two groups.

Further work, including the blood glucose response to insulin and pitressin and the galactose tolerance test, on this abnormality of carbohydrate metabolism is in progress. Certain aspects of fat and protein metabolism will be studied later.

Sheep Research

"*Bowie.*"—Following the success of the composite mineral lick in 1945–46, a trial was made in 1946–47 with a simple bone-flour salt lick. This was found to be ineffective in preventing the disease.

Progeny-testing: Romneys.—This project has yielded disappointing results. Progeny-testing as a method of selective breeding is based on the assumption that sires vary in the quality of their offspring, and that by selecting those individuals that have proven their capacity to leave superior progeny the rate of improvement will be accelerated. So far, 34 rams have been tested over the past three breeding seasons, and in no year has a really outstanding ram turned up. Equally, no really poor breeding-ram has been located; rather have all rams maintained a good performance level. A further series of rams is being tested this season, while a new sire, proven in the flock of one of the leading breeders of the Dominion and the sire of some of the highest-price Romney rams of recent years, has been brought into the nucleus stud flock for trial.

Inheritance of Count.—Two years' results from the experiments to test the inheritance of count in Romneys are now available.

Last year, count of the progeny followed the count of ewe reasonably well, but the two sires used did not breed in accordance with expectation, the stronger-woolled ram leaving lambs with a higher count than the fine-woolled ram. This year, results more in accord with expectations were secured; both sires and dams appeared to exert equal influence and a definite relation between count of parent and progeny existed. The experiment as designed is subject to the weakness that too few rams can be used, so that results tend to be confused by individual ram effects.

Inheritance of Carcass Conformation.—Further data on Romneys have been obtained during the season. Greater variation exists than in the Southdown cross, and it has become clear that more careful control of weight at slaughter will have to be obtained with the small numbers of sheep being employed. The same difficulty of ram individuality has been experienced as with the count experiment. A further test of good and poor carcass ewes with the Southdown ram is being conducted under field conditions on the property of a co-operating farmer.

Influence of Breed of Ram on Carcass Quality of Fat Lambs.—The experiments initiated last year have been continued. Some 50 lambs each from the eight fat-lamb ram breeds under study were bred and reared under the same conditions. Growth data were obtained and all carcasses were measured on the hooks. Results for two more seasons are required before analysis is attempted or any conclusions drawn.

Growth Studies in Hoggets.—The live-weight and carcass composition changes at monthly intervals of a flock of 150 hoggets over a twelve-month period have been measured. Four sheep were killed monthly and dissected for composition data.

Changes in live-weight with the normal fluctuation in seasonal feed supply were closely associated with changes in body composition; the sensitivity of bone was least, and fat most, in this regard; muscle occupied an intermediate position.

Nutrition of the Breeding-ewe.—As a background to experimental studies on ewe nutrition, an examination of live-weight changes of the breeding-ewes before and during pregnancy has been commenced at Ruakura. The work aims at determining whether live-weight changes during the period two to four weeks prior to mating affects the fertility level and whether subsequent changes are related to ewe losses during pregnancy, lamb mortality, and milk-production in the ewe. Practically the whole of the 1,800 breeding-ewes on the farm are involved in this project. No results are yet to hand.

Sterility of Two-tooth Breeding-ewes.—Accurate mating observations are being made on a flock of 100 two-tooth ewes, employing raddled rams. Ewes returning to service for the second time are being examined by laparotomy to determine whether failure to ovulate is the cause of infertility. If ovulation is occurring normally, more detailed observations on the timing of heat and ovulation will be made, and the tubes washed

out to determine whether fertilization has occurred. Live-weight changes in the ewes during mating will be observed in relation to fertility results.

An attempt has been made to increase the fertility level of a flock of 100 two-tooth ewes by hormone injection treatment (P.M.S.) under controlled conditions, with half the ewes remaining untreated.

Effect of Pasture Maturity on Thrift of Hoggets.—Evidence has been accumulated which suggests that weaned lambs thrive better during autumn on feed which is allowed to become more mature than usual. To test this an experiment was conducted at Manutuke; two series of five 1-acre paddocks were used in each of which 30 hoggets were grazed. In one series the pasture was kept at normal height by rotating the lambs at two-day intervals, thus allowing eight days' growth between grazings. In the other series the lambs were rotated at five-day intervals, allowing twenty days' growth between grazings. Half the lambs in each group were drenched with phenothiazine at three-weekly intervals from April to August. When the experiment commenced on 19th January, 1946, each group had the same average weight. Results are shown in the following table:—

	Average Weights.		
	15th August, 1946.	11th November, 1946.	Wool Shorn 13th September, 1946.
	lb.	lb.	lb.
Normal grazing—			
Drenched	90·3	118	7·8
Undrenched	78·8	106	6·4
Mature grazing—			
Drenched	89·8	116	7·4
Undrenched	86·1	112	6·7

Comparison of Crops for Hogget Nutrition.—At Manutuke an area of crops is grown each year to provide "safe" grazing for control of facial eczema during the autumn. This has enabled a comparison to be made of the production obtained from the various crops. In the 1945–46 season the number of sheep-grazing days per acre obtained from the various crops was as follows: thousand-headed kale, 2,274; turnips, 2,115; rape, 1,065; chou moellier, 859; Japanese millet, 1,628.

Hoggets fattened well on all crops except Japanese millet, on which weight increase was rather slow. For the Poverty Bay district thousand-headed kale has proved an outstanding fodder plant, as it can be grazed three or four times during summer and autumn and does not cause anything resembling rape scald.

Comparison of Various Pastures for Ewes and Lambs.—In the course of facial-eczema experiments at Manutuke the following special pasture mixtures have been grown in 1-acre paddocks: short-rotation rye-grass, cocksfoot, timothy, Montgomery red clover, broad red clover, and white clover; Italian rye-grass and white clover; Italian rye-grass, Montgomery red clover, and broad red clover; Italian rye-grass, cocksfoot, and white clover; short-rotation rye-grass and white clover; pedigree perennial rye-grass and white clover. These were stocked with 6 ewes and lambs each with a view to comparing thrift of lambs. The lambs in all paddocks grew well, the average rate of growth being from 0·50 lb. to 0·53 lb. per day. There were no significant differences.

Deaths in New-born Lambs.—An increasing number of reports have been received of lambs dying at or soon after birth. Investigations in Poverty Bay suggested that probably about 10 per cent. of lambs do not live to be a week old, and of these nearly half are born dead. The condition has been reported from a number of districts and from several different types of pasture. An intensive investigation will be commenced as soon as staff is available.

Ketosis in Pregnant Ewes: "Sleepy Sickness."—Another attempt was made to test the value of the calcium-phosphate-potassium-iodide lick. Arrangements were made on six farms for sheep to have access to the lick over the latter part of the period of gestation. Control groups were also run on each farm. Owing to the favourable feed conditions at lambing-time no clinical ketosis occurred. On testing the urine for ketones just before lambing, nearly all ewes were negative, and the few showing only a very slight ketonuria were more or less evenly distributed between the lick and control groups.

At Wallaceville a small flock specially selected to contain a high percentage of twin-bearing ewes was divided into two groups, one to receive lick, the other a control. One month before lambing, both groups were placed on a low plane of nutrition in an endeavour to induce ketosis. The drop in the plane of nutrition was generally not severe enough to produce more than a comparatively mild ketonuria in animals in both groups. Only two animals in the control group developed clinical ketosis, 1 of these dying four weeks post-partum. In the lick group, 1 subclinical case recovered on lambing, 1 died before lambing, and 2 others died after lambing and after they had been removed from the lick. Although there was a slightly higher incidence of ketosis in the lick group, the fact that the feed on the control paddock was slightly better than that on the lick paddock makes any assessment of the value of the lick impossible.

At no stage in the above experiment did any of the 13 ewes bearing a single lamb show any sign of ketonuria, whereas in the 26 twin-bearing ewes all but 7 showed a ketonuria ranging from a (+) to a 4+ Rothera test. The 6 cases which developed were all ewes carrying twins.

Foot-rot.—In January, 1947, steps were taken to eradicate foot-rot from the Experimental Station at Manutuke. The method adopted was that successfully practised in Australia, where paddocks are kept free of sheep for a period of not less than seven days, after which only clean sheep are returned to them. All affected sheep are treated at weekly intervals and placed in a hospital paddock. After being cured they are retained in a convalescent paddock for one week before being allowed to enter the clean paddock. Should successful results be achieved at Manutuke, where conditions are particularly favourable, attempts will be made to clean up foot-rot from other more difficult areas with a view to the general adoption of the above method.

Dairy Cow Research

Mastitis.—With the collaboration of practising veterinarians, the effectiveness of intra-mammary injections of 25,000 units of penicillin on three successive days has been tested. A total of 205 quarters affected with clinical streptococcol mastitis were treated. A total of 170 (83 per cent.) showed clinical recovery, and of these the streptococcus disappeared from 143 (70 per cent.). Very poor results were obtained in cases due to staphylococcus or pyogenes.

An attempt is being made at Ruakura to evolve an effective system for controlling mastitis in New Zealand dairy herds. The cows are segregated on cultural test at calving and thereafter at eight-week intervals. Infected cows are milked last. Teat-cups are disinfected with hypochlorite between each cow at No. 1 dairy (120 cows) and between each herd in No. 2 dairy (80 cows). Teats of all cows are dipped in hypochlorite after milking. Treatment of all clinical cases immediately on detection is carried out with penicillin, except where alternative treatment is indicated diagnostically. The scheme has not been in progress long enough to assess its value, two full seasons' data being desirable before any analysis can be undertaken.

Studies of Milking-machine Methods.—Equipment to permit semi-automatic measurement of the weight of milk produced at each milking and its sampling for testing purposes has been designed and tested. The equipment is an integral part of the milking-machine. A high level of accuracy has been obtained, and the equipment is being manufactured for installation in all the experimental dairies of the Station. By enabling the weighing and sampling of every milking, absolute milk and fat yields will be obtained at a very

low labour cost. A much higher degree of accuracy will thus be possible than from the estimates of production obtained from the usual method of periodic weighing and sampling.

An apparatus for the measurement of intra-mammary pressure has been designed, and preliminary tests have given promising results. This apparatus, if successful, should be of great assistance in fundamental studies of milk secretion.

An improved accurate vacuum pump testing technique has been developed, and field tests indicate that many pumps in milking-sheds are inefficient. Further work with this instrument is planned with a view to setting up standards for vacuum pumps.

Following last year's tests on the relationship of pulsator rate to milking efficiency under various vacuums, a simplified self-contained electric automatic pulsator unit has been designed and is under construction. Testing has not yet been carried out.

The original damped weighted relief-valve, which has now been tested over five seasons with excellent results, has been redesigned with a view to reducing its cost while maintaining its efficiency. On test, the new valve has the same efficiency as the old, but can be produced commercially at half the cost. Cost has been a major factor militating against adoption of the original valve.

An improved " sight glass " has been designed and is being tested. Efficient equipment of this type is essential if milking rate is to be speeded up.

The testing of carbon-black rubber for milking-machines has continued. Air and milk tubes of this rubber have had a life of at least three milking seasons. This is not outstanding, but claw tubes have had the same length of life, which is remarkable. Both types of tube develop an excellent shiny surface, which makes for easy cleaning. The standard specification for milking-machine rubberware has been revised and certain " quality tests " added.

Two new types of teat-cup and a new type of claw developed by private enterprise have been tested. No advantages were found over standard types.

In conjunction with officers of the New Zealand Dairy Board, a field survey of milking-machines on farms in Northland was carried out. Milking speeds showed an average rate of 7·6 cows per hour per set of cups. This is well below the optimum of 10. Vacuum pumps were found to be inefficient, and many redundant gadgets were encountered. General experience with milking-machine problems in the field, and of the work of the co-operative servicing organization at the Kaitaia Co-operative Dairy Co., suggests that application of the principle of co-operative servicing is the solution to getting sound principles over to the farmer. The method would reduce costs and improve efficiency.

Early Prediction of Productive Capacity of Dairy Cows.—The whole of the dairy-calf population at Ruakura has been examined and graded for mammary-gland development in an attempt to test the claims of American workers that the productive capacity of dairy cows can be predicted at the calf stage with some degree of accuracy. No difficulty has been met in grading calves for gland development; repeatable and comparable results have been obtained by two officers working independently and large differences have been noted. Evaluation of the method will have to await lactation by the animals concerned.

Artificial Insemination.—Work during the year has concentrated upon methods of increasing the coverage per bull under New Zealand conditions. The estimate of 200 cows per bull of last year may now be raised to 2,000 cows per bull for the New Zealand breeding season. This has been made possible by reducing the dose rate to 25 million sperms per cow and by more frequent collections from more highly selected bulls.

Experimental work for the year has again been organized on a basis of a winter-mating " pilot " group of about 250 cows and a spring-mating " main " group of 1,200 cows. In addition, a pedigree group was organized along the lines indicated in last year's report. The uterine method of insemination was used throughout.

(*a*) Winter-mating Group: Two dose rates were employed, half the cows being inseminated with each dose rate. One bull only was used, and the visits to the farms

reduced from two to one daily. The experiment was also planned to give information on the effect of storage time on conception rate. The results are summarized below :—

Conception Rate : Winter Mating

Storage Time.	High Dose (150 Million).			Low Dose (35 Million).		
	Six Hours.	Thirty Hours.	Fifty-four Hours.	Six Hours.	Thirty Hours.	Fifty-four Hours.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Hourly basis ..	74	66	65	65	62	57
Rate, regardless of age	..	69	..	..	62	..

Though there was a difference of 7 per cent. in conception rate in favour of the high dose, the low dose maintained the very satisfactory level of 62 per cent. Only slight differences existed between semen stored for the periods 0–6, 24–30, and 54 hours. The bull employed proved capable of maintaining a service three times weekly for six weeks. The general conception rate was as high as previously maintained under twice-a-day servicing of cows, so that it may be concluded that reduction to once a day produced no deterioration in results. The work also indicated that plastic ampoules could replace glass in the inseminating gear with many technical advantages and no ill-effects upon conception rate.

(*b*) Spring-mating Group : In view of the above results, the spring work was designed to see how low the dose rate could be cut without unduly affecting conception. Work commenced ten days before the normal breeding-time to allow the try out of very small dose rates. The dose was progressively increased, so that by the 1st October a reasonable rate of conception was assured. Dose rates of 1, 5, 10, 15, 20, and 25 million were given to a group of 60 cows for each dilution. The one bull was used for this work. The results are shown below :—

Conception Rate for Graded Doses of Semen

Dose Rate (Millions).	Conception Rate (per Cent.).	Dose Rate (Millions).	Conception Rate (per Cent.).
1	2	20	46
5	11	25	58
10	5	50	61
15	34		

The bulk of the rest of the mating for the season was done with 150 million sperms per dose with no better results than with a dose rate of 25 million. In relation to work of previous years, it appears that the uterine technique will permit conception rates with a dose of 25 million sperms at as satisfactory a level as will the cervical technique with 250 million sperms. It is also clear that increasing the dose rate under the uterine technique does not improve the conception rate once the minimum practical limit has been attained.

The spring-mating work confirmed the winter-mating results in respect of the adequacy of the once-a-day visit, the practicability of storing semen for up to fifty hours to maintain a satisfactory field service, and the usefulness of the plastic-ampoule method of distribution and insemination. The spring-mating work also brought to light a feature not previously experienced in New Zealand, but in line with common experience in the United States. Four technicians were used as inseminators, but one of these was singularly unsuccessful, the conception rate obtained by him averaging only 19 per cent., as compared with 58 per cent. of the other three men. This points to the extreme care necessary in selecting and training technicians for this work, since, under New Zealand conditions, where the one technician is handling a group of

600 to 800 cows, the bulk of these will have been serviced before his competence is known, by which time a tremendous amount of damage may have been done.

Summing up the work on dose rate, it is considered that satisfactory field operations could be undertaken at present with a dose rate of 25 million sperms. With bulls selected for good fertility this would give a coverage of 3,000 to 3,500 doses during the first month of the breeding season, when the bulk of the herds have to be serviced. Since it has been our experience that an average wastage of 40 per cent. in available material occurs in practice, due to the varying numbers of cows in season at any one time, the effective coverage per bull may be estimated at 1,800 to 2,100 cows in one month. This estimate may be improved with further research.

(*c*) The Pedigree Group: In last year's report attention was drawn to the limitations of artificial insemination as a means of commercial herd improvement in New Zealand imposed by the grave shortage of fertile proven sires. In consequence, it was proposed that an attempt be made to study the possibilities of applying the method to pedigree cattle, with the object of increasing the supply of pedigree sons of proven sires, which could be used to improve commercial cattle through natural matings. The co-operation of pedigree breeders of Jerseys in the Hamilton, Cambridge, and Te Awamutu areas was enlisted and a group of 200 cows sought. Support was excellent, a total of 287 cows being mated to selected proven sires. Conception rate averaged 60 per cent. on the first insemination, and a total of 213 cows held to the bulls used. Including animals in the other groups, a total of 233 pedigree cows are in calf to proven sires. Thirty-eight breeders participated, each giving selected cows.

Bull Fertility.—The examination of bulls for fertility was continued during the year, 96 bulls being examined and classified as follows: good, 6; moderate, 38; unsatisfactory, 45; sterile, 7.

An experimental study of semen-production has been commenced, employing identical twin bulls. Preliminary observations of their reproductive behaviour when treated alike showed these animals to be considerably more valuable for such work than ordinary bulls. A uniformity trial to test semen-production and characteristics within and between pairs indicated that the group of five pairs of bulls employed would yield as much information as twenty-five pairs selected at random.

A comparison is being made between bulls grazed under natural conditions and those housed and given hard feed, but the results to date are of too preliminary a character to warrant publication.

Cow Sterility.—A preliminary field survey has been made of nine herds that had suffered varying degrees of infertility with a view to obtaining the experience necessary to permit planned experimental work next year. Reports continue to be received of early abortions characteristic to *Trychomoniasis*, but in most cases the presence of the organism has not been demonstrated. In view of the possible importance of this disease as a factor in dairy-cow sterility in New Zealand, plans have been formulated to obtain more definite information on its incidence and control.

The systematic examination of sterile cows with known breeding histories from the A.I. group has been continued and 32 animals were slaughtered for post-mortem examination.

The technical work on the project designed to study the relationship between the pituitary gland and the abnormal ovary has been completed. Preliminary analysis suggests that no gross pathological condition or abnormal histological picture exists in the anterior lobe of the pituitaries of cows suffering from ovarian cysts of either the cystic follicle or cystic *corpora lutea* type.

Contagious Abortion.—The results from vaccination continue to be very satisfactory. As the experimental stage has been passed, a scale of charges was fixed in collaboration with the New Zealand Dairy Board. This has not resulted in any falling off in demand for vaccination of calves during the 1947 season. The experiment with tail inoculation

of 1 c.c. of vaccine will be completed this year, and results will be known before the commencement of vaccination in 1948.

Investigations have been conducted on the growth-inhibiting values of cattle sera against suspensions of *Brucella abortus*. In general it has been observed that the inhibitory activity of bovine sera is correlated with the agglutination titre.

Experimental studies have been directed towards improving the laboratory tests for the standardization of *Br. abortus* strain 19 vaccine. Some improvements have been effected in the routine viability counting procedures for standardization of this vaccine.

Ketosis in Dairy Cattle.—Field surveys in the Waikato during the spring of 1945 revealed that ketosis as a separate disease entity was relatively uncommon, whereas it was quite common as a complication of grass-staggers.

