1949
NEW ZEALAND

DEPARTMENT OF AGRICULTURE

ANNUAL REPORT FOR YEAR 1948–49

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, 1949.

The Director-General's report reviews post-war agricultural policy in the light of the Dominion's undertakings to increase exports during the currency of the long-term contracts and assesses productive resources as a guide to future policy.

A summary of the principal farming activities of the year and the work of the various Divisions of the Department in the development of the Dominion's farming industry are set out in the reports of the Divisional Directors.

I have, &c.,
EDWARD CULLEN,
Minister of Agriculture.

His Excellency the Governor-General.

REPORT OF DIRECTOR-GENERAL OF AGRICULTURE

Despite the expansion in recent years of secondary industries, the economy of New Zealand is still based essentially on primary production. The Dominion is an important contributor to world food-supplies, particularly those of the United Kingdom, and in view of our undertakings to increase exports during the currency of our long-term contracts New Zealand's post-war agricultural policy is of considerable importance.

A review of farming trends since 1920 may assist in assessing our productive resources and guiding future policy. The year 1920 has been selected as it marks the close of one epoch in New Zealand's farming history and the beginning of a new. Up to 1920 the main characteristic of farming development was its extensive nature. Land was plentiful and increases in live-stock numbers were made possible by acquiring and breaking-in new land. Since 1920, however, there has been relatively little expansion of the area occupied, but a much more intensive development of the land already being farmed. It is from a continuation and intensification of this latter trend that, in the main, increased carrying-capacity can be achieved and future production increases must come.

Since 1920 there has been a progressive increase in the volume of live-stock products, as is illustrated by the following tables :—

TABLE I

Year.	Butterfat (Tons).*	Wool (Million Pounds).†	Live-stock Slaughterings (000 Carcasses).‡				
			Sheep.	Lambs.	Cattle.	Pigs.	Calves.
1919–20 ..	60,600	174	3,190	3,281	413	201	..
1929–30 ..	140,200	273	3,992	6,652	367	530	..
1939–40 ..	194,900	310	4,439	10,160	600	826	1,060
1944–45 ..	192,000	372	4,717	10,780	610	679	966
1945–46 ..	164,400	365	5,440	12,741	739	728	983
1946–47 ..	181,200	360	5,037	11,808	719	633	1,085
1947–48 ..	188,000	357	4,640	12,373	712	638	1,174

* Years ended 31st July. † Years ended 30th June. ‡ Years ended 30th September.

INCREASED CARRYING-CAPACITY

The intensification of farming is best illustrated by movement in stock-carrying capacity. Although exact measurement is not possible, the adoption of live-stock and acreage equivalents gives a measure which can be adopted for comparative purposes. In the following table sheep and cattle of all types are expressed as "cattle units" and grazing land as "grass equivalents." The result shows, on this basis, that carrying-capacity has increased from 38·8 to 50·3 per 100 acres since 1920.

TABLE II—THE RELATIONSHIP OF LIVE-STOCK CARRIED AS CATTLE UNITS TO AREA FARMED AS SOWN GRASS EQUIVALENT

Year.	Live-stock as Cattle Units (000's).	Areas as Sown Grass Equivalent (000 Acres).	Cattle Units Per 100 Acres.
1920	6,908	17,802	38·8
1925	7,190	18,170	39·6
1930	8,233	18,770	43·9
1935	8,530	18,581	45·9
1940	9,336	18,733	49·8
1945	9,368	18,791	51·3
1947	9,670	19,233	50·3

Occupied Land

The total area of land under occupation has not varied materially during the period under review: the peak was reached in 1925, since when some land—probably of a submarginal nature—has become "unoccupied." Subdivision of holdings has taken place, resulting in an increased number of occupiers and a reduction in average area of farms.

Table III—Total Area Occupied, Number of Holdings, and Average Size of Holdings, 1920–47.*

Year.	Total Occupied Area (000 Acres).	Number of Holdings.	Average Size of Holdings.
1920	43,473	81,592	532·81
1925	43,632	85,977	507·49
1930	43,369	85,167	509·22
1935	43,105	84,867	507·91
1940	42,928	86,304	497·40
1945	43,006	86,247	498·64
1947	43,100	86,483	498·36

* Agricultural and Pastoral Statistics.

A more detailed study shows that the major movements in size and number of holdings have been a material reduction in the number of small farms—some subdivision of very large areas, and a rapid development of economic family units ranging from 50 acres to 320 acres. These are devoted essentially to intensive production of dairy products and fat lambs, depending on improved pasture-management.