During the spring of this year the intensive study of the environmental factors was continued on two farms in the Morrinsville district where ketosis is usually common and, for comparison, on two neighbouring farms where the disease usually does not occur. It appears from the results of blood ketone, sugar, calcium, and magnesium determinations on a sample of cows from all four herds, both before and after calving, that the cows were in better health in the spring of 1946 than in 1945. This was also borne out by the disease incidence, there being only a few milk-fever cases in the herds usually affected by ketosis and ketosis grass-staggers. This may be explained by the different seasonal conditions. The spring of 1945 followed a very good autumn, when cows produced very heavily (Auckland average, 282 lb. of fat for the season), while the last spring was preceded by a very poor autumn (214 lb. of fat), when the cows dried off earlier than usual. Also, the spring of 1946 was poorer than in 1945, resulting in lower production again. This bears out the belief that full production is one of the factors associated with ketosis in affected herds. It is clear, however, that this is not the only factor, and that feeding and management must play a part, as, of the four herds under study, the highest producing ones are the two unaffected ones (294 lb. and 240 lb., as compared with 220 lb. and 210 lb. for 1945–46). While it is difficult to evaluate exactly all the effects of the various factors in the complex mechanism included under feeding and management, two main ideas have emerged. The feeding of about 7 cwt. to 10 cwt. of good hay per milker from early June to late September, together with the use of rationed autumn-saved pasture over the same period, provides a good foundation for calving and early lactation. A large proportion of short, young pasture in the diet with only 3 cwt. to 4 cwt. of hay per cow is a risky diet and, given a flush of early spring growth, one that will predispose cows to ketosis and grass-staggers or the two together.

Ketosis : Tablet Test.—Supplies of tablets containing all the reagents for the nitroprusside test for acetone and acetoacetic acid were made to specification by a commercial firm. Provided that the necessary precautions are taken to exclude light and air, the tablets retain their potency for over a year. Furthermore, a stale tablet is readily detected by its appearance.

The tablets have been used by Wallaceville workers and a number of field veterinarians and have proved of definite value as a field test for ketonuria in sheep and cows.

Dairy-cattle Breeding

(*a*) *Use of Proven Sires.*—The numbers of daughters of proven sires and sons of proven sires continue to build up. The following shows the present position :—

——	Calves.	Yearlings.	Two-year-olds.	Total.
By proven sires	57	58	38	153
By sons	5	1	12	18
Totals	62	59	50	171

Figures for the production of the first crop will be available for next year's report.

(*b*) *Identical twins.*—The number, age, and sex of identical twins at present in use at Ruakura are shown below (data in "sets"):—

—	Heifers.	Bulls.	Total.
Mature	2	..	2
Rising three years	13	5	18
Rising two years	27	5	32
Rising one year	30	5	35
Totals	72	15	87

The uniformity trial with the first 26 heifers reared to calving under the same conditions is nearing the end of the first production season. Of the 13 sets, one twin proved empty and another aborted, leaving 11 sets calving normally for the uniformity trial. Complete season's data are necessary before analysis can be carried out, but on production records to date it would appear that the high hopes associated with these animals will be realized and that they will prove many times more suitable for production studies with dairy cows than normal animals.

At the twin dairy, 8 sets of three-year-olds and 16 sets of two-year-olds will calve down for next season and will be available for specific production experiments.

An analysis of the growth records of 42 sets of heifer twins between the ages of four and twenty-four weeks has fully substantiated the theory as to the special suitability of identical twins for growth work. The results show that 5 sets of twins will give the same accuracy in experimental work as 40 to 50 animals chosen at random.

Data on the grazing habits of cattle have been collected from the twins. Six sets of twins have been watched once a month for twenty-four hour continuous periods since November last. The information obtained will be of use in the interpretation of experimental results from cows under grazing conditions and will link up with attempts to measure the intake of the grazing animal. The information is also of general scientific interest. Results to date are tending to show how the grazing behaviour of the cow is affected by (*a*) individuality, (*b*) productive level, (*c*) weather.

Sex Determination in Cattle.—In view of recent publicity given to an alleged method of controlling the sex of dairy calves by controlling the stage of estrus at which mating occurs, 100 cows selected from the A.I. group of 1,000 cows as having been mated either during the very late stage of estrus or just after estrus had passed were examined for the sex ratio resulting. The sex data for the calves were collected while obtaining similar information for the 1,000 cows of the group, and the collecting officer and the farmers concerned were unaware of the identity of the 100 animals concerned. Eighty-one cows of those mated very late in estrus calved to the service under investigation. The remainder proved not in calf to this service, but to a subsequent one at a normal stage of heat. Of the 81 successful matings, 38 resulted in heifer calves and 43 in bull calves, yielding a sex ratio of 113 : 100—a normal ratio for cattle. It is obvious that, as in other species, the stage of estrus does not affect the sex of cattle.

Dairy Cow Nutrition

Nutrition Experiment.—The design of this experiment has been covered in previous reports. For convenience, results will be reported in three stages—calf, yearling, and cow:—

(*a*) The Calf Stage: Seasonal body weights of the well-reared (rotationally grazed) and poorly-reared (set-stocked) calves for the 1946–47 season are shown below:—

Body Weights as at 31st March

	Well-reared.		Poorly-reared.		Difference.
	Weight.	Number.	Weight.	Number.	
	lb.		lb.		lb.
1946–47	424	17	326	16	98
Identical twins	414	8	341	8	73

As in previous years, the method of rotational grazing from an early age (four weeks) resulted in better growth than set-stocking. During the current season, both groups have grown better than usual. Identical twins have been added to the experiment on a split basis, one member of each pair going to each treatment. The mean-growth data for these are included for comparison purposes.

(*b*) The Yearling Stage: The special interest of this stage is the behaviour of the two groups under continued rotational and set-stocking conditions during the winter period.

In the 1945–46 season 7 set-stocked animals died. These (23 per cent.) died within a fortnight of regrowth of grass following the drought and late autumn rains. Mortality would have been higher without special treatment of several other animals. This failure of poorly-reared dairy calves to stand up to the rapid change in feed characteristics of autumn growth has been typical of such losses over the past seven years. Even the well-reared (rotated) animals suffer a set-back, though to a less severe degree.

The divergence in weight increases from 71 lb. in March, 1946, to 137 lb. in March, 1947, when the well-reared heifers averaged 692 lb., a very satisfactory weight for Jersey heifers entering their second winter. Careful observations are being made of the reproductive behaviour of the two groups of heifers.

(*c*) The Cow Stage: Results of the first complete year's production of two groups of heifers managed under the two systems from birth are now available. At forty weeks post-calving there was a difference in body weight of 142 lb., the average weight of the control (evenly fed group) being 826 lb. Production records are given in the following table:—

Production Results

Production.	"Controlled" (Even Fed).	"Uncontrolled" (Uneven Fed).	Difference.
Total milk (lb.)	5,022	4,033	989
Fat (per cent.)	5·6	5·5	0·1
Total butterfat (lb.)	282	221	61
S.N.F. (per cent.)	9·3	9·3	..
Total S.N.F. (lb.)	469	377	92
Days in milk	278	260	18

Supplementary Feed of Dairy Cows.—This experiment is one of a series aiming at measuring, as accurately as possible, the precise relationships of supplementary feed to dairy cow performance. Industry surveys indicate that production per cow is affected materially by the amounts of hay and silage fed. From general nutritive principles, importance of supplementary feed during periods of normal grass shortage is obvious, but no reliable information exists on the relative importance of supplementary feed at the various periods when it may be provided. By accurate mapping of this picture it is hoped to assist with the many practical problems of herd feeding and management tied up with the supplementary-feed question. The first step has been

to compare a high with a low level of feeding during the last three months of pregnancy. Two groups of 13 cows evenly matched on previous production records, calving dates, and body weights were fed on a "high" and "low" plane respectively. The "high" group was wintered rotationally on autumn-saved pasture, supplemented with a full ration of silage and free access to hay. The consumption averaged 37 lb. of silage and 7 lb. of hay for the twelve weeks of the feeding period. The "low" group was wintered on a relatively bare pasture with hay on a rationed basis averaging 5½ lb. per day. Both groups were calved down and run for the season on the same pastures.

Data are being collected for changes in body weight, weight of calf, and production, including total milk, fat percentage, solids-not-fat percentage, and the number of days in milk. The experiment is now in its second season, and results already indicate that the difference in favour of the well-wintered group will vary considerably from season to season.

Digestibility of Dairy Cow Pastures.—During the season an almost continuous series of digestibility trials was conducted on material from the "controlled" and "uncontrolled" pastures of the No. 2 area (dairy cow nutrition project). Sheep were employed for this work. Trials from the two types of pasture ran concurrently, and, in all, twenty-six were carried out from September to March. Results showed that during most of the spring and early summer the digestibility of the feed from the "uncontrolled" farm was slightly, but significantly, higher than from the "controlled" pastures; during November a change over occurred, and since then digestibilities have been substantially in favour of the "controlled" area.

The relationship between the lignin content of the feed and digestibility established from previous work was tested further on the above data. Good agreement was obtained between digestibility figures calculated from lignin and actual figures. This short-cut method was also tested out on data derived from digestibility trials with paspalum at various stages of growth, but further work will be essential before the method could be used with confidence.

Further checks on the usefulness of stalled sheep for measuring the digestibility of cut pastures have been made, and it is apparent that there are some defects in the technique.

Nutritive Value of Pampas-grass.—Most of the previous work on pampas was conducted on cows fed indoors on cut material. Intake was always very low under such circumstances, and seldom sufficient to provide for maintenance requirements. In consequence, dairy cattle on digestibility trials with pampas usually lost weight. The points arose, therefore, as to whether intake would be greater under free grazing, and whether such intake would be improved by the addition of supplementary feed. Accordingly, three trials have been conducted to measure intake under grazing conditions. The "bag" technique for collecting fæces was employed. Pampas was fed alone, and in combination with dried grass of high quality. Complete results are not yet available, but it appeared that intakes of pampas alone were adequate for maintenance of dry cows.

Two further trials were undertaken to measure the effect of seed-head removal on digestibility. These trials were on twelve months' growth of pampas-grass. The following figures were obtained:—

	Average Digestibility Organic Matter, per Cent.
With seed heads	45·1
Without seed heads	44·1

Measurement of Intake by the Grazing Animal.—This still remains the greatest limiting factor in the study of New Zealand stock. The chromic-oxide method of determining appetite has been gradually but steadily improved, and now it is capable of giving results within about 5 per cent. of those obtained by direct measurement of dry weight of fæces. The main improvements were in the method of determination

of chromium and in the nature of the chromic-oxide dose, explosive capsules being used to favour greater distribution in the rumen.

In the course of the work it was found that dry matter of fæces was lost if they were kept moist and unpreservatized. Losses were probably due to growth of moulds. Toluene was found to be the best preservative. Dyed polystrene and copper phthalocyanin have also been tried as markers.

Pig Research

(1) *Inbreeding Studies with Large Whites.*—The inbred strain of Large Whites established at the Station two years ago is now progressing satisfactorily. In the first season most of the possible defects normally experienced in inbreeding appeared in the strain—anal atresia, cryptchordism, scrotal hernia, defective feet. Selection and test mating have aimed at eliminating these. An inbreeding coefficient of approximately 30 per cent. has been maintained, and present indications are that some progress has been made in the reduction of defects mentioned. Further test matings of brother-sister combinations are required to verify this.

(2) *Relative Efficiency of "Wild" and "Improved" Strains.*—Some interest attaches to the degree of improvement that has been effected over the past one hundred years in pig stock. The visit of New Zealand Forces to the Auckland Islands during the war made it possible to obtain a wild boar from this area. Records indicate that British pigs were released on uninhabited islands here approximately ninety years ago and that no further importations were ever made. Matings of this animal with New Zealand wild sows have produced a "wild" strain of pigs. The performance of these has been compared with the progeny of Large White × New Zealand wild sow matings. The "wild" pigs required 347 days to reach 200 lb. live-weight; the half-wild, 241 days. The latter contained 11 per cent. more bone, 11 per cent. more muscle, and 28 per cent. less fat than the "wild." Organ weights were uniformly greater in the half-wild animals. Comparisons with "improved" animals are in progress. This study is of special interest to pig-improvement work.

(3) *Feeding Value of Candle-nut Meal.*—In view of available supplies of candle-nut meal from the tropics and the general shortage of concentrates in New Zealand, the suitability of this product for pig-feeding has been examined. On analysis, the meal has the characteristics of a 40 per cent. protein concentrate, and its fat content is high. On test with 4 pigs it was found to be extremely unpalatable, and was not consumed in sufficient quantities to maintain body weight of young growing pigs, even when mixed with barley-meal. This lack of palatability affected total intake adversely at both a 50-per-cent. and 25-per-cent. level with barley-meal. At both levels of feeding, severe scouring of pigs resulted after some days on the mixture. It is indicated from this admittedly limited experience that the meal is not a very satisfactory food for pigs.

(4) *Relationship of Body Conformation to Heart and Lung Capacity.*—In view of the great difficulty experienced in persuading breeders to decrease the depth and increase the length of the pig, a study of the relationship between chest depth, chest girth, body length, and the development of the thoracic organs—lungs, heart, &c.—is being made. Breeders commonly believe that decreasing chest depth in relation to length restricts heart and lung capacity and reacts adversely on constitution. Preliminary data are being analysed.

(5) *Development of Pork-judging Standards.*—In co-operation with meat trade and National Pig Industry Council interests, a method of evaluating the porker carcass on a basis of measurements has been developed. A standard system for judging has been tried out on an extensive scale with satisfactory results. This has been accepted by the National Pig Industry Council as the official judging system, and the details will be published shortly. This method is likely to have some value in promoting our export pork trade.

Salmonella Infection of Pigs.—Experiments have been initiated with a view to elucidating the role played by *Salmonella cholerae suis* as a swine pathogen. From infected pigs in seventeen different outbreaks *Salmonella cholerae suis* was isolated. These strains have been examined biochemically and serologically and all proved to be the diphasic variety, which is in contrast to the monophasic variety, which predominates in Australia and America.

Trace Minerals

Cobalt.—Of 19 pasture samples examined in connection with the diagnosis of cobalt deficiency 9 were low and 1 borderline, and of 81 livers 8 were low and 5 borderline. Liver and pasture analyses have confirmed the existence of dual cobalt and copper deficiency at Pakipaki, Hawke's Bay.

Iodine.—The analytical procedure for iodine has been under investigation, as the present procedure does not always give satisfactory results.

Copper.—It has been found that molybdenum solutions drenched to cattle and sheep grazed on pasture containing normal quantities of copper will reduce the storage of copper in the liver. In cattle on copper-deficient pasture, results were not the same. Molybdenum drenches did not reduce the already low copper stores. When molybdenum and copper were drenched together, the extra copper reduced the storage of molybdenum.

The work confirms the interrelationship of copper and molybdenum and the possibility previously suggested that peat scours may be a low-grade molybdenosis, and not a simple copper deficiency.

Aerial Top-dressing.—Trace elements are at the present stage of technical development the most suitable top-dressing materials for application from the air. A successful trial with bluestone was carried out in 1946 in co-operation with the Public Works Department—1,100 acres of copper-deficient land on the Hauraki Plains were top-dressed in nine hours with 3 lb. bluestone per acre. Subsequent pasture analyses showed that an effective increase in pasture copper was achieved and stock kept on the area have shown no symptoms of copper deficiency.

Preliminary arrangements have been made to top-dress a property near Taumarunui with cobalt sulphate during June of this year.

Radioactive Tracer Elements.—Preparations are being made to undertake work on radioactive tracer elements, and the first to be employed will be radioactive isotopes of minor elements such as cobalt. Some preliminary work was carried out in 1939 with radioactive cobalt, but the war interrupted this. New supplies are now becoming available, so that the work can be resumed.

It is hoped to develop the tracer technique using radioactive and heavy isotopes, and to apply this to a great variety of problems of animal metabolism.

Enzootic Icterus.—An extensive outbreak of enzootic icterus occurred for the first time in Hawke's Bay. Deaths commenced in September, 1946, and some are still occurring. The area affected was all of one soil type, Takapau silt loam, and was badly affected by drought the previous autumn. The outbreak is under investigation, as it presents some special features of interest.

General Biochemical Work at Ruakura

Considerable work has been carried out on the validity of nitrogen determinations for pasture feed under the Kjeldahl method.

Work designed to identify the large undetermined portion of the "nitrogen-free extract" fraction of green feeds has continued, as also have more detailed investigations on the lignin complex of stock-feeds. These two projects are possibly interrelated.

Milk samples have been analysed for fat, casein, and total solids from all dairies throughout the year. This routine task, essential in relation to various experiments, absorbs a large proportion of the chemical staff's available time.

The identification of the toxins of paspalum ergot has proved more difficult than anticipated. Light has been shown to affect the toxicity of extracts, and it appears essential to carry out analytical work in the dark for further progress.

Parasitology

Trials with Phenothiazine in Salt Lick.—Trials with a salt lick containing 10 per cent. phenothiazine indicate that the addition of phenothiazine to salt lick renders it rather unpalatable, consequently lick consumption may be greatly reduced. In addition, lick consumption within the group may be far from uniform, and in a considerable proportion of the animals lick consumption may be inadequate.

Immunity and Resistance to Internal Parasites.—The study of immunity and resistance to nematode infections in sheep was continued. Two groups of lambs were raised under worm-free conditions. One group was given repeated infections with larvæ of Haemonchus with the object of producing an infection from which natural recovery would take place. It was found necessary to give anthelmintic treatment on two occasions in order to save the experimental animals. Partial recovery, however, occurred eventually, and a test infection of larvæ was given to both infested and control animals. Both groups were killed on the twelfth and thirteenth days, and a significant difference in the size of the worms recovered from the two groups was observed, a marked growth retardation being observed in the infested group.

Observations were also made on the production of oral, anal, and excretory pore precipitates formed about the ensheathed larvæ incubated in immune serum of experimental sheep. Precipitates of this type were found on the third-stage larvæ of trichostrongyles, both ensheathed and ex-sheathed, and also on the filariform larvæ of Strongyloides. The possibility of using this reaction as a test for immunity is being explored.

An attempt was made to break down the resistance of twelve-months-old paddock-reared sheep by repeated and severe hæmorrhage. Four sheep were bled three times weekly until 5 to 6 litres of blood were removed from each animal over a period of six weeks. A test infection of Haemonchus larvæ was then given to bled and control animals. Differences between the resultant infections were not significant.

Sheep-dipping Trials with D.D.T. and Gammexane.—Eradication of keds and lice from three flocks which could be completely isolated was attempted using Gammexane in a power-spray unit and Gammexane and D.D.T. in dipping-baths. In the flock treated in the spray unit some of the sheep were exposed to heavy rain shortly afterwards, and the whole flock was redipped. The efficacy of the dipping will be assessed at shearing-time.

Longevity of Embryophores of Echinococcus.—Observations have been continued on the longevity of embryophores of *Echinococcus granulosus* exposed to ordinary climatic conditions. Cysts were detected in the liver and lungs of sheep dosed with material which had been exposed for 134, 140, and 158 days during winter, spring, and early summer.

Cestode Infection in Ferrets.—The possibility of ferrets, stoats, and weasels playing a part in the spread of cestode infections of lambs, particularly *Cysticercus tenuicollis*, has been considered. It is not very likely that they play any significant part in the field, as only on very rare occasions would viable cysts be available to set up an infection in ferrets. Attempts at artificial infection of laboratory-reared ferrets were unsuccessful.

Metabolism of Phenothiazine.—In connection with the photosensitized keratitis which occasionally occurs in calves dosed with phenothiazine, studies on the metabolism of this substance in domestic animals are in progress. The main derivative formed in the alimentary tract of sheep and cattle appears to be phenothiazine sulphoxide, which is absorbed and converted in part to phenothiazone and thionol, probably in the liver. The last-named compounds are more readily conjugated to form excretable products than is the sulphoxide. In calves and pigs the conversion of sulphoxide to phenothiazone

and thionol is less efficient than in sheep, so that even on low doses sulphoxide remains in the blood of pigs and calves and appears to pass readily into the aqueous humour. Only after administration of amounts of phenothiazine greatly in excess of the recommended dose has the sulphoxide been found in the blood and aqueous humour of sheep.