Table IV—Number of Holdings, by Sizes and Total Occupied Area, for Each Size for 1920 and 1947*

Size (Acres).	Number.			Area (000 Acres).		
	1920.	1947.	Difference.	1920.	1947.	Difference.
Under 10	15,554	11,450	−4,104	72	53	−19
11–50	13,367	13,838	+471	377	351	−26
51–100	10,039	12,824	+2,785	380	937	+157
101–320	21,579	26,837	+5,258	4,128	4,850	+722
321–640	10,116	10,486	+320	4,642	4,742	+100
641–1,000	4,080	4,130	+50	3,301	3,290	−11
1,001–5,000	5,722	5,881	+159	11,306	11,497	+191
5,001 and over	1,085	1,037	−48	18,867	17,380	−1,487
	81,592	86,483	+4,891	43,473	43,100	−373

* Agricultural and Pastoral Statistics.

The Technique of Grassland Farming

The foregoing tables show clearly that rapid and, in fact, almost spectacular progress has been made in live-stock production from a relatively static area of occupied land and of land sown in grass. How has this progress been possible? The answer lies virtually in one word—grass. By the development of good-quality pastures properly managed and top-dressed with adequate supplies of phosphatic fertilizers, many farmers have achieved levels of production which are eulogized internationally. It is true, however, that the quality of a large proportion of New Zealand's pastures still leaves much to be desired and there is all too frequently a lack of adequate utilization of surplus pasture growth.

Statistics of fertilizer and lime usage are not available for the early years of the period under review, but the figures shown in Table V illustrate the development in usage since 1926.

TABLE V—FERTILIZER AND AGRICULTURAL LIME PRODUCTION, 1926–27 TO 1948–49

Year.	Fertilizer Usage (Tons).	Lime Production (Tons).*	Year.	Fertilizer Usage (Tons).	Lime Production (Tons).*
1926–27 ..	291,991	..	1938–39 ..	614,388	391,069
1927–28 ..	391,746	182,949	1939–40 ..	672,611	593,995
1928–29 ..	465,184	221,756	1940–41 ..	698,647	728,474
1929–30 ..	525,905	204,811	1941–42 ..	502,431	613,168
1930–31 ..	402,640	171,159	1942–43 ..	362,331	752,603
1931–32 ..	359,812	201,735	1943–44 ..	285,415	903,808
1932–33 ..	403,332	191,888	1944–45 ..	429,681	812,635
1933–34 ..	376,175	261,940	1945–46 ..	514,084	929,794
1934–35 ..	373,428	288,559	1946–47 ..	633,471	1,020,810
1935–36 ..	426,400	317,055	1947–48 ..	689,267†	1,092,139
1936–37 ..	502,880	410,770	1948–49 ..	686,431†	..
1937–38 ..	611,316	481,712			

* Calendar years: Mines Department data. † Estimated.

The figures of fertilizer usage cover all types, but the great bulk is in the form of superphosphate and less-soluble phosphates. Shortages of raw materials are reflected in low usage in the war years, a factor which has probably had more effect on dairy production than is often appreciated. The endeavours of farmers to compensate for this lack of fertilizer by increased lime usage is clearly reflected in the figures of lime-production.

In 1929 the Department inaugurated a seed certification scheme for the purpose of ensuring adequate supplies of high-grade " pedigree " grass and clover seeds to farmers. The value of this service has been generally appreciated, and the use of certified seeds is now general in the resowing of pastures and in the establishment of new grass. Certification is also the basis of successful overseas trade in these commodities.

The rapid development of this service is illustrated by the following table of production of perennial rye-grass seed and the amounts certified :—

TABLE VI—TOTAL PRODUCTION OF PERENNIAL RYE-GRASS SEED AND QUANTITIES UNDER CERTIFICATION

Year.	Total Production (Tons).	Certified Seed (Tons).
1935	7,641	1,621
1940	5,982	2,255
1945	6,156	3,657
1947	13,693	9,373

LABOUR ON FARMS

Technical advances associated with the development of intensive pasture-management have enabled carrying-capacity, particularly of dairying and fat-lamb farms, to be substantially increased. How has this extra live-stock affected the farm labour force necessary to handle it ? Statistics of the number of people engaged in farming are far from being complete for the period under review. Such figures as are available indicate a declining number of farm workers since 1935–36. Part of this is due to the number on farms in the depression period being unduly inflated by lack of opportunity elsewhere, and part is due to increased mechanization, but these two factors do not entirely explain the large fall in numbers. It is extremely doubtful whether substantial increases in production

can be expected unless the present labour force is considerably augmented. Table VII shows the trend in numbers engaged in farm-work in relation to volume of farm production.