Examination of urine of animals dosed with phenothiazine has led to the discovery of several conjugates of phenothiazine derivatives hitherto not reported. In bobby calves a large part of the excreted derivatives consists of a protein conjugate of phenothiazone. Analysis of this protein has revealed the presence of at least six amino-acids, including arginine, tyrosine, and glutamic acid. With older calves much less of this conjugate was found, the pigments being probably excreted as compounds of glucuronic acid. In sheep, evidence of the presence of both the ethereal sulphate and the glucuronide of phenothiazone has been obtained. In urine passed within four hours of dosing, a new unidentified conjugate of phenothiazone has been found, and such urine also yields a large amount of phenothiazine on acidification.

The *in vitro* preparation of phenothiazine sulphoxide has been improved, and a quantity of this compound obtained for tests of anthelmintic activity.

Toxicology

In the autumn and winter of 1946 work was carried out with the Government Veterinarian, Hastings, on suspected poisoning of cattle by variegated thistle (*Silybum marianum*) and winged thistle (*Carduus tenuiflorus*). The evidence obtained indicates that these thistles may become a serious menace to cattle if allowed to spread. The toxic principle, potassium nitrate, was determined in some specimens.

Poisoning of cattle and pigs by raw mangels was again encountered.

Some work has been carried out on the suitability of *Eschscholtzia californica* as a fodder for sheep. The plant causes no mortality in the Southland district, where it grows on waste land, but one sheep died on a small plot grown at Wallaceville. The plant contains high concentrations of HCN and is therefore potentially dangerous to stock. Samples from Wallaceville and from Southland contained up to 0·095 per cent. total HCN in the green material. In the course of this work a new technique was devised for determination of HCN in green material without loss due to enzyme action. The method is to disintegrate the plant substance in a Waring blender in the presence of mercuric chloride.

Apiculture

Work carried out with the Senior Apiary Instructor and Honey-grader has resulted in the designing of a satisfactory plant for the removal of excess moisture from honey, so improving its keeping-qualities. The plant operates on the principle of removing excess moisture by indirect heating and drying of the honey. A plant has been in commercial operation throughout the season.

It was discovered that the cause of "spring dwindling," or reduction of hive strength by disappearance of field bees in the spring, was *Nosema apis*, a protozoan parasite. Experimental feeding of drugs to hives, in an effort to combat the disease, was commenced in collaboration with the Apiary Instructors.

Further work in connection with toxic honey and on pollen supplements was carried out.

FIELDS DIVISION

REPORT OF J. W. WOODCOCK, ACTING-DIRECTOR

Climatic Conditions

Weather conditions were somewhat abnormal during the season under review. In general, the winter was extremely mild, the spring was cold and backward, while the summer was mainly fine and warm. In the Auckland Province the mild winter alleviated to a considerable extent the acute stock-feed position which had developed during the previous autumn. In spring, however, cold spells and late frosts continued up till the end of December. The summer was dry and hot, but good rains during March prevented serious drought conditions again developing. Almost similar conditions prevailed in the southern portion of the North Island, except that in spring the east coast had exceptionally dry weather in contrast to the very wet and cold spring in Taranaki and on the west coast. But in the Wellington Province generally favourable weather was experienced in summer and autumn. In the South Island, except in Westland and Nelson, unusually heavy rainfall was experienced in most districts during autumn and winter, although the latter was milder than usual. The heavy autumn rain in the arable districts interfered with the sowing of autumn wheat, and as Canterbury again experienced wet conditions in spring, crop-sowing activities were again made difficult. A moist, cool summer in that area and a relative freedom from drying north-west winds were favourable to the growth of crops. Harvesting was almost a month later than usual. On the west coast and in Nelson the autumn of 1946 was mild and fine, the winter was wet and cold, while the summer in both these districts, as well as in Marlborough, was dry. In the coastal districts of Otago the season was marked by an unusually high winter and spring rainfall and by cold conditions from spring to early summer. In Central Otago and in Southland dry conditions and heavy frosts were experienced in winter, while cold rainy periods later seriously retarded work on the land and checked pasture growth, resulting in one of the worst springs experienced by farmers for many years. Dry weather set in during January, and the season closed under almost drought conditions in these districts.

Extension Service

The agricultural extension service is the main activity of the Fields Division, and this is carried out by personal visits to farms, lectures, demonstrations, radio broadcasts, articles in newspapers and the *Journal of Agriculture*, and correspondence on cropping, pasture establishment and management, use of fertilizers and lime, feeding of live-stock, land-improvement, and farm-management in all its phases. This important part of the Division's activities is being increased as further trained staff becomes available, and a number of returned servicemen are taking special courses at the two agricultural colleges to fit them for this work. Experience in the past has shown that the best results are obtained by decentralization of the instructional staff, locating the officers at all the important country centres so that their services may be more readily available to the farming community. This policy is being pursued as circumstances and staff permit, and ultimately it is hoped to have officers stationed at sixty centres, as compared with the thirty-seven instructorates now existent.

Pastures

The season was generally a good one for pastures, chiefly because of the good autumn rainfall and mild winter with a relative freedom from long dry

periods during summer. In the far North and east coast districts of the North Island, where severe drought conditions during the summer of 1946 had bared pastures considerably, these wet and mild conditions did much to regenerate them. The winter growth was better than normal and stock in many districts were saved from a period of starvation threatened by the using-up of most reserves of hay and silage before winter began. The drought, however, left its mark; pasture-production in spring was backward, with poor clover growth, and weeds often made their appearance where swards had become thin. This was especially so on the east coast, where winged thistle, Scotch thistle, and in some districts variegated thistle became troublesome. Favourable weather in late spring and early summer was responsible for heavy growth of pastures, giving farmers an opportunity of making good the depleted stocks of hay and silage. In parts of Canterbury serious damage to pastures was caused by the depredations of grass-grub and porina in the winter of 1946, but the mild, wet conditions enabled farmers to bring their stock through the winter satisfactorily and allowed some recovery of the affected areas. In the South Island the use of better strains of grasses and clovers is on the increase, and this, combined with better cultivation and the greater use of lime, is resulting in an all-round improvement of pastures. It is likely that a good many pastures will need renewal in the North Island, where the effects of many years' fertilizer rationing are being felt. An increased allocation of fertilizer, especially for the sowing of new grass, will give a stimulus to pastures during the coming season.

Supplementary Fodder

During the autumn and winter of 1946 considerable movement of hay took place from the south-western part of the North Island to the east coast and to the Auckland Province, where stock-feed was at a dangerously low level. In addition, large consignments of hay and chaff were shipped from South Island ports and it became necessary for the Government to charter special ships to cope with the 4,300 tons of hay and 6,000 tons of chaff which were transported between 1st March and 30th September, 1946. To keep the cost of hay down to a reasonable level for the ultimate purchaser a Price Order was issued setting a maximum price for hay and chaff, while freight and other charges were subsidized. In order to ensure that fodder-supplies were distributed as evenly as possible, special allocation committees were set up by the Department of Agriculture in collaboration with merchants at centres of distribution. With the coming of spring most of the surplus stocks of hay and silage in the North Island had been disposed of, and it was therefore fortunate that sufficient pasture growth became available during summer for large areas of grassland to be closed. There is a marked tendency to bale hay direct from the swath, and the increase in this practice last season made heavy demands on the limited stocks of baling-wire available, although special twine manufactured for the purpose was used as a substitute when available. Root crops grown for supplementary fodder during the present season have been variable. Sowings of swedes were generally late and establishment uneven, but, although crops improved with better weather conditions, yields are likely to be lower than usual, particularly in Southland.

Crops

Wet conditions in the autumn and again in spring were not conducive to expansive cropping. As a result the area in autumn-sown crops, particularly wheat, was reduced, but there was almost a compensating increase

in the sowing of spring crops. Details of estimated crop acreages and the comparative figures for 1945–46 are as follows:—

	1945–46. Acres.	1946–47 (Estimated). Acres.
Wheat	164,286	140,000
Oats (all purposes)	182,123	160,000
Barley (all purposes)	54,717	59,000
Potatoes	23,228	19,000
Onions	1,387	1,200
Peas	32,740	31,000
Maize (for grain)	7,034	9,670

Wheat.—The acreage in wheat was the lowest for several years, mainly because of the unfavourable sowing conditions in the autumn, but a big proportion of the crop was sown in spring. Autumn- and winter-sown areas did not do as well as those sown in spring, samples from the farms generally being pinched and of low bushel weight. The weather was better suited to spring-sown crops, which yielded well in most districts.

Oats.—Crops recovered satisfactorily from adverse spring conditions and yields were anticipated to be slightly above average. Harvesting was carried out under good conditions and the quality of the grain was mostly up to average.

Barley.—The area in barley again showed an increase, the late season no doubt having some influence on this, because some areas intended for other crops such as wheat or peas were diverted to barley. In the main the yields were good, and favourable samples of malting-barley were secured. There was an appreciable increase in the growing of feed-barley crops in many districts where malting-barley cannot be grown.

Potatoes.—The area sown in potatoes showed a reduction on the past few years. Early crops were affected by the cold spring and yields were lower than usual. Main crops were planted late and some areas in Canterbury had to be replanted owing to very wet conditions, but in spite of early setbacks most crops grew through the summer satisfactorily and the prospects are for normal crops to be harvested.

Onions.—Owing to the wet spring, crops in the main growing districts were sown late and did not come away well. The prospects are not as good as in the previous season, although harvesting weather is favourable to long keeping.

Peas.—As weather conditions were not good for sowing, many areas were late sown. Crops generally have done well, with yields of field varieties about average. Garden varieties, however, were variable in yield, but harvesting-conditions were conducive to satisfactory quality.

Maize.—Despite the drought of the summer and autumn of 1946, maize crops in Poverty Bay and the Bay of Plenty yielded satisfactorily. An increased acreage was sown in maize last season, and although early growth was checked by the dry spring and early summer, the crop made excellent growth later and there are indications that yields will be above average.

Crop Advisory Committees

Various Advisory Committees in connection with specific crops continued to function during the year and have been of material assistance both to the Department and to growers. The Barley Advisory Committee consists of representatives of growers and brewers. The Onion Marketing Advisory

Committee, constituted under the Board of Trade (Onion) Regulations 1938, consists of growers' and merchants' representatives and acts in an advisory capacity in matters affecting the production and marketing of the onion crop. Similar functions and representation obtain in regard to the Potato Advisory Committee, set up under the Primary Industries Emergency Regulations 1939. The Commercial Advisory Committee, comprising members of the New Zealand Grain, Seed, and Produce Merchants' Federation, has continued to give valuable assistance in implementing certain controls which are still necessary in connection with the export and import of seeds.

Seed-production

A general increase in the production of grass and clover seeds occurred in the 1946 harvest. Approximately 224,000 acres were devoted to this purpose, as compared with 180,000 acres in 1945 and an average of 135,000 acres for the six immediately preceding seasons.

Except in the case of cocksfoot seed, prices have remained at high levels, due to the keen demand from the United Kingdom for grass and clover seeds generally. During 1946 an embargo had operated against the importation of any cocksfoot seed into that country, with the result that the price of this seed has fallen very sharply. As a similar prohibition has recently been introduced against both certified and uncertified Italian rye-grass and against uncertified perennial rye-grass, and as a restricted importation only of certified perennial rye-grass and crested dogstail is permitted, an appreciable reduction in the prices of these items might be expected in the near future.

The market for both red- and white-clover seeds remains firm at present, but in view of the position in regard to the grass seeds it appears too much to expect that prices for clover seeds will remain long at present levels.

The growing of grass and clover seeds must be regarded as an activity primarily to supply local requirements. Thus, while under certain conditions appreciable exports may take place, it is obvious that the relative instability of the overseas demand, as evidenced by the embargoes referred to, would provide little incentive to seed-growers.

As an industry to meet local requirements, however, with perhaps exports to relieve the market of over-production, the production of small seeds is a vital part of farming practices in this country.

There has been a marked increase in the production of timothy seed, and during 1946 sufficient was harvested to meet local requirements. Multiplication is now taking place of a selected strain of this species, and as a result there should be a marked improvement shortly in the strain quality of timothy seed available.

The production locally under departmental supervision of supplies of turnip, swede, rape, and similar seeds is being continued. The experience being gained in this work emphasizes the necessity of strict control over growing-operations if the market is to be regularly supplied with seed of high quality. A small demand from Australia exists for rape seed, but in general the production of these seeds is for local requirements only.

A good market still exists for peas of all types—garden varieties, food peas, and maple peas. In this commodity the bulk of the crop is exported, and high prices ruled for the produce of the 1946 harvest.

The export of agricultural seeds during 1946 reached a value in New Zealand currency of over £2,750,000. Over half of this value was exported to the United Kingdom, with Australia and the United States also prominent buyers. Other purchasers of seeds valued at over £50,000 in each case were Eire, the Netherlands, Belgium, and Hong Kong.

Seed Certification

Corresponding with the general increase in seed-production has been an increase in the quantity of seed certified. The following table sets out the total quantity of the various seeds certified during 1946, with the 1945 figures also given for comparison:—

Seed.	1945.	1946.
Perennial rye-grass ..	405,656 bushels	550,675 bushels
Italian rye-grass ..	221,807 bushels	284,288 bushels
Short-rotation rye-grass ..	6,150 bushels	48,449 bushels
Cocksfoot	443,966 lb.	477,961 lb.
Brown-top	594,258 lb.	773,209 lb.
Timothy	86 lb.	25,020 lb.
White clover	1,655,481 lb.	3,654,326 lb.
Montgomery red clover ..	292,356 lb.	927,834 lb.
Cow-grass	15,399 lb.	141,479 lb.
Subterranean clover ..	34,110 lb.	4,241 lb.
Lucerne	..	3,050 lb.
Seed wheat	25,690 bushels	39,820 bushels
*Seed maize	..	1,207 bushels
Rape	239,098 lb.	311,918 lb.
*Turnip	164,172 lb.	5,499 lb.
*Swede	122,584 lb.	424,173 lb.
Chou moellier	46,167 lb.	41,633 lb.
Onion seed	9,830 lb.	10,478 lb.
Seed potatoes	3,575 lb.	7,651 lb.

* This seed is termed "Government approved."

Supplies of short-rotation rye-grass seed have increased markedly, the 1945 harvest being the first in which this strain was produced on a commercial basis.

Certification of timothy seed was undertaken during 1946 for the first time. In the meantime certification is based on the S.48 strain raised by the Welsh Plant-breeding Station, Aberystwyth. A re-selection of this strain has been made locally, and is now in course of multiplication. The type of plant from which certified seed is produced is markedly superior to that represented by commercial stocks of seed imported in the past.

The increase in production of certified white clover, Montgomery red clover, and cow-grass seed is largely a reflection of the improved harvesting-conditions for this seed during 1946 in comparison with those of 1945.

The production of certified subterranean-clover seed showed an appreciable reduction, due primarily to the fact that seasonal conditions during 1946 did not suit this plant. The information to date suggests that a greater quantity of seed will be saved this year. With the experience in harvesting methods which is being gained, further extensions in the production of subterranean-clover seed may be expected, thus reducing the quantity which it is necessary to import.

The first commercial production of certified lucerne seed occurred during the 1946 harvest. This seed represents a selected strain developed by the Agronomy Division of the Plant Research Station and is an improvement on the Marlborough strain commonly grown in New Zealand.

For the first time the Department of Agriculture has been concerned in the production of seed maize. The seed is of hybrid character, the particular type (Pfister Hybrid No. 360) having been imported privately from the United States of America several years ago, and in the intervening period having given good results. The acreage of this type had increased very considerably,

but some stocks of seeds had become very impure, and in view of the drive for increased acres of maize it was deemed advisable to provide a source of seed of reasonable purity. Seed of the parent material has also been imported from the raisers, with a view to producing locally seed of the original hybrid generation.

The fluctuations in the production of Government-approved turnip and swede seed do not indicate that a shortage of the former may be expected. The altered production from the 1946 harvest is a controlled one. On the one hand, increased carry-overs of turnip seed enabled a considerably reduced area to be required for seed purposes, while, on the other hand, production of swede seed was increased to build up the diminished reserves from the previous season.

A very appreciable increase has taken place in the quantity of seed potatoes tagged as certified after examination of the tubers. This is all to the good, in that, while similar quantities of good-quality seed from provisionally certified crops may have been utilized in past seasons, the buyer is entitled to receive seed which is satisfactorily identified as being the produce of such crops and to have this seed properly graded.

Seed-testing Station

Requests for seed-testing services during the year 1946 exceeded previous records. The increase of work coincided with an acute staff shortage and a continuance of deficiencies in equipment resulting from wartime restrictions overseas. In these circumstances there was an aggravation of difficulties which have recurred with increasing weight since the early years of the war.

Number of Samples.—The total number of samples received for testing during the calendar year 1946 was 44,933, of which 17,176 were officially drawn samples of seed for certification and 27,757 were samples received directly from merchants and farmers. The number of samples received in each of the past five years is as follows:—

1942	21,793
1943	23,964
1944	26,960
1945	35,000
1946	44,933

The growth in demand for seed-testing was due mainly to the expansion of seed-production and the activity of the export trade, but partly also to the increasing appreciation on the part of merchants and farmers of the importance of seed quality. The number of tests carried out during the year is shown in the following table, with the figures from previous years for comparison:—

——	1942.	1943.	1944.	1945.	1946.
Purity	17,469	20,079	22,350	29,366	33,732
Germination	21,793	23,964	26,960	35,011	40,000
Ultra-violet tests	3,106	2,201	4,675	4,150	5,190
Picric-acid tests	2,954	3,628	3,455	4,780	7,258
Totals	45,322	49,872	57,440	73,307	86,180

The work was fairly evenly distributed through the year. The decline in the rate of receipt of samples during the early summer provided an opportunity for disposing of large arrears of work and for the overhaul of equipment.

During the year the work was reorganized to enable more samples to be handled, and when additional equipment comes to hand there should be no difficulty in handling an even greater number of samples expeditiously. The total number of rye-grass samples received for strain testing was 3,486, including 2,983 officially drawn samples representing lines entered for certification and 503 samples for preliminary tests. The total number of officially drawn samples of white-clover seed entered for certification by the picric-acid test was 5,616. One hundred and twenty-one samples were submitted for "preliminary" tests. Tests for the information of the Department's field officers, the agronomist, and farmers brought the total number of picric-acid tests up to 7,262. Trial plots of white-clover samples which were laid down by the Grasslands Division in 1945 gave satisfactory confirmation of the laboratory classification.

Pre-harvest Examination of Rye-grass Seed.—Substations established in Christchurch and Timaru for the examination of rye-grass seed for blind-seed disease examined 4,057 samples, the majority of which were affected by the disease to an extent sufficient to involve some financial loss to the growers in the harvesting of seed.

Moisture Tests.—Only 17 samples of wheat were received for pre-harvest moisture-content tests. In good harvesting weather such as was experienced this year few farmers feel the need of the assistance of moisture test in judging the condition of grain. Moisture tests were also carried out on Chewings-fescue and crested-dogstail seed. These tests are being requested with increasing frequency, and are used to indicate the suitability of seed for shipment or long storage.

Field Experimental Work

The past year has seen a considerable expansion of activities, although to some extent this expansion has been limited by a shortage of trained field officers. Nevertheless, the number of field experiments in progress has increased from 331 at the commencement of the year to 580 at the present time. A large number of trials now open are complex experiments of a modern design that call for increased field-work and statistical analysis.

The Statistical Section is undertaking a greatly increased volume of work not only on account of the experiments now in progress, but also in the analysis of data which has accumulated during the war. The design and analysis of trials not included in this summary but carried out at the Soil Fertility Research Station, Hamilton, are an important and increasing section of the work, and it is anticipated that in the near future similar work will be carried out for the Winchmore Irrigation Research Station, Ashburton, and for the projected Otago-Southland Experimental Farm.

At the Marton Experimental Area a wide range of experimental work is being carried out. While the emphasis at this area remains on pasture trials, a portion of the farm is now devoted to experiments with crops. The intensive experimental activities on this area continue to yield valuable information, as they have over the past twenty years. At the Dargaville Demonstration Farm a programme of field experiments, which includes several pasture mowing trials, is to commence shortly. Together with investigations into the "ironstone" soils in co-operation with the Soil Fertility Research Station, this work will commence a more intensive attack on the problems of soil and pasture as found in North Auckland. The programme of experimental work at the Stratford, Waimate West, and Winton Demonstration Farms has also been expanded.

(1) *Grassland Trials*

(*a*) *Mowing Trials.*—At the Marton Experimental Area nine pasture mowing trials are in progress. These include four continued from last year—namely, (1) trial I, which has now been in progress fifteen years. For the last seven years this top-dressing trial has not received fertilizer, and the residual effects of the previous eight years' applications are still showing. The lime reponse is marked, and there are also definite responses still showing to the forms of phosphate applied (superphosphate, basic slag, and ground rock phosphate); (ii) trial S, where serpentine-superphosphate is compared with superphosphate and superphosphate plus lime; (iii) trial T; and (iv) trial V, where various strains of grasses and clovers are being compared. The experiments laid down during the year at Marton are (v) trial A, where the placement of superphosphate and of lime when sowing down a pasture is being investigated; (vi) trials B1 and B2, which are essentially technique trials, the responses to various phosphates and lime being measured on one section on a pure white-clover sward derived from a single plant, and on a similar section on a standard mixed pasture, both sections being under a modified "mowing and grazing" technique; (vii) trial C, where types of timothy are compared with and without perennial rye-grass; (viii) trial D, where pasture establishment and growth following surface working-in only of a green-manure crop of barley are compared with the establishment and growth of pasture after a similar crop of barley was ploughed in and worked to a seed-bed in the usual manner; and (ix) trial E, where new types of phosphatic fertilizers from the United States and England are being examined against standard types of these manures. An additional pasture mowing trial with a new "long-rotation" type of rye-grass bred by the Grasslands Division, Department of Scientific and Industrial Research, is to be laid down shortly.

At the Stratford and Waimate West Demonstration Farms "rate of growth" trials are in progress on both a standard perennial rye-grass and white-clover sward and on one sown with a fifty-fifty mixture of "short-rotation" and perennial rye-grass, together with white clover. At the Winton Demonstration Farm a large-scale pasture mowing trial comparing the merits of serpentine-superphosphate and reverted superphosphate has been commenced. The pasture-production data from this trial will be supplemented with animal-production records, a policy which it is hoped to extend to many additional trials in the near future.

(*b*) *Observational Top-dressing Experiments.*—The major object with these trials is to complete the survey of every major soil type in the Dominion with respect to their fertilizer and lime requirements for maximum pasture-production of high-quality stock-food. This entails close co-operation with the Soil Bureau, Department of Scientific and Industrial Research, and ensures the fullest use and widest application of the trial results. A great deal of work requires to be done with regard to the summarizing of the numerous trials carried out in the past and in carrying out further experiments on the many soil types which have not been thoroughly examined from this point of view.

The other section of this work concerns the examining of the suitability of various types of phosphatic fertilizer—in particular, serpentine-superphosphate and reverted superphosphate—for particular soils and climates. The problems of hill-country top-dressing are not being forgotten, and in particular the practicability of more concentrated fertilizers is being investigated. The use of such fertilizers would reduce transport charges substantially, and they have also to be considered in connection with the possibility of top-dressing from aeroplanes. The soils of the trial areas are in all cases subjected to

chemical analysis, and other tests, such as tissue tests, are made on the pasture whenever convenient by officers of the Soil Fertility Research Station.

An increasingly important section of this work deals with investigations into possible "minor" element deficiencies, and in several cases simple pasture-production figures have been secured from trials of this nature. A total of 106 observational top-dressing trials is now in progress, 85 of these including serpentine-superphosphate plots, and 4 are essentially "minor element" trials.

(*c*) *Pasture Species and Strains.*—The Grasslands Division, Department of Scientific and Industrial Research, collaborates in the carrying-out of trials of this nature by supplying the seed. Strains newly bred or introduced by that Division are tried out on farmers' properties throughout the country. The series of trials now in progress includes investigations into seeding rates and mixtures, as well as the above. Paddock-scale trials are carried out whenever sufficient seed is available, and stock-grazing data are thereby secured in addition to the usual observations on pasture establishment and growth—this has been the case, for example, with most trials with short-rotation rye-grass. Surface-sowing trials with subterranean clover and other legumes are an important investigation in connection with the improvement of hill-country pastures. A total of 129 trials with pasture species and strains is now in progress; 40 of these are the standard types of plot trials, 6 deal essentially with methods of pasture establishment, 30 are trials of short-rotation rye-grass, and the remainder (53) are essentially surface-sowing trials with various species, mainly clovers.

(*d*) *Trials on Depleted Land: Soil Erosion Control.*—Most of the work in connection with the depleted country of the South Island centres round the Pisa Flat Experimental Area, where a considerable amount of information concerning the possibility of introducing various native and introduced species has been secured. It is hoped to expand this work in the near future on to a more extensive block of depleted land and to demonstrate means by which such land may be brought back into production.

Soil-conservation problems are not new to the Fields Division, and a large amount of experimental work that has been carried out in the past, by its emphasis on the production and maintenance of high-quality pasture on hill country, has done much to assist in the saving of our soil. The experimental work of the Fields Division will be therefore closely co-ordinated with that of the Soil Conservation and Rivers Control Council to enable this to be carried out with the maximum of efficiency and despatch.

(2) *Annual Crops*

(*a*) *Wheat-manuring Trials.*—Five complex experiments of modern design and layout were sown this year as the commencement of a thorough investigation into the fertilizer needs of the wheat crop in relation to soil type and district. Four of these trials promise to yield most interesting and informative data.

(*b*) *Wheat Variety Trials.*—These trials are carried out in co-operation with the Wheat Research Institute, and are designed to test out in the field the crosses they produce or the varieties they introduce. Twenty-one such trials are in progress.

(*c*) *Oats.*—Five trials of milling-oat varieties are in progress in Canterbury and Otago-Southland. In these trials new introductions and new crosses from the Agronomy Division, Department of Scientific and Industrial Research, are tried out in the field with the varieties commonly grown in the district. Such co-operation with the Agronomy Division is a feature of the work with all crops other than wheat.

(*d*) *Barley.*—During the year 10 trials have been conducted with green-feed barley varieties, and have demonstrated the value of Newal and Oderbrucker as quick-growing but essentially "one crop" types, as compared with the Cape barleys, Black Skinless, and especially a new introduction, Wong, which show good recovery after grazing or cutting. The green-feed trials during the coming year will include various oat varieties and ryecorn.

Twelve trials with malting-barley are still in progress. Eight of these are variety trials, and some of the more recent introductions, such as Golden Archer, are showing considerable promise. A close watch is kept on malting-quality, and samples of all trial varieties are tested to estimate this factor. The remaining trials (4) are manurial experiments, with the major emphasis placed on the value of lime as it affects yield and malting-quality of barley.

(*e*) *Brassica Crops.*—Thirty-three of the 47 trials with these crops are trials with a number of turnip and swede varieties which have been laid down mainly to obtain preliminary information concerning the growth, disease resistance, and keeping-quality of various lines grown from New Zealand and introduced seed. These trials are proving most valuable and informative. Six trials are with turnip and swede varieties, some of which may show resistance to club-root disease. These trials also include treatment with "mercurated phosphate" (which is a mixture of superphosphate and mercuric chloride), which in earlier trials has given promise of being an effective means to control the disease. Three trials compare "silico phosphate" (a new type of fertilizer recently produced in England) against reverted superphosphate as a swede-fertilizer. Two trials are investigating the manuring of the swede crop for seed-production, with special reference to nitrogenous fertilizers. Finally, 3 trials at the Marton Experimental Area compare the productiveness and feeding-value of various varieties of rape and chou moellier, and an investigation into rates of seeding and methods of sowing the rape crop.

(*f*) *Linen Flax.*—The trials this year were again concentrated on a single area, this time at Claremont, near Timaru. The experiments included a variety trial, manurial trials, rate-of-seeding trials, and trials with the new type of coulter which gives a "broadcast" distribution and which is proving of value in linen-flax sowings. Sheaves from these trials are now being processed by the Linen Flax Corporation for straw and fibre yields and estimation of fibre quality. One trial with the new type of coulter compared with the ordinary type was also sown in the Centre Bush district, Southland.

(*g*) *Linseed.*—Four trials are in progress in which a varietal comparison is made at two rates of seeding. The trials include Golden Viking, a variety which was particularly promising last season.

(*h*) *Peas.*—Another trial was sown this year on the lines of those in the previous season—namely, the use of organic mercurials and other products in the "dusting" of the seed to improve field germination and establishment of plants.

(*i*) *Sugar-beet.*—In co-operation with the Department of Industries and Commerce, two 10-acre sugar-beet field trials have been established, using machinery introduced for the purpose. Specially imported harvesting and loading equipment will also be used on these trials, the object of which is to investigate the economic possibilities of sugar-beet growing under conditions of full mechanization. A small-scale trial, to test various lines of sheared and decorticated sugar-beet seed in respect of the efficiency of the "singling" of the seed, was also sown.

(*j*) *Maize.*—Twelve trials, the majority of which are in the Gisborne district, have been sown this year. Seven of these are varietal trials, including the hybrid lines imported from the United States, which have given promise

of being high yielding. The possible deterioration of these lines after continued growing for seed in New Zealand is also being investigated. Three trials are selection areas sown for the Agronomy Division, Department of Scientific and Industrial Research, and 1 is a disease-control trial where the Plant Diseases Division, Department of Scientific and Industrial Research, is investigating control methods against "head smut" of maize. One manurial trial has been sown at the Dargaville Demonstration Farm.

(*k*) *Potatoes.*—Twenty-five of the 35 potato trials laid down this year are varietal trials of a simple type comparing vigour and growth, disease-resistance, yield, and quality of tubers. Four trials compare "strains" of the one variety, and investigate the possibility that the crop grown from seed from certain districts or growers is any different in respect of yield and other characteristics from that grown from other districts or growers. Four trials have manurial comparisons, and 1 at the Marton Experimental Area investigates different cultivation practices on the potato crop. Two trials compare methods of controlling late-blight of potatoes.

(*l*) *Other crops.*—One trial with "kudzu" is at present in progress. This plant is reported on favourably in the United States in connection with soil conservation, and further experiments with kudzu will be commenced in New Zealand in the near future.

(3) *Miscellaneous Trials*

(*a*) *Weed Control.*—The experimental programme with the new type of "hormone" weed-killers and other products is now in full progress, ample supplies of the materials having arrived during the year. A total of 80 trials, 73 of which are still in progress, have been laid down during the year, and cover a wide range of annual and perennial weeds everywhere where they present a farming problem. The work so far has not reached finality, but it has shown that, although they will be very useful in the hands of the practical farmer, the new forms of weed-killers have very definite limitations in respect of the weeds they will eradicate and the circumstances under which they can economically be used. Farmers should view with caution any extravagant claims as to their value. There is every possibility, however, that for certain purposes they are invaluable, and it is these instances which it is hoped the trials will clearly define.

Close co-operation is being maintained with the Soil Fertility Research Station, Hamilton, where an officer is specializing in weed-control problems.

(*b*) *Pampas-grass.*—The 5 plantations of various so-called "strains" of pampas-grass should be ready for feeding-off shortly. In the meantime a survey of all pampas-grass plantations is to be carried out, with the object of placing on record all the information available so that detailed conclusions concerning the establishment and utilization of the plant can be arrived at.

(*c*) *Casting Worms.*—The 79 plantations of these worms should be ready for inspection during the coming winter. The transplanting of casting worms in the Raetihi district has resulted in promising improvement in pasture composition and growth and stock-carrying capacity of hill country.

(*d*) *Cultivation Practices.*—Four of these trials are designed to investigate the effect on the soil and on the growth and yield of subsequent crops of ploughing-in of the straw stubble left after heading cereal crops compared with burning such stubble before ploughing. Results are not yet to hand.

(*e*) *Miscellaneous Trials.*—These include 2 trials in which is investigated the "dusting" of grass and clover seed in an endeavour to improve field germinations. The use of the usual types of dusts commonly applied to peas

to improve field germinations did not give any improvement to grass-seed germinations in these trials. The other major project is the investigation into methods of control of blind-seed disease of rye-grass, which is proving a serious problem to seed-producers.

Summary of Numbers of Experiments laid down, discontinued, and carried on, 1st April, 1946, to 31st March, 1947

Nature of Trial.	As at 1st April, 1946.	Discontinued during Year.	Laid down during Year.	As at 31st March, 1947
1. Pasture—				
(*a*) Mowing trials	9	4	7	12
(*b*) Serpentine-superphosphate observational top-dressing	63	13	35	85
(*c*) Other observational top-dressing	15	8	10	17
(*d*) Minor-element trials	..	1	5	4
(*e*) Strains trials	15	6	31	40
(*f*) Pasture establishment	5	2	3	6
(*g*) Subterranean clover	4	2	8	10
(*h*) Surface-sown legumes	..	..	23	23
(*i*) Soil-erosion control by pasture oversowing	..	1	21	20
(*j*) Miscellaneous pasture species	3	3	..	..
(*k*) Short-rotation rye-grass	35	6	1	30
(*l*) Technique trials	4	4	..	..
(*m*) Miscellaneous pasture trials (depleted land)	7	4	..	3
(*n*) Grazing trials	..	..	2	2
2. Crops—				
(*a*) Wheat manurial	6	7	5	4
(*b*) Wheat variety	5	5	21	21
(*c*) Oats	2	2	5	5
(*d*) Barley	5	15	22	12
(*e*) Brassicas	18	18	47	47
(*f*) Linen flax and linseed	6	7	10	9
(*g*) Sugar-beet	..	..	3	3
(*h*) Onions	2	1	1	2
(*i*) Lucerne	4	2	4	6
(*j*) Lupins	..	..	5	5
(*k*) Peas	2	2	1	1
(*l*) Maize	8	8	12	12
(*m*) Potatoes	..	2	35	33
(*n*) Other crops	3	3	1	1
3. Miscellaneous—				
(*a*) Pampas-grass	5	1	1	5
(*b*) Weed control	9	16	80	73
(*c*) Feed flavour	17	17	..	..
(*d*) Cultivation practices	..	..	5	5
(*e*) Casting worms	79	..	..	79
(*f*) Miscellaneous	..	..	5	5
Totals	331	160	409	580

Soil Fertility Research Station

This report covers the first year's operations of the Soil Fertility Research Station, established at the beginning of 1946.

The laboratory staff are still located at the Galloway ex-ammunition factory, but working drawings and specifications for permanent administrative and laboratory buildings to be erected on the Station have now been drawn up. Some additions to the research staff have been made during the year, but there is still a shortage of qualified chemists and field research officers.

The Weather Bureau has installed a standard climatological station on the farm. A modified system of soil-drainage gauges is ready for installation, preliminary investigation showing that the classical type of lysimeter would be prohibitively expensive to construct at the present time. A travelling laboratory in the form of a specially fitted caravan has been constructed and given preliminary trials. So far it has been found well suited for rapid soil- and tissue-test work in the general programme of correlating chemical methods of determining manurial requirements with the results of observational field experiments. Detailed reports of the work of the various sections follow.

Field Research.—In the field-work carried out at this Station much attention has been given to the question of the technique of pasture measurement, and a series of trials designed to compare existing techniques has been laid out. Applications of fertilizers to the trials will be made this autumn and the trials themselves will then be under way. Work so far done has consisted in laying them out and in making preliminary cuts for purposes of establishing the degree of uniformity over the area.

Observations and weighings have continued on the technique of keeping sheep at constant weight on the ½-acre paddock, and certain preliminary comparisons have been made with the pasture-production measured from the adjoining control plots of the "nitrogen" series. So far differences of the order of 16 per cent. have been observed between the mower and the sheep techniques.

The series of trials with nitrogenous fertilizers was laid down primarily with the objective of chemical determinations of the fate of added nitrogen. The trial is being continued, employing the mowing and clippings returned technique, with a view to following up effects on pasture yield of the different nitrogenous fertilizers.

A trial designed to test out under the mowing and grazing technique different types of imported phosphatic fertilizers such as themo-phos, silico phosphate, and metaphos is at present being laid down and should provide information on the value of these materials on the Hamilton clay loam.

Investigational work on the Rukuhia peat soils has been commenced and some striking effects from the use of nitrogenous fertilizers have been noted, particularly where these have been used at high rates of application. Initially there is little or no response to lime, phosphate, and potash, although there is evidence to suggest that a potash response will be more evident with the passage of time. Work on the peat has so far been restricted to observational trials, but with the sowing-down of a recently acquired area it is hoped that mowing trials will be undertaken to give some quantitative measurement and responses to various treatments. In conjunction with the Agrostologist, investigations on pasture species—particularly clovers—are being planned.

An extensive trial employing the white-clover technique has been laid down to compare the effect of different rates and frequencies of applications of lime, superphosphate, serpentine-superphosphate, and potash.

Soil-moisture Studies.—An irrigation trial was commenced in January on the Hamilton clay loam to investigate the effect of water as a limiting factor on pasture-production. An area of approximately 2½ acres of sloping ground, so chosen because of its proximity to an existing high-pressure water-supply, was subdivided to give 6 plots of 0·43 acre with an interconnecting race. The type of irrigation employed is a spray system operating with movable pipes. Two plots are irrigated to receive 1 in. of water at each irrigation, 2 to receive ½ in., and the remaining 2 remain unirrigated.

Irrigation commenced on 8th January, 1947, and by 21st March 11 irrigations had been completed. Production is gauged by taking mower cuts in the plots, calculating the weight of dry matter per plot, and grazing off with a calculated number of sheep. Adjustments of sheep numbers are made to ensure uniform grazing, and then sheep hours per plot are used as the final indicator. Over the period 8th January, 1947, to 1st February, 1947, the ½ in. plots have shown three times the production of the unirrigated, and the 1 in. plots five times. A marked improvement of the pastures also occurred. Soil-moisture tests were taken each time the plots were grazed.

Experiments on Peat Soil.—In December "sighter" experiments, which included more than 300 plots and covered a wide range of fertilizer and chemical treatments, were commenced on a portion of the Rukuhia peat swamp. The outstanding result was the greenness and marked increase in growth on all plots receiving nitrogenous fertilizers applied either as ammonium nitrate, ammonium sulphate, or sodium nitrate. The responses to 1 cwt. and 5 cwt. of ammonium nitrate per acre had largely worn off after six weeks and four months respectively, whereas the plots receiving 20 cwt. were still conspicuously green after four months. The latter dressing had the effect of suppressing clovers and considerably stimulating the rye-grass in the sward, which was predominantly Yorkshire fog on untreated areas. Combinations of lime, serpentine-superphosphates, and muriate of potash when applied as cross-treatments considerably enhanced the response to nitrogen, but when applied without nitrogen these fertilizers have not had much effect in the short time the experiments have been laid down. There was some evidence that oxidizing agents—*e.g.*, potassium permanganate—when incorporated with the top few inches of peat before sowing improved the establishment of the new pasture. A number of treatments—for example, heavy liming to reduce the extreme acidity of the peat (which is pH 3·5 to 4·0 on untreated areas)—have so far not given noticeable responses. It is too soon to pass judgment on such treatments, which may give responses at a later stage.

Studies with Nitrogen Fertilizers.—A study of the nitrogen cycle in grassland soils, with particular reference to the use of nitrogenous fertilizers for increasing production of pasture during the winter, was commenced during the period under review. Applications of ammonium nitrate, ammonium sulphate, sodium nitrate, and dried blood were made in May to replicated pasture plots on Te Kowhai soils. The applications, which each contained the nitrogen equivalent to 1 cwt. of ammonium sulphate, were repeated in July and September.