TABLE VII—PERSONS ENGAGED IN FULL-TIME FARM-WORK IN RELATION TO VOLUME OF PRODUCTION

Year.	(1) Numbers Engaged in Farm-work (000's).*	(2) Index Nos. of (1), 1928–29 = 100.	(3) Volume of Farm Production. 1928–29 = 100.
1928–29	140·6	100	100
1929–30	140·1	100	105
1930–31	..	..	106
1931–32	..	..	106
1932–33	..	..	122
1933–34	..	..	125
1934–35	..	..	122
1935–36	160·8	114	128
1936–37	..	..	132
1937–38	..	..	132
1938–39	..	..	127
1939–40	..	..	129
1940–41	..	..	147
1941–42	..	..	140
1942–43	..	..	137
1943–44	..	..	133
1944–45	128·5	91	143
1945–46	..	..	135
1946–47	126·4	90	139

* Persons engaged on farms; the figures for 1928–29, 1929–30, and 1946–47 are as collected in the annual Agricultural and Pastoral Statistics, with an estimated addition of 2,000 to allow for persons engaged on land inside boroughs and on holdings of less than 1 acre. The figures for 1935–36 and 1944–45 are from the 1936 and 1945 census returns, including the Maori census for 1936, and an estimate of the number of Maoris engaged in farm work in 1945. Because of differences in classification the two census figures, though comparable with each other, are not strictly comparable with the figures for the other three years.

MECHANIZATION

There is a limit in the extent to which mechanization displaces labour, particularly in live-stock farming. Machines enable work to be done more quickly and more easily, eliminating much backbreaking drudgery, but there are many periods in the farmer's year when no machine can replace a watchful eye and a skilled pair of hands. The power-driven milking-machine and the cream-separator have probably been most instrumental in aiding farmers to maintain high production levels with a reduced labour force. In 1925, only 59·79 per cent. of the cows were machine milked, but by 1948 the figures had reached 91·88 per cent. Formerly used almost exclusively in arable farming and in land-development, the agricultural tractor is now replacing the horse on dairy-farms. The development of farm mechanization is illustrated in Table VIII.

TABLE VIII—STATISTICS OF SOME OF THE MAJOR ITEMS OF MECHANICAL EQUIPMENT ON FARMS, 1920–48*

Year.	Agricultural Tractors.	Milking Plants.	Cream-separators.	Electric Motors.	Shearing Plants.	Internal-combustion Engines.
1920	324	8,806	26,678	456†	5,155	13,981
1925	1,026	15,561	44,656	3,451	5,728	19,894
1930	3,891	20,415	48,302	16,456	7,394	19,169
1935	5,349	25,630	55,920	31,631	8,174	22,117
1940	11,278	29,564	55,773	56,511	10,634	23,276
1946	18,940	31,805	47,783	76,946	13,544	21,473
1947	21,156	32,596	48,194	82,721	14,564	23,109
1948	23,423	33,461	48,457	88,282	15,468	24,922

* Agricultural and Pastoral Statistics. † 1921 figure.

Scientific Advances

In addition to the development of grassland farming and mechanization, there have been many related fields where scientific advances have played an important part. Herd-testing under the Department's C.O.R. and O.H.T. methods and group testing carried out by the Herd Improvement Association have provided a basis for selection on performance. The Ruakura and Wallaceville Research Stations are engaged on work of a fundamental nature which is having its effect on stock and pasture management. Vaccination against contagious abortion and the treatment of some forms of mastitis with penicillin are two outstanding developments contributing to the prevention of wastage in dairy herds.

The trend in agricultural development during the past three decades has been active exploitation of favourable natural resources. The application of scientific developments and the adoption of proved advances in knowledge and practice has resulted in improved potentiality in all branches of our primary industries and a rapid advance in efficiency of labour employed on the land.

An increasing population will absorb additional quantities of our exportable surpluses, and thus the quantitative export objectives of dairy products and meat become more difficult of attainment.

Experience of the past has crystallized the pattern of our food exports, and additional quantities can be made available only by intensification of the production methods which have given us our increases to date.

To summarize, we must concentrate on increased usage of fertilizers ; the provision of more and better fodder, whether it be in the form of pastures or crops ; mechanization of farming operations to the limit in order that unit costs may be reduced ; improvement in animal efficiency through breeding, feeding, and avoidance of wastage through disease control ; improvement in coverage and productivity of hill country and the insurance of adequate labour to cope with farming developments as the over-all programme of expansion materializes. Each of these principles has a background of problems which must be faced by farmers and the whole community in order that an expanding national economy may be achieved.