The percentage nitrogen in the pasture on the untreated plots rose to a maximum of 5·92 in July and dropped to 3·91 in December. The figures for the treated plots were slightly higher for two to four weeks after each application of fertilizer. Fluctuations within the seasonal trend were inversely related to the height of the pasture. During May–August the percentage nitrogen in the pasture was extraordinarily high and was never less than 5 per cent. on any plot. The figure of 6·4 per cent. which was obtained from the ammonium sulphate plot in July was the highest average for the four replicated plots from any one treatment. This is probably the highest recorded figure for New Zealand pastures, which give, in general, higher figures than those overseas.

Soil analyses indicated that none of the ammonia or nitrate-nitrogen added in the fertilizers could be recovered from the soil later than two or three weeks after the application. There was no evidence of leaching, and the recovery of added nitrogen from the pasture in that period was less than

20 per cent., except after the September application, when 40 per cent. to 50 per cent. recoveries were obtained from some treatments. The experimental data does not show what happened to the rest of the nitrogen.

Microbiological Research.—A temporary microbiological laboratory has been set up and a start made with the equipment to hand. To date, rhizobium organisms have been isolated from clovers growing on the Rukuhia peat, and comparisons of these strains with those from clovers on the Hamilton clay loam will be made with the object of evaluating the efficiency of the strains growing on peat with the object of isolating a strain that may increase the fixation of nitrogen on peat soil in the district.

Laboratory and Pot Culture Studies.—The assessing of available phosphate and potash in soils through Mitscherlich pot cultures commenced in 1945 has been continued on a larger scale in the season 1946–47. Results serve as a standard of comparison for the more rapid laboratory methods under investigation. Accumulated data of this nature from the plant growth and laboratory studies form a sound basis on which to build a Dominion-wide advisory service for farmers—a project regarded as of prime importance. With such a service in view, attention has been directed especially to quick-test methods, as these can be handled by field officers able to relate findings to their personal knowledge of the farms under investigation. Advice, too, can be given more expeditiously than from a central laboratory. The Purdue soil and plant test kit has been used tentatively on a fairly wide scale. The need of much experience for confident interpretation of results has become obvious. Samples of soil from observational top-dressing trials will be analysed by those laboratory methods showing to best advantage, the comparison with field pointings forming an additional check. At the Soil Fertility Research Station a replicated trial on the effect of molybdenum and lime dressings on cauliflower-production is in progress. Some marked deficiency symptoms have appeared, but these are not associated with any particular treatment. No whiptail, a malformation which has been attributed to molybdenum shortage, is in evidence. The Research Station is also associated with small trials with molybdenum in Wellington and near Dunedin. In one instance an initial advantage in colour and growth shown by the molybdenum-treated plants was later lost, the control outgrowing them. In 1946 a pot experiment was conducted in which rape was grown on selected soils which had received a wide range of fertilizer treatments during vegetable-production in the preceding war years. Each pot was provided with an adequacy of all major nutrients other than phosphate. The correlations of the yields, which varied greatly, with the contents of available phosphate indicated by a variety of laboratory methods were noted. No laboratory method gave results closely following yield data, but all clearly indicated the most deficient soils.

Analysis of soil samples representative of each of the differently fertilized blocks at the Station have been completed. There is little connection between the levels of the major plant nutrients and the recorded fertilizer applications. A lack of uniformity prior to the S.V.P. work may account for the discrepancy. A study of the heavy crop removals might also throw some light on the subject.

Plant-tissue Testing.—The concentrated work on sap analysis occasioned by vegetable-production work during the war and the investigations into the sap composition of white-clover petioles from variously manured plots has been followed up to determine whether such methods will materially assist research on soil-fertility problems. As sap extracts lend themselves to quick tests, it was considered worth while investigating the possibility of providing advisory officers with a simple and reliable kit for use in the field. In

particular, Purdue methods are being examined. Use has been made of the travelling laboratory facilities for this investigation. Some correlation between the sap-analysis results and responses to fertilizer treatment has been found, but the research is complicated by several factors such as the different mineral requirements of different plant species, by weather conditions, and by differences of soil types. More work is required to reconcile the frequent conflict between the results of soil tests and tissue tests on these trials.

Analytical Services.—Some of the activities of the laboratory have been restricted in their scope and results have been delayed by shortage of staff and supplies. Despite this, a fair indication of the increase in work undertaken is the total of 3,000 samples received this year, in comparison with 1,000 last year. This total includes both material from research programmes and from field officers.

Soils.—Quick-test methods adapted by the research team have enabled manurial advice to be given on 187 samples received from Instructors. Where more detailed work is warranted, a more complete analysis is done. Eighty-three samples were examined for their lime requirement, and in cases where this was satisfactory quick tests were used to check up on other factors which might be causing trouble. If such services are to be used to best advantage, it is very necessary that follow-up reports are sent in upon the results obtained by following the recommendations.

The research work at the Station depends upon the uniformity of the experimental areas in regard to manurial status. This has involved a large number of analyses both of soils and plants.

Limestones.—The quality of ground limestone on the market is checked by analysis, and with few exceptions the carbonate content is satisfactory. Exceptions occur regularly only in areas where supplies of high-grade stone do not exist. A noticeable decrease in the fineness of grinding has been observed and is ascribed to wear of machinery, difficulty in securing replacements, and the demand for maximum production. This must materially reduce the value and efficacy of the product.

The need for analysing materials used in manurial trials is shown by a sample from one experimental area. This sample was found to contain only 49 per cent. of carbonate of lime and was from a reputable works which apparently had struck a patch of poor stone. The use of such material in an experiment would give very misleading results.

Three samples of agricultural burnt lime were analysed and found to be poorly burnt. This is commonly observed, and as the neutralizing value of the product is about the same as that of ground limestone, it is an expensive way of applying lime. Good-quality burnt lime would save cartage costs where these are a consideration.

Fertilizers.—The bulk of these samples were from manurial trials. This check is very necessary, as in the past bags have been mislabelled and trials would have been ruined had tests not been made.

The usual number of rocks suspected to be of use as a fertilizer were received, but all were lacking in fertilizing properties.

Pastures.—Dry-matter determinations on herbage samples for the Station and other experimental areas made up half the total of samples received. In a few instances dried samples are kept for ash analysis.

Weedicides.—Some 30-odd samples have been analysed to standardize or identify commercial preparations for field trials. Some opportunity has been found for preliminary research into oil sprays.

The following is a summary of samples received for service reports and research investigations:—

Soils—	
Research	743
Service	270
Limestones	174
Fertilizers	197
Pastures	1,740
Weedicides	33
Miscellaneous	33
Total	3,190

Weed Control.—At the commencement of the year there were 58 field-experiment plots in weed-control trials under observation. During the year 306 field plots were laid out in 28 experimental series, and at the end of the year 290 plots remain under observation or are scheduled for retreatment at a later date.

The main weeds on which work was carried out were ragwort, blackberry, gorse, wild garlic, *Oxalis cernus,* periwinkle, triquetrous onion, stinging nettle, *Poa aquatica, Glyceria fluitans,* Californian thistle, willows, creeping buttercup, Scotch thistle, variegated thistle, and cress.

In addition to the above, observations have been made of a considerable number of incidental weeds not enumerated, while a very large species tolerance trial was laid down in the spring wherein some 70 species of pasture crop and weed species were put on trial for tolerance to 7 weedicides applied at various stages of growth.

The following general indications are well established and are worth recording at this stage—

(1) *Blackberry.*—None of the chemicals on trial is alone capable of a satisfactory kill by one or more applications at any time of the year. The eradication of blackberry requires repeated treatments combined with a mechanical method for removal of rubbish to permit access by stock, re-establishment of pasture, and controlled grazing.

(2) *Gorse.*—This has been shown to be susceptible to hormones and other weedicides, but almost invariably treatment is followed by regrowth from basal shoots.

(3) *Ragwort.*—This weed can be satisfactorily controlled, if not exterminated, by hormone weed-killers applied as sprays, provided they are applied by the beginning of December. Later treatment may not react quickly enough to inhibit flowering. Ragwort can be satisfactorily controlled and flowering inhibited at later stages by chlorate spraying, and, actually, the later the ragwort is treated by chlorate the more readily it is controlled.

(4) Twin cress can be controlled by hormone weedicides.

(5) Californian thistle is not controlled by single applications of any of the many weedicides on trial.

Considerable supplies of a very wide range of weedicides are now on hand, but many arrived too late during the past season to be put on trial under satisfactory conditions. There are on hand some fifteen hormone preparations; five arsenicals; four chlorate; a small amount of ammonium

sulphamate; various oils, with and without creosote; two D.N.O.C. preparations; a number of soil sterilants; and sundry salts and wetting agents. The variety of treatments is therefore practically unlimited, and it will be long before trials of all possible types and combinations have been investigated.

Irrigation

The year has been one of adequate rainfall in Canterbury, and consequently there has been little need for irrigation water on the established schemes at Redcliff, Levels, and Winchmore. This fact, however, has not prevented the necessary advisory services and development work of the Department from being pushed ahead in order to provide both at present and in the future sound advice on irrigation farming in Canterbury. Through the strengthening of the irrigation staff in Ashburton (the centre of Canterbury irrigation development) during the year 1945–46 there is an adequate service available to irrigating farmers on the Winchmore Scheme (64,000 acres), which is at present the only completed scheme north of the Rangitata River in Canterbury.

The main feature during the year has been the establishment of the Winchmore Irrigation Station. The area of 750 acres has been subdivided into the following units:—

(1) An experimental and research area of 250 acres.

(2) A demonstration mixed farm unit of 350 acres.

(3) A demonstration experimental dairy unit of 150 acres.

The land is typical of the greater portion of the land for which it is proposed to make irrigation water available. The units are worked by the Department along lines approved by the Advisory Committee which has been set up. This Committee consists of appointees of the Public Works, Lands, Agriculture, and Scientific and Industrial Research Departments, together with farmer representatives elected by the farming community and a representative from Canterbury Agricultural College. Up to the present, despite difficulties in obtaining equipment and supplies, considerable progress has been made.

Development plans have been drawn up and approved for all three areas. Stock has been purchased, and the coming year will see the project well on the way to the objective of its function—namely, to provide present and future knowledge to the intending irrigation farmer in Canterbury. It is felt that the establishment of this area is the greatest practical step forward yet made to the successful utilization of irrigation in Canterbury. It is confidently expected that the Station will become the centre from which information regarding irrigation advice will be disseminated to the South Island schemes, both completed and contemplated.

Research Station for Otago and Southland

During the year approval was obtained for the establishment of a research station in South Otago or in Southland for investigating the farm problems peculiar to the far South. A special committee was set up to advise on the location of a suitable area. An inspection of several properties has been made, but so far no decision has been made. This project is generally receiving the whole-hearted support of all members of the farming community, as a suitable research station will fill a long-felt need in this territory.

Fertilizers

Rationing.—The rationing of phosphatic fertilizers was continued during the year with certain modifications. For top-dressing, the allocation was increased from 42 per cent. of the quantities used in the average of the two base years ended 31st May, 1941, to 50·4 per cent. This meant a 25 per cent. increase over the quantities allocated the previous year. The only further alteration was an increase for vineyards and orchards from $1\frac{3}{4}$ cwt. to 3 cwt. per acre. Additional quantities were granted as a result of appeals, and the concessions to returned servicemen continued. Supplies of organic fertilizer were still controlled, and emphasis was placed on priority for market-gardening, nursery, vineyard, and orchard purposes, and for the production of vegetable seed.

Importations.—For the fertilizer year, July, 1946, to June, 1947, the imports of phosphate rock were scheduled to be 370,000 tons, while allowance was made for the importation of small quantities of basic slag and ground North African phosphate. Supplies from Nauru and Ocean Islands recommenced on a limited scale. Limited quantities of nitrogenous and potassic fertilizers were also imported.

Transport of Lime and Fertilizers.—The delivery of maximum quantities of lime and fertilizer to farmers is being retarded on account of the limited number of railway trucks available for this purpose, but the output of lime from the various works in the Dominion is almost twice the pre-war quantity, while the fertilizer output is almost equal to pre-war years. To assist the transport of fertilizers, arrangements were made to subsidize road transport up to one hundred miles from works when railway trucks were in short supply. The Railways Department took over the co-ordinating of these two methods of transport.

Nassella Tussock

During the year legislation was passed giving the necessary powers to local bodies to take action to prevent the spread of and bring under control nassella tussock in the northern part of the South Island. Two special Boards were formed for this purpose in North Canterbury and Marlborough respectively, and some preliminary work has been carried out to define areas where intensive eradication measures will be conducted.

Phormium Tenax

During the past year the industry has been passing through a very trying time and production has fallen very considerably. The main reasons for this are an acute shortage of labour for cutting green leaf and the millers not being able to pay wages equal to competitive industries. Since the American rope contracts ceased, millers have not had very much faith in the industry, with the result that the flax-growing areas have been allowed to go back and maintenance has been more or less neglected. The low price of fibre and the increasing costs of production, together with the labour shortage, have accounted for this.

In November, 1946, the Government announced that the recommendations of the Flax Plan Industrial Committee be approved, whereby finance would be made available to millers to develop and rehabilitate the industry. In addition, a guarantee was given that all fibre produced would be purchased by the Government and a guaranteed price would operate when decided upon.

Production figures for the period 1st February, 1946, to 31st January, 1947, are shown below:—

Production of green leaf—	Tons.
Total quantity of green leaf cut	18,017
Total quantity subsidized	15,932
Total quantity unsubsidized	2,085

This is a decrease of 9,433 tons.

Consumption of Fibre, &c.—The total amount of fibre, tow, stripper slips, and unscutched fibre (straw) produced was 3,265 tons, made up as follows:—

	Tons.
Fibre	1,867
Tow	394½
Straw (unscutched fibre)	873½
Stripper slips	130

This is a decrease of 1,570 tons from the previous season.

Flock House Farm of Instruction

During the year plans for improving the standard of training at Flock House were proceeded with, but unfortunately the improvements to the existing buildings so that more trainees can be accommodated have not yet been carried out. The appointment of a Supervising Instructor to take full charge of the training side of the establishment and the institution of a syllabus of training, however, have paved the way for a more thorough tuition of each trainee. The average number of trainees during the year was 29, and there is at present accommodation for a maximum of 35 boys. The improvements referred to will allow of a maximum of 45 trainees to be accommodated.

Sheep.—The flock comprised 5,650 ewes, of which 1,000 were two-tooths. The overall lambing percentage was 98 per cent. A total of 3,370 fat lambs were sold.

Cattle.—Two hundred and fifty-nine run cattle produced 211 calves, a percentage of 82. A total of 156 cattle were sold during the year.

Dairy Herd.—The dairy herd of 100 cows produced a total of 26,096 lb. butterfat and 44,661 lb. milk. Testing for tuberculosis was continued with a negative result for the milking-herd, but 12 of the two-year-old heifers reacted to a first test. A later test was made, when 4 of those heifers and 2 cows reacted. The latter were disposed of.

Pigs.—A total of 98 pigs were sold during the year. No carcasses were condemned for tuberculosis.

Cropping.—The usual programme was carried out of growing oats, potatoes, peas, sugar-beet, carrots, swedes, chou moellier, and rape, and a considerably increased acreage of wheat was grown, giving an average yield of 46 bushels per acre.

General.—A severe storm in February caused much damage to the fruit crops and to the shelter-belts and forest areas. Flood-protection work has been fully justified, with marked improvement to pastures on country which was previously subject to flooding.

Young Farmers' Clubs

Very definite progress has been made in the Young Farmers' Clubs movement over the past twelve months. During the war the membership fell to below 1,000 and the number of clubs to 50. In 1945–46 the number of clubs increased to 210, 7 in excess of the pre-war total. The membership in the individual clubs has shown a steady rise during the past two years, and there are now 278 clubs, with a total active membership of approximately 8,000. This represents an increase of 75 clubs and about 2,000 members over the pre-war number.

A major factor in the progress of the movement since the war has been the work carried out in the various districts by the Field Instructors, whose release from duties directly connected with the war effort has enabled them to concentrate on Y.F.C. work as part of their ordinary instructional duties, and in practically every district in the Dominion an Instructor is acting as the district Y.F.C. secretary.

The following indicates the number of clubs in the four council areas:

Council.	Pre-war.	1946.	1947.
Otago-Southland	35	27	38
Canterbury	38	36	53
Wellington	77	61	90
Auckland	53	60	97
Totals	203	184	278

A national Y.F.C. memorial scheme to commemorate the sacrifice of those members who lost their lives overseas during the war embodies the erection of additional buildings at Massey and Lincoln Colleges for the provision of Y.F.C. short courses. The sum of £20,000 is the target aimed at, and funds are being raised and collected by all units of the Federation.

The Y.F.C. movement is now in its thirteenth year in New Zealand, and the agricultural education and inculcation of the spirit of leadership and citizenship carried out by clubs is the true measure of the movement's value to the farming community and to the Dominion.

The Federation has made a move in the direction of the establishment of a "sister" organization, the Country Girls' Association.

General

With the return to normal conditions, officers of the Fields Division are enabled to devote more time to activities which were curtailed on account of the war. There has been some revival of crop and pasture competitions, and although lack of materials and other facilities prevented renewal of the departmental show exhibits, small displays have been arranged by local officers at some of the A. and P. shows. Special surveys have been carried out by field officers in connection with local problems. The Department is represented by officers of the Fields Division on numerous local organizations such as Catchment Boards and Regional Planning Councils.

DAIRY DIVISION

REPORT OF H. A. FOY, DIRECTOR

The Season

While climatic conditions during the season now coming to a close varied considerably throughout the dairying districts of the Dominion, and were, taken as a whole, not ideal for either production or quality, the total quantity of butterfat produced promises to be about normal, and will certainly be higher than for 1945–46. The past season has seen dairying commenced on a number of areas, and the many new farms which are being brought into dairy production under the rehabilitation scheme may be expected to have a significantly beneficial effect upon "cows in milk" population and consequently upon butterfat-production.

With regard to the butter and cheese statistics used in this report, it should not be overlooked that the figures relate only to gradings for export to the United Kingdom, not to production. For several reasons the grading figures from year to year, and particularly during war years, are influenced by factors which make them unreliable, not only as a guide to production, but even as a representative picture of dairy-factory output. For instance, they take no cognizance of butterfat used for various products made from processed milk, a quantity which varies from year to year, and was considerable last year. The statistics do, however, indicate the extent of the grading work for which the Dairy Division is responsible.

Export Values

The total value, for Customs purposes, of all dairy-produce exported during the year ended 31st December, 1946, was £29,614,856, a decrease of £330,717 over the 1945 valuation of £29,945,573. The products included in this trade are butter, cheese, casein, dried milk, sugar of milk, and condensed milk and cream.

Taking separately the principal products, butter and cheese, butter exported during the year was valued at £19,841,455 and cheese at £8,448,321, the values for the previous calendar year being £19,277,704 and £9,519,363 respectively.

The quantities represented in the foregoing valuations are actual shipments and therefore, for various reasons, should not be related to the grading statistics included elsewhere in this report.

Dairy-produce Grading Statistics

Hereunder are given ten-year tables relating to the grading of butter and cheese by the Dairy Division :—

Butter and Cheese graded for Export

Year ended 31st March,	Creamery Butter.		Cheese.		Total Butterfat Equivalent.	
	Tons.	Increase or Decrease.	Tons.	Increase or Decrease.	Tons.	Increase or Decrease.
		Per Cent.		Per Cent.		Per Cent.
1947	119,113	+10·71	86,624	−4·30	133,231	+6·45
1946	107,582	−10·18	90,523	−3·84	125,151	−8·47
1945	119,781	+26·12	94,140	+10·62	136,735	+21·52
1944	94,972	−14·08	85,100	−22·60	112,516	−16·80
1943	110,542	+0·76	109,955	−25·87	135,238	−9·59
1942	109,707	−20·92	148,331	+29·71	149,592	−6·77
1941	138,745	+12·48	114,355	+32·22	160,466	+17·37
1940	123,349	−4·58	86,486	+2·67	136,707	−2·88
1939	129,277	−11·20	84,236	−2·06	140,764	−9·22
1938	145,596	−3·85	86,012	−4·39	155,060	−3·97

Grade Points and Grade Classification of Creamery Butter graded for Export

Year ended 31st March,	Total Graded.	Average Grade Points.	Finest Grade.		First Grade.	Under First.
			Total Finest.	94 Points and Over.		
	Tons.		Per Cent.	Per Cent.	Per Cent.	Per Cent.
1947	119,113	93·376	82·94	41·27	16·86	0·19
1946	107,582	93·245	80·28	32·09	19·49	0·22
1945	119,781	93·402	84·72	40·38	15·10	0·17
1944	94,972	93·391	83·66	41·59	16·03	0·30
1943	110,542	93·173	77·87	35·22	21·66	0·46
1942	109,707	93·335	82·22	38·01	17·45	0·32
1941	138,745	93·253	80·50	34·65	18·94	0·55
1940	123,349	93·361	81·21	42·11	18·25	0·53
1939	129,277	93·373	82·42	40·02	17·06	0·51
1938	145,596	93·371	83·07	39·97	16·40	0·52

Whey Butter graded for Export

Year ended 31st March,	Tons.	Average Grade Points.	First Grade.
			Per Cent.
1947	2,406	88·451	82·58
1946	2,658	88·387	86·37
1945	2,779	88·503	94·26
1944	2,343	88·479	91·88
1943	2,274	88·491	92·74
1942	3,078	88·502	94·57
1941	2,766	88·559	96·05
1940	1,782	88·536	97·31
1939	1,904	88·152	94·59
1938	1,820	88·263	89·69

Grade Points and Grade Classification of Cheese graded for Export

Year ended 31st March,	Total Graded.	Average Grade.	Finest Grade.	First Grade.	Under First.
	Tons.		Per Cent.	Per Cent.	Per Cent.
1947	86,624	92·257	33·84	62·66	3·49
1946	90,523	92·114	25·33	69·84	4·82
1945	94,140	92·121	25·94	69·71	4·34
1944	85,100	92·064	21·43	74·21	4·35
1943	109,955	92·032	18·69	77·33	3·97
1942	148,331	91·839	21·11	71·00	7·88
1941	114,355	92·048	20·43	74·77	4·79
1940	86,486	92·065	17·06	79·32	3·61
1939	84,236	92·133	17·41	79·64	2·94
1938	86,012	91·934	10·84	84·61	4·54

Dairy-produce Grading

The following comments cover the main aspects of the past season's output from the point of view of the officers who grade the produce prior to export:—

Grading Standards.—The standard of butter and cheese grading at the various stores is mainly on fairly uniform lines, although, to some extent, Graders at the smaller ports are handicapped in not having more lines for comparison purposes. The latter naturally tends to some leniency when grading

produce more especially of lower and border-line quality, and the officers in sole charge are particularly at a disadvantage in that they have not the benefit of another opinion. In a measure, district conditions and characteristics are also inclined to influence the Graders' judgment, but, generally speaking, good-quality butter and cheese are recognized and pointed accordingly at all ports. As previously mentioned, it is more in the border-line quality of the different classes that variations in the Graders' decisions are noticed, and it is in this direction that more uniformity is desired.

Quality.—Feed and land-cress flavours were again pronounced in most of the butter coming forward for grading in the spring months, and in some cases the trouble extended over a longer period than usual, due, no doubt, to the drought conditions experienced during the previous season. The quality of both butter and cheese can be said to have been well maintained, and some ports, particularly Auckland, will show an improvement, due to the better climatic conditions experienced in the Waikato and North Auckland. At New Plymouth, Wellington, and Patea the cheese has been uniformly close with good bodies, and the latter port shows a considerable increase in the quantity of cheese classed Finest during the peak months. My visit to the South Island was rather late in the season, but the cheese seen at Lyttelton and Timaru were somewhat open but pleasing in body. The Southland cheese, although in the main closer in texture, were verging on the tender side as regards body.

Following the spring period the butter examined at Auckland and New Plymouth has mainly been satisfactory and of fairly uniform quality. On the other hand, the Wellington butters, with the exception of a few choice brands, have not, in my opinion, been just as pleasing as at some of the other North Island ports. There is a tendency to harshness in some brands of butter at all the ports, and this, in the spring months, was very pronounced in many of the lines seen at Wellington. The body of the butter generally has been mainly satisfactory, but here again much of the Wellington butter has lacked the desired firmness, being somewhat sticky and greasy in character.

During the season faulty colour in butter has been more in evidence than for some years, and this defect has been more prevalent in the Auckland and Wellington districts. Some brands also were of brittle texture, due, no doubt, to a fault in manufacture.

Whey butter has been (with the exception of the majority of that received at Auckland) of very fair quality. Undoubtedly the best whey butter is manufactured in Taranaki, where a large proportion is made at the cheese-factories. The reverse is the case in the Waikato, and the whey cream in this district is mainly forwarded to a few central butter-factories. This entails long transport and delay, which is not conducive to the manufacture of a good product.

Taking into consideration the labour and other difficulties with which dairy companies have had to contend, I consider that there is a general endeavour to maintain and improve quality on the part of the majority of directors and managers. At the same time, there is a trend in some cases to commercialize the method of manufacture to the extent of being detrimental to the attainment of choice quality. I refer to the managers who persist in incorporating more salt in the butter than desirable, also to the non-segregation of lower-quality cream and the inclination to reduce costs at all hazards, irrespective of the result on the finished product.

Examination of Stored Butter.—I examined some twenty-two boxes of creamery butter which had been stored at Wellington for approximately three months. The butter held up very satisfactorily and the regrading points indicated that the original scoring was sound. However, the butter of many brands was decidedly harsh on the palate, which bears out my previous remarks regarding the Wellington butters.

Finish and Packing of Butter and Cheese.—The finish and appearance have been mainly satisfactory and generally are watched closely by all Graders.

In the case of cheese, there has been a good improvement where faults in this category were in evidence previously; in consequence, cracked rinds and faulty lips have been less prevalent this season. The cheese have also been clean and only a few odd cases of mouldy rinds have been noted on arrival at the stores. I have been impressed with the absence of mould growth on the cheese examined in the cheese-chambers at a number of the grading-stores.

This improvement is no doubt due to the efforts of Graders in charge and the Instructors, and also because the cool-store authorities are taking more interest, due to the repercussions from the shipping of mouldy cheese.

The butter examined at the various ports has been generally well finished and packed. The mechanical packer makes for a neat and tidy block of butter, and if the parchment is applied in the proper manner the result is usually satisfactory from the point of finish and appearance.

The fibre container for butter, especially the heavier type, appears to be giving satisfaction at this end. The application of the tape is much improved, but there is a tendency in some cases for the overlap to extend down on the impressed brand. This package when well finished presents a neat appearance, more so when the tape and container are the same colour. However, there does appear some room for improvement in connection with the impressed brand and the space available for the necessary markings, including the grade stamp.

The beech timber used in the South Island makes a very solid cheese-crate, also much of the *Pinus insignis* used in the North Island is quite suitable, provided the timber is not immature or denatured. Some of the crates seen in the Auckland stores have not been as satisfactory as those at other ports, and on one occasion I saw whole consignments of crates of cheese with battens fully half

in inch narrower than specified by the regulations, which necessitated action by the Grader in charge to prevent a recurrence.

Some of the timber supplied to other centres has occasionally been defective, but, on the whole, the quality of the crate timber at other ports has been up to standard.

Cool-store Facilities.—The facilities for the grading of produce are better at some ports than others. Butter-grading rooms, with the exception of the Bluff room for light and the room at Christchurch in a lesser degree, are generally suitable for the work of grading.

The grading of cheese is more difficult at some of the larger ports because of the system of "plugging" in the trucks. In this respect New Plymouth and Patea are under a disadvantage. There is now, however, more assistance rendered by the works staff, also a much better understanding at these ports. At all other grading-stores there is evidence of mutual co-operation, which is beneficial to all parties and the work generally.

Butter Instruction

The more important instructional aspects of butter-manufacture and allied subjects are :—

Manufacture.—The serial system of vacreation continues to be popular in the larger factories. The use of the "pressure head" has been extended, and factory-managers claim improved results following its use. In some cases there has been a fall in grade, due, it is considered, to excessively high pasteurizing temperatures while using the pressure head. A reduction in temperature has brought about an improvement in grade.

The neutralization and vacreation of cream are, on the whole, reasonably well carried out. Because of staff shortages, lack of skilled operators, and inadequate or ineffective plants, temperature control of cream, churning, and working have in a number of cases not received the attention necessary to produce a butter of the desired body and texture. Colour defects which were evident throughout the hot period are considered chiefly due to the above causes.

Several dairy companies have at times discontinued the usual method of washing of butter in the granular stage. This has the effect of increasing the curd content. While we are not aware of any serious deterioration in quality as a result, we are of the opinion that an indiscriminate adoption of this procedure would be dangerous. This matter was discussed at the Dairy Research Institute during Factory-managers' Week last year. In cases of doubtful water-supplies, officers of the Institute were inclined to view the non-washing of butter favourably.

Moisture.—Apart from the fact that some butters showed free moisture due to insufficient dry working, the previous high standard of moisture incorporation has been maintained. As evidence of the degree of skill exercised in this respect, averages of 15·955 per cent. and 15·977 per cent. have been noted for each day's make of nine churnings, and monthly averages up to 15·85 per cent. are not uncommon.

Cream-grading.—Although it is generally found that in areas where there is no competition for supply the grading standard is fairly well maintained, the reverse is the case where competition exists. It is considered that the standard in the latter areas will continue difficult to maintain while competition remains. Where cream is delivered daily, the senses grading, even on a uniformly high standard, concedes an advantage to the supplier which it is considered is more than sufficient.

Milk-treating Houses.—A number of plants and buildings have been inspected. It is evident that there is room for considerable improvement in quality of the raw milk as delivered to treating-houses and treatment afterwards. All concerned, however, have promised full co-operation, which should enable satisfactory results to be achieved.

Cheese Instruction

A summary on quality and comments on the instructional aspects of cheese-manufacture follow :—

Cheese Quality.—In most districts the majority of the managers are still striving for quality and any new suggestions made by the Instructors for the improvement of quality are readily adopted. This position is very gratifying, as it is not many years ago that most of the dairy companies in the North Island were concerned more about quantity rather than quality. In the Waikato there are still one or two companies which consider yield more than grade, but I believe this fallacy is gradually being worn down, and from recent indications there is every prospect of the Waikato factories coming more into line with those of other districts.

Cheshire Cheese.—The manufacture of Cheshire cheese has continued during the season at the Dalefield Factory, and, while certain minor adjustments have been made in the technique of manufacture, it is just questionable whether the desired qualities in this type of cheese are being obtained.

Starters.—Owing to better facilities for keeping single-strain starters active, and the fact that at practically all factories these starters are run on the rotational system combined with careful technique

in inoculating, few complete failures have been experienced this season. While most of the factories in South Taranaki are equipped with the Jones starter outfit and are having a good run, equally good results are being obtained in other districts where different starter apparatus is in use. In Canterbury and Otago, mixed-strain starters are still being used at practically all the factories. This is mainly due to the poor facilities available at most of the factories for keeping single-strain cultures and also to the fact that much of the cheese made in these provinces is for local trade.

Curing-rooms.—During inspections of curing-rooms at the different factories throughout the Dominion I gained the impression that there was a definite improvement in the condition of these rooms. The cheese were in most cases free from mould and the shelves much cleaner than last season. While this may have been due in some measure to climatic conditions, indications pointed to the fact that more attention was being given to the cheese after they had been put on the shelves. At the same time, there are some factories where there is still room for improvement. In those factories that are equipped with temperature- and humidity-control units, very little trouble is experienced in keeping the cheese clean and free from mould. No doubt this is the ideal method of curing cheese. At the Milford Factory, in South Canterbury, where one of these units is in operation, large quantities of cheese are held for the local trade. The fact that these rooms are always kept in good order and the cheese are reasonably clean demonstrates the value of air-conditioning plants for curing-rooms.

Milk Grading.—While milk grading is being carried out conscientiously at the majority of the factories, at some there is too much tendency to give border-line cases the benefit of the doubt. In my opinion, any samples which are at all doubtful should be placed in the second-grade class, as it is recognized that our standards of grading err, if anything, on the lenient side.

Labour in Cheese-factories.—During the season the shortage of labour has been very acute at most cheese-factories, and at a few it was almost impossible to carry on making this product. As the labour position has been so unsatisfactory, it is gratifying that neither the quality nor the finish of the cheese has suffered to any extent, which reflects great credit on factory-managers and all those concerned.

Inspection of New Zealand Dairy-produce in Britain

During the year Mr. M. H. Wallace, previously Dairy Instructor in Charge of the North Auckland district, was transferred to London to assist Mr. F. H. Taylor in carrying out the inspection of New Zealand dairy-produce in Britain. Mr. G. V. Were, who has assisted Mr. Taylor for some years, is still stationed at Liverpool, where he transferred during the war to suit the special conditions then operating.

Although originally our representatives in Britain were appointed principally for the purpose of checking up on the quality and condition of our butter and cheese on its arrival on the English market, circumstances have necessitated their attention to a much wider field of activity. Because of his wide experience and specialized knowledge, Mr. Taylor has been able, particularly during the war years, to render valuable assistance to the British Ministry of Food, and has also become actively associated with several other important organizations, including the Food and Agricultural Organization, Nutritional Committee, and International Standards Institute. His association with such organizations is not only of assistance to the Mother-country, but is of benefit to the dairy industry of New Zealand.

The following extracts from Mr. Taylor's report cover the broader aspects of his work and observations during the year under review:—

Much of the produce is still being discharged in Liverpool, and the inspection of cheese cargoes is practically confined to the dockside when cargoes are being discharged. Even this is becoming increasingly difficult, for the shortage of food-supplies is necessitating the almost immediate distribution of both cheese and butter on its arrival. It will be a great help to our routine inspection work when some system is introduced into the marketing of our produce which necessitates the sorting to brands of both cheese and butter. It may take some years before this demand is made, owing to the shortage of food stocks, but unless some system is shortly introduced which gives traders an interest in the goods they handle, the quality of all commodities reaching this country will rapidly deteriorate. New Zealand has done a wonderful job in maintaining the quality of her cheese and butter, and I think her produce has never been held in such high esteem. The bulk purchasing of low-grade produce from countries who are not so jealous of their reputation, and the marketing of that produce to the public, who have no knowledge of its country of origin, may indeed result in a falling off of the consumption of that particular commodity. I refer in particular to cheese. New Zealand is particularly interested in this commodity, and I think it would be conceded that in bulk our cheese is holding the premier position for uniformity and good quality. During the past few years some produce has reached this country which has not helped the public to appreciate cheese, and it remains to be seen what the reaction may be when more meat is available. New Zealand should avoid

any suggestions that because of loss of identity an easing up in the supervision and grading of her dairy-produce should take place, provided, of course, she is satisfied that her classification is on the right lines.

Butter.—During the past year we have been called upon, on behalf of the Ministry of Food, to make reports and to classify into table category or manufacturing grade butters from various countries. The number of brands previously forwarded from the Argentine seems to have fallen away and now only about one dozen marks appear in the various shipments. These are more uniform in quality and show improvement. Several shipments of Kenya have been seen, and this has a character quite distinct from Australian and New Zealand. Owing to the shortage of stocks and labour problems, incoming shipments of Danish butter are now going into direct distribution and consumption, and classification to grade for the Ministry of Food has, so far as my knowledge goes, ceased entirely.

I cannot pass from the subject of butter without touching upon the increasing number of instances of oil-taint upon cargoes of butter. The examination of these cargoes when this defect is discovered has given us considerable trouble. On several occasions the defect has not been located until some portion of the cargo has been distributed; this has generally meant tracking down the butter from each hold, to ascertain how much of the produce has become tainted. Generally speaking, the defect is more pronounced upon the corners of the block of butter or wherever there is a cavity on the surface of the block. Recent shipments have shown that the carton is less susceptible to tainting than the wooden box or the fibreboard Saranac. Mr. Were has been kept fairly busy at Liverpool helping to adjust complaints and surveys on the tainted butters in Liverpool. The assistance of Reading Research Institute and other scientists is appreciated in their attempt to evolve some system for detecting surface taint from oil-fumes. However, as yet this has proved somewhat difficult, but it is hoped that some method may yet be evolved which will assist us in establishing beyond any doubt the source of contamination.

Cheese.—As previously mentioned, the quantity of cheese available for examination has been somewhat disappointing. This is due to the fact that factory brands are no longer separately stacked, and also to the wide distribution of produce on its arrival in this country. So long as the present system of handling produce continues, I do not see much prospect for an increased number of reports which may cover a reasonable percentage of each factory's consignment. Frequently it is possible to visit a store or warehouse and make an examination of a quantity of cheese which are stacked ceiling high, but without employing labour and breaking down the stacks it is not possible to report upon more than one crate of cheese from the various brands represented. If it is possible to be at the dockside when the cheese are discharged upon the quayside, then there is an opportunity of seeing a reasonable number of vat dates from the brands represented. However, at present, few consignments are left on the quayside for more than one day. The quality of cheese examined is good, uniformly the best which is arriving into this country. One hears little of the open texture and drying out of the cut surface as in former days. However, the marketing conditions are hardly comparable, and one must guard against easy compliments which are arrived at by comparison with cheese of a standard which would not have been tolerated in pre-war times. Much of this doubtful produce is being converted into processed cheese and distributed on the ordinary ration. Consumer preference is now a very difficult thing to arrive at, for one has to take what one can get, irrespective of type or country of origin. Continental cheese of 45 per cent. fat in dry matter are being distributed along with processed cheese, and the small portion of cheese which reaches the householder's larder may be Canadian, Australian, New Zealand, Continental, American, or processed. Some fancy cheese is available on points; this consists of Danish blue, or Gorgonzola, and quite a quantity of Camembert is now seen in the shops.

Cheshire-type Cheese.—During the year a considerable number of shipments of Cheshire-type cheese made at Massey College and also at the Dalefield Dairy Factory have arrived from New Zealand. It was considered that there would be a market in England for this type of cheese during a period when the English product was in short supply. Expert opinion seems to suggest that, while the cheese made is palatable and acceptable to the British consumer, it is, in the main, not a true Cheshire type. Moreover, the trials appear to indicate that for various reasons, one of them being the practical difficulty of making in New Zealand a Cheshire cheese which will satisfactorily withstand the long carriage to England, it may be unwise to endeavour to make a cheese to be marketed under this name. There appears no reason, however, why we should not make a New-Zealand-type cheese, following the Cheshire lines, for marketing in this country under some appropriate name.

Continental Visits.—During the past year my routine work has been somewhat broken by several visits to the Continent. In September, with the Director-General of Agriculture, I attended the Food and Agricultural Organization Conference at Copenhagen.

Two visits were made to Sweden during the year, one in conjunction with the Director-General to examine the new Alfa-Laval buttermaking process at Malmo, the second in connection with the supply of fibre butter-cartons.

Switzerland.—With the Director-General I visited Switzerland to examine the Dr. Senn process for buttermaking by CO_2 method. This is an entirely different process from the Alfa-Laval method, and the initial cost of the machine for the production of butter is fairly substantial. The process eliminates the old-type wooden churn, as does also the Alfa-Laval. However, the Senn method relies

upon a rapid separation of the buttermilk and a washing of the fat globules, whereas the Alfa system is a conversion of the high-testing fat to a butter phase.

A return visit was made to Berne for the purpose of attending the first post-war meeting of the "International Dairy Federation." This was an interesting gathering, as prior to 1939 many of the Committees were largely represented by Germans, Austrians, and Italians. The Scandinavians now hold a fair representation. The next international meeting will be held at Stockholm. I felt it inexpedient to press New Zealand's claim for priority owing to the shipping position and the generally unsettled state of food-supplies, &c. Close working with FAO was advocated, but it was unanimously decided that the Federation maintain its own individuality.