E. J. Fawcett, Director-General.

EXTENSION DIVISION

REPORT OF P. W. SMALLFIELD, DIRECTOR

Amalgamation of Fields and Rural Development Divisions

The Fields and Rural Development Divisions were amalgamated and reorganized as the Extension Division as from 1st August, 1948. The Rural Development Division was established to study farm management and economics, farm engineering, farm forestry, and rural sociology, and to supply statistical, economic, and technical information on primary production. The Division had always worked in very close collaboration with the Fields Division, and the amalgamation of the Divisions has widened the sphere of extension activities of local Instructors in Agriculture and has allowed a wider degree of decentralization by making each Fields Superintendent's district responsible for local research and instruction work of both of the former Divisions.

The 1948–49 Season

Weather

The season was generally a favourable one for farm production, particularly in the dairying districts of the North Island. Throughout the Dominion the autumn and winter were exceptionally mild.

In the North Island heavy rainfalls occurred during May with some flooding in the Bay of Plenty and Poverty Bay. In the remainder of Auckland Province occasional heavy falls continued through to early spring with cool temperatures. During late spring and summer, temperatures were warm and falls of rain evenly spread. Almost similar conditions prevailed in the northern part of Wellington Province, but farther south the spring was more favourable and a hot, dry period in December was followed by heavy rains in east coast districts. The early autumn continued cool and moist with prolific growth of crops and pastures. Harvesting conditions were not, however, particularly difficult, as there were frequent spells of dry weather throughout the harvesting season.

Canterbury experienced a dry season and there was less rain than usual during winter, which accentuated the hot, dry conditions during summer.

In Marlborough there was a good deal of rain in the winter, with flooding in May and July. Westland experienced a cold and wet season right through to midsummer.

North Otago and Central Otago had a dry season, but in the remainder of Otago and in Southland mild winter conditions were followed by adequate rainfall and warm temperatures. Early in November flooding occurred in the lower Clutha area. Frosts early in January and again in February caused losses in wheat and potatoes, but generally the season was the most favourable for many years.

Pastures

Because of the mild, wet winter and absence of dry conditions during summer, pastures produced exceptionally well in most parts of the North Island. Some shortages of feed occurred during August and September in parts of Auckland Province, but prolific growth in late spring and early summer was general and caused difficulties in controlling pasture. Similar conditions in the central part of the North Island enabled grassland to recover from the effects of the drought in the autumn of 1948, but in southern Hawkes Bay and the Wairarapa winter conditions were not so favourable, causing pastures to be fairly bare until the spring. Along the west coast of Wellington Province pasture growth was exceptionally good from early spring onward.

In Canterbury, after a good deal of growth in autumn and early winter, pastures were affected by summer drought. In Marlborough, grass growth during the season was better than average, but on the west coast of the South Island growth was spasmodic.

Apart from North Otago and Central Otago, both of which suffered from drought, pasture growth in Otago and Southland was considered the best for many years. This resulted in a surplus of root and green fodder crops and was reflected in the improvement of fat-lamb production as well as in dairying output. There were difficulties in controlling the exceptional flush of feed in Southland, especially on sheep-farms where cattle are not normally used for pasture control.

Supplementary Fodder

Hay and Silage.—During the past summer a good deal of hay was saved in the North Island, but owing to showery conditions during the harvesting period much of it was of inferior quality. The baling of hay has become very popular and is increasing. The favourable season enabled farmers in the central part of the North Island to build up stocks of hay which had been depleted during the drought of 1948, after which some assistance by way of railage subsidy on hay became necessary. In dairying districts there was a marked increase in silagemaking, partly because of the earlier spring growth, but also probably on account of the weather being somewhat unsettled for satisfactory haymaking.

In the South Island, harvest weather was mainly satisfactory and the quality of hay saved was generally good, although it was light in quantity in parts of Canterbury and North Otago.

Lucerne.—Slight increases in the area of lucerne were reported, especially in those districts in the North Island which suffered from drought during the two previous seasons. New stands established fairly well and established stands yielded good crops of hay.

Swedes and Turnips.—Both swedes and turnips are being grown to a greater extent in some districts in the North as part of the plough and resow policy for pastures. Crops were generally good.

In the South Island, especially in Southland, the area in swedes and turnips is decreasing. Early-spring sowings established well, but later dry conditions retarded growth of the later-sown crops in Canterbury and North Otago.

Rape and Chou Moellier.—Good crops of chou moellier were grown in the North Island, where this fodder crop is increasing in favour for lamb-fattening and for winter and early-spring feed for sheep and cattle. Rape crops were poor in Canterbury but satisfactory in Otago and Southland. The new club-root-resistant type is in particular demand in the South, where it is giving good results.