International Standards Conference.—This was held in London and, in company with Messrs. Wallace and Jervis, of the High Commissioner's Office, I attended most of the meetings. The Committees covering the Dairy Section were presided over by representatives from each of the Dominions.

The following extracts, which relate principally to the quality and condition aspect, are taken from Mr. Were's report:—

Creamery Butter.—The average quality of this commodity as inspected soon after discharge from overseas vessels and frequently at patting-plants after storage of varying periods, which depends upon the stock position, may be described as sound, but this does not mean that all of it is as good as it could be. Much of our creamery butter possesses a more or less negative quality, due to its flat, insipid flavour; these features are particularly noticeable among Auckland brands. Where the cream-supply is reasonably sound, I am of the opinion that better butter would result by the use of smaller quantities of neutralizing agents. In my judgment it is most undesirable that New Zealand should produce a high-acid butter for export to Britain, but there seems to be no sound reason for hovering so near the point of neutrality.

I estimate that there is only a small proportion of the population of this country who can differentiate between some of our flat, characterless butter and margarine.

Notwithstanding the foregoing critical comment, New Zealand butter has a high reputation for quality and it is a very rare occasion to find it deteriorated to such an extent as to bring it into a lower category than that indicated by the grade stamp on the package.

Whey Butter.—So far as can be judged on the limited quantity inspected of this product of the cheese-factory, I am inclined to the opinion that there is a slight improvement in quality. My impression of improvement may be due to the fact that I have examined more whey butter from Taranaki than from other districts. Some of the Taranaki cheese-factories produce a very high standard of quality in respect to this by-product, and the questions which naturally come to mind here are: Why does Taranaki excel in the manufacture of this commodity? And why do some other districts fail?

At the present time, whey butter is being distributed for consumption, without being blended, in some areas of Britain. This is due to the scarcity of creamery butter and the need for the use of whey butter to meet the ration. If the average quality of New Zealand whey butter was equal to that from Taranaki there would be no serious cause for apprehension, but, unfortunately, this is not so. Cheese companies who, through lack of thought or knowledge, are not producing the highest possible quality whey butter, whether manufacturing it themselves or selling their whey cream to a creamery, are imposing a severe handicap on the interest of all butter-producers.

Cheese.—The average quality of New Zealand cheese can be confidently described as sound and its reputation with traders in this country is second to none. My association with the provision trade through connections with the Ministry of Food leads me to believe that the prestige of our cheese was never higher than at present. It is not difficult to find technical faults in much of this produce, the chief of which is bitterness. Perfection in cheese from all countries seems to be an elusive quality, but I am of the opinion that the average quality of this product from New Zealand is at least as near perfect as that from any other source.

Wartime conditions of storing cheese exploded the belief held by many traders here that New Zealand cheese would not mature satisfactorily. At present our cheese, like our butter, is going into almost immediate consumption owing to short supply. This means that it will be consumed before it has a chance of maturing, but this is not the fault of producers, who should be congratulated on supplying a sound raw material and the cheesemakers on their craftsmanship.

Distribution.—Under the Ministry of Food rationing system there is no discrimination as between produce from different countries. Butter and cheese are sold as "National" butter and cheese, with the exception of comparatively small quantities of fancy brands from the Continent which are sold at their economic values, such as Rocquefort at 6s. per pound plus 12 points; Danish blue, 3s. per pound plus 12 points, &c. (Every person can spend up to 20 points per month on points goods.)

Packages.—Experience is forcing the conclusion that some of our best solid fibre cartons make as good a container for butter as any other in use. Their contents are less vulnerable to contamination by oil-fumes and other extraneous matter than is the case with wood and Saranac packages. It is highly desirable, however, that fibre cartons should be made to resist absorption of moisture caused by condensation, otherwise they become soft and flabby and easily torn, thereby exposing contents to pilferage and contamination.

Mr. Were's duties as a member of the Dairy Technology Institute involve attendance at a number of meetings. He has also represented the Ministry of Food on a considerable number of surveys of damaged produce from other countries as well as New Zealand.

Analytical Tests

pH Testing.—Some 4,841 pH tests were made during the year, which was practically the same as the previous year's total of 4,867. The number of tests carried out at the various grading stores were: Auckland, 2,772; Gisborne, 61; Napier, 35; New Plymouth, 788; Wanganui, 239; Wellington, 890; Dunedin, 38; Bluff, 18. The results of these tests indicate that there is still a tendency toward over-neutralization of some butters.

Bacteriological and Chemical.—The number of samples from the various grading stores submitted to chemical and bacteriological examination was as follows: Auckland, 2,679; Gisborne, 169; Napier, 6; New Plymouth, 788; Wanganui, 209; Wellington, 808; making a total of 4,659, compared with 4,709 for the previous year. In keeping with past procedure, all samples from ports other than Auckland were forwarded to the Division's Dairy Laboratory at Wallaceville for examination.

Moisture.—Some 113,648 churnings of butter were tested for moisture, and of these only 0·28 per cent. was found to exceed the legal limit of 16 per cent. Churnings tested during the previous year totalled 112,265, of which 0·35 per cent. was found to be over-moisture. The average moisture content of New Zealand butter graded for export during the past season is estimated to have been 15·692 per cent. An interesting and gratifying feature is that the skill of the buttermakers and the efficiency of the appliances used are such that a standard so uniform and so closely related to the maximum permitted can be maintained.

Salt.—Samples of butter tested for salt totalled 113,365, of which only 0·08 per cent. failed to comply with the regulations. For the previous year 111,613 samples were tested, 0·06 per cent. being found to infringe the regulations.

Dairy Laboratory, Wallaceville

During the past year the laboratory work was carried on with some difficulty because of staff changes and a scarcity of suitable replacements. The total number of samples dealt with was 3,023, of which 2,717 were bacteriological and 306 chemical. The figures for the previous year were 3,463 bacteriological and 897 chemical, a total of 4,360.

Curd Storage Trials.—Experiments on the preservation of buttermilk curd for pig-feeding, commenced at Featherston in 1944, were completed at the beginning of the period under review. The storage trials were quite successful, and the results published.

Chemical.—The principal chemical work carried out has been the examination of samples of butter and cream for their copper and iron content. Results show that a considerable amount of metallic contamination is present in certain brands of butter, especially whey butter, so there is need to do more of this work.

A few factory and farm water-supplies have been chemically examined and advice regarding treatment given where necessary.

Bacteriological.—The principal bacteriological work has continued to be the examination of butter samples, which have been sent regularly from the dairy-produce grading-stores. Although this work has proved of great value to the Dairy Instructors in effecting improvements in the cleaning of butter-factory equipment, the fact that at least three weeks usually elapses between the churning date and the completion of the examinations is a disadvantage. To meet this position, some benefit might be obtained if the examinations could be supplemented with a simple test done in the factories on cream and buttermilk samples taken at the time of churning. A comparatively small number of trials have shown that the resazurin test offers possibilities for this purpose, but further investigation is required. A few samples of dairy-factory water have been submitted to bacteriological examination.

New Buttermaking Processes

Following inspection of several new types of buttermaking plants in Germany, Switzerland, and Sweden by Mr. F. H. Taylor, London Officer of the Dairy Division, and later by the Director-General of Agriculture, Mr. E. J. Fawcett, a recommendation was made by Mr. Fawcett that the Government should purchase a Senn machine from Switzerland and an Alfa from Sweden for the purpose of placing them on trial under practical conditions in New Zealand factories. Orders were placed for these two machines, and a general committee representative of the dairy industry and Government Departments concerned has been set up to control the trials and to report to the Government as to the value and merit of these new processes compared with existing practices of butter-manufacture.

These machines introduce novel principles in buttermaking, and the results of the trials due to commence in the 1947–48 dairy season will be awaited with much interest.

The committee referred to, and to be known as the Buttermaking Processes Committee, comprises the Director of the Dairy Division, as Chairman; Mr. A. J. Murdoch, M.P., representing the New Zealand Dairy Board; Mr. W. Marshall, the New Zealand Co-operative Dairy Co., Ltd.; Mr. F. Parsons, the National Dairy Association; Professor W. Riddet, the Dairy Research Institute; and Mr. G. M. Pottinger, the Marketing Department (Export Division).

Market Milk

The Dairy Division assumed responsibility for the administrative control of market-milk treatment on 1st January, 1947, appropriate regulations, Dairy (Milk Treatment) Regulations 1946, coming into force on that date. There are at present some forty milk-treating houses in the Dominion, these being defined as premises where milk is pasteurized for sale for human consumption.

A preliminary survey indicates that there is much scope for improvement in a number of milk-treating plants before they can be considered to be of a really satisfactory standard.

Casein-manufacture

For many years the manufacture of casein has been carried out at a varying number of North Island dairy factories. Since 1938 the market for this product did not warrant manufacture on an extended scale, but in April, 1946, it again became active, and during the current season, in addition to continued make by the Midhirst Co-operative Dairy Co. in Taranaki, eleven cheese-factories in the Waikato were changed over to either lactic or rennet casein, following the finalizing of contracts with the United Kingdom Board of Trade. The change from cheese to casein was in effect a change-over from cheese to butter supply, as in casein-manufacture all the butterfat in the milk is available for butter-manufacture. The United Kingdom Ministry of Food has, however, indicated that any further development in casein-manufacture should come from existing butter-suppliers, as it is not desired further to reduce cheese output by this means.

Buttermilk-drying

In the past years buttermilk, which is a by-product of buttermaking similar in protein value to skim-milk, has been very largely utilized for pig-feeding. It is possible to dry the product efficiently, and during the year some dairy companies in the Auckland Province have installed roller buttermilk-drying plants, and others propose similar action. The product can be used for human consumption in various forms, and is also a valuable animal foodstuff. Apart from the local market, there appears to be some scope for the sale of buttermilk powder overseas.

Dairy Supply Control Order

The Dairy Supply Control Order 1945, which has as its purpose priority for butter-production over cheese to meet the requirements of the food situation in the United Kingdom, has been retained for another year. The administration during the latter

portion of the 1945–46 dairy season presented some degree of difficulty, and several prosecutions against suppliers and dairy companies for contraventions of the Order became necessary. The position generally gave rise to dissatisfaction in the industry, and as a consequence Amendment No. 1 was gazetted in July, 1946. This amendment provided for the granting of exemptions to suppliers to butter-factories, to enable them to supply milk for cheesemaking where special circumstances existed. At the request of the dairy industry, an independent appeal authority in the person of the Deputy Chairman of the Executive Commission of Agriculture was appointed. All applications are handled through the Dairy Division, and since the amendment came into force a number of applications have been dealt with. The administration is, in effect, carried out jointly between the Dairy Division and the appeal authority, and is now working smoothly.

Farm Dairy Instruction

Farm Dairy Instructors made 107,096 visits of inspection, instruction, and advice to farm dairies during the year, representing an average of about 1,409 visits per officer. In respect of milking-sheds, 33·4 per cent. were classified as good, 50·3 per cent. as fair, and 16·2 per cent. as bad. The classification percentages for milking-machines were 38·5, 41·3, and 20·1 respectively. It is quite clear from these figures that there is considerable room for improvement in the condition of both sheds and machines.

The number of new milking-sheds erected during the year was 1,083, while the number substantially reconstructed was 901, compared with 836 and 898 respectively in 1945–46.

The amount of repair and renovation work carried out was again to some extent limited by the availability of cement. Farm Dairy Instructors were able to see that such quantities as could be made available were used to the best advantage by making recommendations for releases in accordance with the urgency of the work requiring to be done.

The following provides a general survey of the Division's farm dairy instruction service to dairy-factory suppliers.

The year in review has seen the inauguration of a system and control designed to improve the service of the Farm Dairy Instructor to the industry. The scheme is intended to promote uniformity among the staff of Farm Dairy Instructors and Supervisors, to introduce innovations and reforms to the service on a Dominion basis, to guide officers to a more systematic and improved method of working, and generally to tighten the system of inspection and instruction. The need for improvement in this service has been apparent for some years, and, as the service deals with the fundamental of quality of the raw product, any improvement which can be made should provide a more efficient service in other directions and have a definite bearing on the quality of manufactured dairy products.

The first approach to the supervision of policy was the introduction of a number of reforms in method and practice calculated to provide a more efficient service and to serve as starting-points for further and more gradual improvement in the future. There has been insufficient time to obtain first-hand opinion of the effect of these reforms, but several managers of dairy factories have already commented in enthusiastic terms on the effects so far noted in relation to their own particular factories, and the improved service to those factories from the innovations and reforms introduced.

Milking-machines

In the period under review 1,375 new and 878 used milking-machines, making a total of 2,253 machines, were installed. In the previous year the figures were 1,165, 917, and 2,082 respectively.

Check-testing of Milk and Cream Samples

This work was continued as part of the routine duties of Dairy Instructors and Special Inspectors. During the year officers checked the factory testing at 522 visits, and during these visits checked 3,194 samples. The work appeared to be carried out accurately and conscientiously in the great majority of cases, though there were some instances where it was necessary to issue a warning in regard to compliance with the regulations.

Certificate-of-record and Government Official Herd-testing

Due to acute staffing difficulties and the impossibility of obtaining sufficient motor-vehicles, it was decided to hold in abeyance for another year the introduction of plans for the extension of the C.O.R. and O.H.T. systems.

Even though entries are still being accepted on a selective basis, rather than under the proposed all-cow rule, both systems continue to receive considerably increased support. The growth of the testing has, in fact, been almost phenomenal. In 1939 there were 247 breeders on our lists. The figure rose to 330 in 1943, to 422 in 1944, to 507 in 1945, and to 627 in the year under review. Cows on certificate-of-record test rose from 611 in 1939 to 1,484 in 1946, while the O.H.T. figures for the same years were 2,200 and 7,900 respectively. It is apparent from these figures that the systems have the confidence of breeders of pedigree dairy cattle.

Dairy Factory Managers' Registration Board

For some years the number of new applications for registration has been between 40 and 50 per annum. The number dealt with by the Board during the year under review totalled 52, certificates being granted in 43 cases. There are at present 707 holders of certificates on the register, 240 being creamery managers' certificates, 398 cheese-factory managers' certificates, 4 with first-class cheese and second-class butter, 2 with first-class butter and second-class cheese, while 63 hold first-class certificates for both butter and cheese.

Redundant Cheese Plant

The list value of plant sold during the year was £8,600, and the value of unsold plant at 31st March, 1947, was £8,100.

The list value of cheese plant rendered redundant at the time of reversion to butter in 1942 was £64,000, and net realizations to date have resulted in a loss of approximately £20,800. The plant remaining on hand will be difficult to dispose of because of the lack of demand, and such of it as may ultimately be saleable will have to be offered at a price considerably below the list value.

As the plant was originally purchased by cheese-factories in preparation for an output considerably beyond normal operations, and in general can be used only by cheese-factories, it was expected that there would ultimately be a fairly substantial residue of plant and equipment for which little use could be found. It is considered that the transactions relating to the disposal of this redundant plant have been reasonably successful, and the final loss will be smaller than anticipated.

General

The work of the Division is in three main sections: (1) that relating to butter and cheese and the by-products of milk and cream, (2) market milk, and (3) herd recording of pedigree dairy cattle.

The Division's assumption of responsibility for administration of the Dairy (Milk Treatment) Regulations 1946 is an additional activity. The appointment of a Supervisor of Herd Recording is in readiness for an extension of the service to breeders of pedigree dairy cattle through the long-established certificate-of-record and Government official herd-testing systems.

Activities in relation to farm dairy instruction, butter and cheese instruction, and the grading of dairy-produce are directed towards assisting the industry to produce and maintain an even uniformly higher standard of quality than in the past. It is not unlikely that before long our dairy products, which under war conditions have enjoyed an unlimited and uncompetitive market, may have to compete in quality and attractiveness with much improved products from other countries.

Staff

Director and Assistant Director.—Consequent upon the retirement of Mr. G. M. Valentine from the position of Acting-Director, Mr. H. A. Foy was appointed Director and Mr. H. J. Petch Assistant Director.

HORTICULTURE DIVISION

REPORT OF W. K. DALLAS, DIRECTOR

Climatic Conditions

Weather conditions in general have been unfavourable to the fruitgrowing industry and horticultural crops in most districts of the Dominion.

Following on the drought in the Auckland Province there was a long period of mild and showery weather through the winter and spring. Consequently, the trees had a shortened rest period in the winter before the spring growth commenced, resulting in erratic blossoming. Vegetable and citrus crops were also affected by the drought.

Due to the meagre rainfall over the past two years, the subsoils of the Hawke's Bay commercial fruitgrowing area have not been sufficiently saturated to enable the trees to withstand a lengthy period of drought successfully. These conditions, together with the effects of severe late frosts, seriously decreased the fruit yield.

Wind-storms, drought, and frosts have taken toll of fruit crops in the Wairarapa district.

Substantial losses to fruit crops in Canterbury have been caused by cold, wet conditions in spring, followed by severe frosts. Bright sunshine and high temperatures during the summer benefited market-garden crops. Severe frosts in April, 1946, reduced the tomato crops by approximately half the anticipated yield.

In Otago heavy frosts during the spring substantially reduced the fruit crops over a large part of the district, but those crops not seriously damaged realized payable prices.

Area and Number of Orchards

For the year under review the number of orchards registered is as follows :—

Taxable orchards (containing 120 and more trees)	2,126
Non-taxable orchards (less than 120 trees, but not including domestic orchards)	2,687
Total	4,813

This shows a decrease of 243 registrations from the preceding year.

The total acreage devoted to pip, stone, and citrus fruit trees is nearly 18,000 acres, the areas (approximate) utilized for commercial production of the principal kinds of fruit being as follows :—

	Acres.
Apples	10,000
Pears	1,100
Stone-fruit	4,800
Lemons	850
Other citrus	1,000
Other tree fruits	170
Total	17,920

The relative sizes of taxable orchards in the Dominion are :—

10	orchards over 50 acres.
53	„ 26–50 acres.
45	„ 21–25 acres.
112	„ 16–20 acres.
246	„ 11–15 acres.
542	„ 6–10 acres.
1,118	„ 1–5 acres.

2,126 orchards aggregating approximately 16,000 acres.

The average economic orchard unit is in the vicinity of 12 acres; but the size of such unit is dependent mainly on the fertility of the soil in which the trees are established and efficient management and orchard practices.

A disturbing feature in the fruit industry is the continued shortage of all varieties of fruit-trees for the replacement of unprofitable and diseased trees in existing orchards and the establishment of new orchards. Until this shortage is overtaken, the quantity of fruit produced is unlikely to be sufficient for domestic and export requirements.

Production

The quantity of fruit produced during the 1945–46 season was:—

	Bushels.
Apples	2,898,100
Pears	256,820
Stone-fruit	557,600
Lemons	97,875
Other citrus	69,770

Apple-production was higher, but pear-production decreased by 107,000 cases on the previous season.

The total 1945–46 production of apples and pears was distributed as follows:—

——	Apples.	Pears.	Total.
	Bushels.	Bushels.	Bushels.
Exported to Great Britain	281,969	..	281,969
Distributed to consumers by Internal Marketing Division	2,086,984	181,971	2,268,955
Sold privately by growers	270,230	52,660	322,890
Sold to canning-factories	150,317	21,689	172,006
Sold for dehydration, pulping, cider, &c.	108,600	500	109,100
Totals	2,898,100	256,820	3,154,920

The apple and pear crop estimates for the 1946–47 season are 1,840,000 bushel cases of apples and 278,000 of pears. The substantial decrease in the apple crop is due to severe frosts in Canterbury and Otago, gales and drought in Hawke's Bay, and generally to a lighter setting of the pip-fruit crop.

Stone-fruit.—In Central Otago a severe frost more than halved anticipated production, while the Canterbury crops were adversely affected by frost and hailstorms.

The estimated production of stone-fruit for 1946–47 season is:—

	Bushels.
Peaches	211,000
Nectarines	15,000
Apricots	70,000
Plums	89,000
Cherries	11,000

A number of new stone-fruit orchards have been established near Alexandra and Hastings during the past year and pip-fruit trees have replaced stone-fruit trees in some instances.

Citrus Fruits.—The estimated citrus production for the 1946–47 season is:—

	Bushels.
Lemons	106,385
New Zealand grapefruit	69,675
Sweet oranges	16,280

Citrus orchards at Kerikeri have again been adversely affected by drought, but growers who installed irrigation systems have benefited by their action.

Small Fruits.—A growing demand, accompanied by higher prices, is causing growers to increase the areas planted with small fruits. The estimated production of small fruits in commercial areas is :—

	1946–47 Season. Tons.	1945–46 Season. Tons.
Gooseberries	270	150
Strawberries	380	250
Raspberries	530	750
Loganberries	25	40
Currants	120	150

During the year a preliminary survey of raspberry varieties was undertaken to locate the heaviest-cropping strains for selection in the propagation of further supplies for extension of plantings. It is intended to propagate the selected strains at the proposed horticultural station at Levin, the ultimate aim being the establishment of a "certified raspberry stock" scheme.

A limited number of plants of several varieties of black currants, gooseberries, and strawberries have been introduced from reliable English sources for establishing a supply of disease-free, true-to-name plants.

It is particularly desirable that virus-free strains of strawberries, which will provide a succession of good crops, should be raised.

The culture of other fruits is increasing, and greater quantities of tree tomatoes, Chinese gooseberries, and feijoas are being produced for market.

Viticulture

Weather conditions during the past year have not favoured good grape crops. In parts of Hawke's Bay, Te Kauwhata, and Auckland, spring frosts caused some damage to the vines. The cold weather conditions in December had an adverse effect on the good setting of the berries.

Indoor Grapes.—The production of grapes grown under glass is estimated at 600,000 lb. An expansion in indoor grape-growing is expected when materials for the construction of glasshouses are again available.

Wine Grapes.—The grape crop harvested in 1946 was fair average yield, with the average production per acre somewhat higher than the previous year. The increase in wine-production is mainly due to the new areas of vines which have come into bearing.

Wineries and Vineyards.—Winemakers continue to extend and improve their cellar layout and accommodation and equipment by the installation of up-to-date filters, crushers, presses, and pumping units. Winemakers generally have sought the advice and guidance of the Vine and Wine Instructor when about to make any large alterations to premises or equipment.

Diseases.—Fungous diseases have not seriously affected glasshouse grapes. The improved fumigation methods introduced in co-operation with the Plant Diseases Division of the Department of Scientific and Industrial Research are effective in the control of mealy bug.

The warm and humid weather conditions experienced in the Hawke's Bay district during February, 1947, were the cause of powdery mildew in that area.

Wine-production.—The approximate area under outdoor grapes grown for wine-making is 800 acres.

The production of 191 licensed winemakers was approximately 388,800 gallons, mostly of the sweet red and sweet white type.

It is estimated that there is also a further 78,770 gallons of wine made from fruit other than grapes.

The quantity of grape wine produced in New Zealand since 1940 is as follows:—

	Gallons.
1940	185,000
1941	186,000
1942	207,000
1943	309,000
1944	348,000
1945	357,000
1946	389,000

During the year instruction was given to grape-growers on many phases of viticulture. Winemakers visiting the Horticultural Station at Te Kauwhata were given an insight into modern winemaking methods and information on various features of cellar layout, machinery, distillation, &c. Advice was also given on vine varieties under trial, pruning, manuring, spraying, cultivation, and soil erosion.

Cidermaking.—The estimated production of 32 recorded cidermakers is 90,000 gallons.

Te Kauwhata Horticultural Station.—Adverse weather conditions during the past spring resulted in a light grape crop this season. Replacement of vines which have served their purpose in the experimental area of the vineyard, together with the planting-up of the land previously in grass, is proceeding satisfactorily, and young vines are making good progress. The nursery, in which some 12,000 vine cuttings are being tended, has been transferred to a new location.

Experimental work has been undertaken in connection with such problems as shy-setting varieties to improve the yield by practising different systems of pruning and cincturing at certain periods of the growth of the vines. A number of experimental wines were made from individual grape varieties to determine their properties for producing quality wines.

Further quantities of apple wine have been made from apples below the grade suitable for marketing. The wine previously released demonstrated that a good wholesome apple wine could be made in the Dominion.

Fruit Cool Storage

The cool storage space for fruit has an estimated capacity of 1,136,650 bushel cases and is distributed as follows:—

——	Public Cool Storage.	Growers' Private Cool Storage.	Total.
North Island	797,000	63,800	860,800
South Island	199,480	76,370	275,850
Totals	996,480	140,170	1,136,650

The stocks of pip-fruit held in cool store on the 30th June, 1946, amounted to:—

	Bushel Cases.
Apples	891,183
Pears	60,214
Total	951,397

The quantity held in shed storage in orchards was approximately 90,196 bushel cases of apples.

Vegetable-production

Although there has been a slight decrease in area used for vegetable-growing in the Auckland district, the Dominion acreage has increased.

Registrations.—The 2,850 commercial vegetable-producing areas registered in 1945–46 represented 20,000 acres, of which 650 acres were devoted to glasshouse crops.

Land requirements for housing have caused reduction of vegetable-producing areas in populated centres. Consequently, commercial vegetable-production is now being established on suitable land farther away from consuming centres.

Officers have visited market-gardeners throughout the Dominion and advised on cultural and disease problems. The Plant Diseases Division of the Department of Scientific and Industrial Research has given valuable assistance in this work.

The Home Garden

Public interest in the home vegetable and flower garden has increased in recent years. Most noticeable is the average home gardener's desire for guidance in the adoption of approved cultural methods.

Bulb-growing Industry

An endeavour is being made to increase the variety and quantity of bulbs grown for export and local use. Research, however, is needed on such matters as the cultural aspects of tulip-growing, pest and disease control on narcissi and other kinds of bulbs and corms, grading of bulbs, and preparation for shipment.

Tobacco Industry

A further increase in the tobacco acreage is recorded. The comparative figures for 1945 and 1946 harvesting years are :—

	1945.	1946.
Area cropped	3,383	3,405
Poundage sold	3,288,968	4,080,135
Number of licensed tobacco-growers ..	487	553

Tobacco-manufacturers are making extensive additions to their leaf-conditioning and storage establishments in Motueka and erecting new large buildings.

Hop Industry

The hop-growing industry suffered a severe setback by the low production of the 1946 season, when only 1,828 bales were delivered into the store, as compared with 3,103 bales in the 1945 season. The incidence of blackroot in the hop-gardens necessitated a greater number of plants being replaced with the resulting lower yield per acre. An additional 50 acres were planted, but this has been offset by a corresponding area in the older gardens going out of production.

Plant Nurseries

The registration of 752 plant nurseries was an increase of 92 over that of the previous year. Particular attention has been paid to the inspection of nurseries raising fruit-trees and stocks. The nurseries are maintained in a satisfactory condition and reasonably free from disease, but in one large nursery citrus canker was found, and drastic measures were taken to have all infected trees destroyed.

There is a sustained demand for all kinds of fruit-trees, fruit-bushes, ornamental trees, shrubs, trees for farm planting, and bedding-out plants.

Diseases of Horticultural Crops

As a result of the abnormal weather conditions, fungous diseases and insect pests were more troublesome than usual.

Brown-rot of Stone-fruits.—In the Auckland district during the ripening and blossoming period, brown-rot has been more active. In other districts little loss was occasioned.

Fireblight.—Fireblight infection has again been in evidence in the pip-fruit orchards near Hastings and in Canterbury.

Silver-leaf continues to take its toll of stone-fruit trees. In Hawke's Bay the incidence of silver-leaf was somewhat greater than it has been in recent years.

Red Mite.—The dry conditions experienced in Auckland and Hawke's Bay caused a considerable increase in the mite population.

Codling-moth.—The control of codling-moth has been effective in most districts this season because growers have given stricter attention to efficient spraying. In the Moutere Hills district, however, growers were handicapped through lack of water, and consequently codling-moth was more prevalent than usual.

Citrus Canker.—Small outbreaks of citrus canker took place in the Tauranga commercial orchards and in a nursery in New Plymouth. They were promptly and effectively dealt with.

Crown Gall has been found to be prevalent on Chinese gooseberries, although not seriously affecting growth or cropping propensities.

Cicada was reported to be causing serious injury to citrus trees and Chinese-gooseberry plants in the Kerikeri district.

Red-legged Earth-mite (Halotydeus destructor).—In the spring of 1946 an infection of red-legged earth-mite occurred in the Bay View area of the Hawke's Bay district, a lesser infection being located at a later date in the Gisborne area. This pest is new to the Dominion, and steps are being taken, in conjunction with officers of the entomological staff of the Department of Scientific and Industrial Research, to eradicate this pest before it spreads to other parts of the Dominion.

Other pests and diseases were not troublesome during the year.

Horticultural Experimental Station

During the year plans have been well advanced towards the establishment of a horticultural experimental station near Levin, where it is proposed to conduct systematic experimental work on the more urgent horticultural and market-garden problems. In the past attempts to solve these problems have been based on cultural practices developed overseas, and these do not necessarily apply to New Zealand conditions. It is also proposed to lay down trials and experiments investigating the growing of vegetables.

Through the experimental work at this station it is hoped to give a much better advisory service to market-gardeners, horticulturists, and private gardeners.

Rehabilitation

Reports have been supplied to the Rehabilitation Department on various properties comprising either nurseries, market gardens, orchards, or apiaries concerning their suitability for the settling of prospective ex-servicemen. After the ex-servicemen have been established, advice and guidance on horticultural activities have been given.

Beekeeping

Statistics show a small increase in the average number of apiaries and hives kept by beekeepers. There are 6,798 beekeepers in New Zealand owning 10,457 apiaries containing 140,703 colonies. The distribution in the various apiary districts follows :—

Apiary District.	Number of Beekeepers.	Number of Apiaries.	Number of Colonies.
Auckland	1,608	1,913	16,648
Hamilton	835	1,575	34,516
Hastings	887	1,356	15,383
Palmerston North	1,234	1,985	23,750
Nelson	494	614	7,040
Christchurch	867	1,665	23,379
Invercargill	873	1,349	19,987
Dominion totals	6,798	10,457	140,703

Climatic Conditions and Production.—Conditions generally in most parts of New Zealand were unfavourable to beekeeping during the spring months and some difficulty was experienced in maintaining colony strength sufficient to take full advantage of improved conditions and nectar-supplies available in January. The honey season was four to five weeks later than usual.

The estimated production of honey harvested during the past year from commercial apiaries is 3,400 tons.

Research Work.—Research work on beekeeping problems has been carried out in conjunction with the Animal Research Station of this Department at Wallaceville, and with the Department of Scientific and Industrial Research. This has included diagnostic work on bees submitted for examination, experiments with pollen substitutes, honey-poisoning, and identification and control of a bee-disease called *Nosema apis*.

Part-time Apiary Inspection.—Seventy-one competent beekeepers were employed during the season as part-time Apiary Inspectors to assist the permanent Instructors in the detection and control of bee-diseases. Working under this seasonal plan, 2,016 apiaries containing 16,332 hives were inspected, in addition to the work done by the Apiary Instructors, during the year.

Expansion of Beekeeping in New Zealand.—A survey on a county basis completed during the year shows that there is scope for the expansion of apiary holdings to the extent of at least 17,000 hives in good beekeeping areas. Production could also be increased if more intensive and up-to-date methods in apiary management practices were adopted.

Expansion beyond the above limits will only be possible as new country is cultivated and more permanent pastures are established.

The rehabilitation of ex-servicemen in the beekeeping industry has resulted in 15 men being assisted in the establishment of apiaries in various parts of the Dominion, and constant advisory service is maintained by the Apiary Instructors in helping these newcomers to the industry to become efficient beekeepers.

RURAL DEVELOPMENT DIVISION

REPORT OF P. W. SMALLFIELD, DIRECTOR

Although difficulties have been encountered in securing all the trained staff required, the Division has carried out a great deal of useful work during the past year. Unfortunately, it has not been possible to fill the positions of Land Utilization Officer, Rural Economist, and Farm Engineer, and until these officers are secured the Division cannot function with full efficiency.

In its work the Division has received assistance from the Fields, Horticulture, and Live-stock Divisions, and a large part of the field-work for the land-utilization and cost-of-production investigations carried out during the year was done by the field officers of other Divisions. The Division's own field-work was chiefly restricted to the Auckland and Canterbury districts.

Food and Agriculture Organization of United Nations

The Division has been assigned the task of providing and assembling information required by the Food and Agriculture Organization of the United Nations. During the year reports were prepared on the following subjects: the production, export, import, and local consumption of agricultural seeds, fertilizers, dairy products, cereals, pulses, stock-foods, fats, and oils; controlled marketing in New Zealand (prepared in conjunction with Economic Stabilization Section of Treasury Department); the Dominion's storage capacity for agricultural produce; the extent of food wastage through rodents, insects, and moulds; farm production and nutritional standards; and various minor reports.

The amount of work necessary to supply the information required by FAO will expand greatly during the coming years as the Organization formulates its plans for the improvement of food-production and the raising of nutrition levels.

The Preparatory Commission of FAO, set up to investigate Sir John Boyd Orr's proposals for a World Food Board, has issued its report. Its task was to work out specific proposals for achieving, first, the development and organization of production, distribution, and utilization of basic foods to provide diets on a satisfactory health standard for the peoples of all countries, and secondly, the stabilization of agricultural prices at levels fair to producers and consumers alike.

Briefly, the Commission, while not recommending a World Food Board with authority and funds of its own, does advocate the establishment of a World Food Council consisting of the representatives of eighteen nations and forming an integral part of FAO. The Council would provide machinery such as commodity councils and study groups which would enable nations to act together in matters of food and forestry production.

The Council would also aim at stabilizing prices, building up reserves of food, and using the International Bank for Reconstruction and Development to finance development projects in the under-nourished countries, including, if necessary, the disposal of surplus supplies at special prices.

Land-utilization

Sheep-farming.—In conjunction with the Fields and Live-stock Divisions, a review of the progression and regression of the sheep-farming industry in various regions of the Dominion has been carried out. Between 1920 and 1945, total sheep increased from 24,000,000 to 34,000,000, and breeding-ewes from 12,000,000 to 21,000,000. Sheep-farming has shown remarkable progression in the areas devoted to intensive grassland farming, but has either remained stationary or regressed slightly on most areas devoted to extensive pastoral farming. In the Waikato, for instance, 10 acres of grass in 1920 carried only 1 dairy cow and 2 ewes, whereas in 1945, 10 acres of grass carried 4 dairy cows and 6 ewes. In Tauranga County the development of sheep-farming through top-dressing with cobaltized superphosphate has been remarkable; the ewes carried

increased from 3,600 in 1920 to 132,800 in 1945, or from an average of 1 ewe and 1 dairy cow on 24 acres in 1920 to 12 ewes and 4 dairy cows in 1945.

The increased carrying-capacity of the lower country through the use of fertilizers and other intensive grassland-farming methods has tended to mask the regression or stationary position on much of the hill country devoted to extensive pastoral farming. Up to the present the regression generally has not been very serious, but may become so if present tendencies are not halted. Over large areas, especially in the North Island, the application of some of the principles of intensive grassland-farming methods such as the introduction of clovers and light top-dressing, an increase in the proportion of cattle to sheep grazed, and the control of erosion by the stabilization of land in gullies with debris dams and spaced planting to help to control slumping of the land are necessary to conserve and increase the fertility and carrying-capacity of hill-country grazing-lands.

Wheat-production.—During the 1945-46 and 1946-47 seasons surveys have been conducted in Canterbury to collect data on wheat-production practices and yields to determine whether the survey method could be used to measure the mean yields for particular soil types, the influence of prior crop on yield, and the influence of cultivation, rate of seeding, and time of sowing on yields. An examination of the data collected for the 1945-46 season indicates that the period under which the land had been in crop was the most important factor influencing yield; differences in yield due to various rates of seeding, cultivation, and dates of sowing showed no definite trends. It is expected that these surveys of management practices and yields will provide data of great value in elucidating some of the economic problems of wheat-production by providing information on the yields to be expected on each main wheat soil, and the variation in yield depending on the place in rotation and intensity of cropping.

Vegetable-production.—A survey of commercial vegetable-production has been carried out with the assistance of the field officers of the Horticulture Division, and the data are now being tabulated. The survey shows the very specialized nature of commercial vegetable-production, and how the production of even the common vegetables is concentrated in very restricted localities. This specialization in production makes it desirable that land-use policies should be formulated to conserve market-gardening land and prevent it being absorbed in urban development, for, contrary to general opinion, the area of land suitable for vegetable-production, especially for early spring vegetables, is very restricted.

Land Use.—As a preliminary to more detailed studies of land use, work has been done in dividing the Dominion into farming regions and tabulating available data on farming applicable to each region. A preliminary report on this work is now nearly ready for publication.

Agricultural Development Committee

In view of the fact that land development and reclamation works cannot progress at present through lack of many essential materials, the type of work planned for the Agricultural Development Committee has had to be held more or less in abeyance, and the Department, in advising on farm-development policies, has worked through the Farm Advisory Committee of the Rehabilitation Board and the Land Development Board of the Lands Department. Reports on the development of the fruit industry prepared for the Agricultural Development Committee have consequently been passed on to the Farms Advisory Committee. The proposal for bulk distribution of lime outlined in last year's report is being put into operation by the Railways Department, which is erecting a trial silo and bulk handling plant at Winslow (Ashburton) in co-operation with a local firm of cartage contractors.

Farm Management and Economics

Considerable field-work has been undertaken in connection with cost-of-production surveys for city milk, wheat and other cereals, and potatoes. In addition, basic

information covering power units, implements, crop rotations, and cultivation methods on mixed arable farms has been collected as a basis for improving and expediting future cost investigations of cash crops.

An investigation of orchard-tree valuation has been carried out. This involved the collection of information on production, depreciation, and costs in various districts so that standards could be set for the valuation of trees.

The Farm Management and Economics Section has also prepared a number of departmental reports on the Dominion's primary industries and overseas trade and contributed a number of articles to the *New Zealand Journal of Agriculture*.

Farm Engineering

Shortage of trained staff has retarded the development of the Farm Engineering Section, but I anticipate that in the coming year it will be possible to establish the nucleus of a farm machinery extension service and an implement-testing station.

Some useful work was carried out on tractor usage and implement equipment on mixed arable, dairy, and pastoral farms. A fairly complete survey was made of the work intended for tractors released during the latter war years, which showed that the adoption of the tractor by practically all classes of farmers does not appear to be reflected in any important change in farm-management practice or production. However, an analysis of the data covering wartime releases indicates that in the initial purchase of a tractor the majority of farmers are inclined to start with one that is slightly underpowered for the work required.

A farm forestry officer has been appointed to initiate an extension service on farm shelter, plantations, and wood lots.

Statistical Section

The volume of work handled by the Statistical Section has increased greatly in consequence of the extension of field investigations. In addition to the routine work of compiling statistics and tabulating data collected by the field staff, the Section has furnished information covering a wide range of subjects in response to requests from other Divisions of the Department, other Government Departments, foreign Legations, and private individuals both in the Dominion and overseas. The routine statistics compiled by the Statistical Section consist of monthly butter and cheese production, butterfat-supply to dairy factories, live-stock slaughterings, wool pull, and sales of pelts.

Rural Sociology

The work in rural sociology has covered the preparation of articles on home management and economics for the *New Zealand Journal of Agriculture* and surveys on farm housing and rural population patterns. A survey of the rural areas of Marlborough and Nelson has been completed and will shortly be published. The survey was designed to study the relation between the development of primary and other industry, the origin, progress, and location of towns, together with the services they provide for the interdependent countryside. It covers housing and social activities, population trends, and land use.

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