Cereal, Pulse, and Food Crops

Conditions in the autumn were favourable for sowing of cereals and it is estimated that there was a substantial increase in the over-all acreage. Dry conditions during late summer in the main grain-growing districts had an adverse effect on yields but enabled harvesting to be carried out under good conditions, except in Southland. Details of estimated crop acreages and the comparative figures for 1947–48 are as follows :—

	1947–48. Acres.	1948–49. Acres (Estimated).
Wheat (all purposes)	125,439	150,000
Oats (all purposes)	177,252	190,000
Barley (all purposes)	73,275	65,000
Potatoes	21,887	19,500
Peas	52,138	50,000
Onions	1,572	*
Maize (for grain)	7,345	*

* Not available.

Wheat.—Although there was an increase in the acreage of wheat, the area was still much lower than was necessary for domestic requirements. Autumn sowing was carried out under favourable conditions and crops grew well through winter and early spring. Conditions also favoured spring-sown crops in Otago, Southland, and parts of the North Island. In Canterbury, yields were good on the heavy to medium land, but on the light land crops were below average. Early frosts had a detrimental effect on many crops in Otago and Southland. In Wellington Province, yields were exceptionally good and the grain was of good quality.

Oats.—The area sown in oats showed a slight increase, but in Canterbury the season was too dry, with yields and samples below average. In Southland crops were established under good conditions and made good progress until harvest, when adverse weather resulted in severe lodging in many districts. Had it not been for the use of the header harvester, many crops would have been a total loss.

Barley.—The acreage declined slightly, but there has been an extension of barley-growing in certain parts of Wellington Province, where the crop is replacing oats.

In Canterbury the yields were about average and the samples of malting barley fair to good. In Central and North Otago good yields of grain of satisfactory quality were secured.

Potatoes.—After the large surplus of potatoes during the 1947–48 season, when crops were often difficult to dispose of, the acreage planted last season declined. Early crops in the North Island were affected by late blight, but second earlies gave satisfactory yields and were harvested in good condition. In Canterbury, yields are expected to be considerably lower than in the previous year and crops ripened off much earlier than usual. Some crops in Otago suffered from early frosts, and flooding in the Balclutha district caused substantial losses.

There is likely to be a shortage of table potatoes toward the close of the current season.

Peas.—The acreage in peas was well maintained. Although there were some good crops, the season did not generally favour peas, and yields in the main pea-growing districts were below average.

Onions.—The area in onions was approximately the same as in the previous year and good yields were generally obtained, especially in southern districts.

Maize.—There has been a reduction in the area under maize, especially in Poverty Bay, where there was a disastrous flood during May. The flood not only caused the loss of many areas of maize during the 1947–48 season, but also resulted in the soil remaining wet through to the following planting season, which prevented the normal acreage being planted. The maize sown, however, has grown well and shows good promise.

Extension Services

During the year the Division has widened and improved its instructional services, but there are still vacancies on the instructional staff which must be filled before the Division can give a full service to the farming community. Difficulty has been experienced in securing a full complement of recruits thoroughly trained in the science and practice of farming. However, plans are now in operation to cater for the thorough training of future recruits through the Rural Field Cadet and Science Scholarship Schemes organized by the Public Service Commission, and the first group of officers trained as Rural Field Cadets will join the Division next year. The careful selection and training of recruits under these schemes should ensure a regular annual intake of well-trained officers and provide the basis for progressive improvement in the instructional service to meet the increasing demands of the farming community.

During the past three decades Instructors in Agriculture have devoted the major part of their activities to the improvement of pasture-production on ploughed land, and their work has been reflected in the greatly-increased volume of production from those lands. Increased attention is now being paid to the problems of pasture improvement on hill-country grazing-lands, for it is these lands which present the chief problems in soil conservation and which must provide an increasing volume of wool and store, breeding, and fat stock if primary production is to keep pace with the Dominion's increasing population.

Lectures, Field-days, and Farm Schools

The Division carried out a very successful programme of lectures, field-days, and farm schools, and was assisted in the farm-school work by officers of other Divisions and Departments and by lecturers from the agricultural colleges. Thirty-two farm schools were held, the Division organized 242 field-days, and the Instructors delivered an additional 615 special lectures. Weekly radio talks were continued from Auckland, and broadcasts were also given from Palmerston North, Wellington, and Christchurch.

The Division's supply of instructional films and lantern-slides is being improved, and the Visual Aids Officer took approximately 2,000 photographs during the year for use in illustrating departmental publications, for the preparation of lantern-slides, and for general publicity.

Flock House Farm of Instruction

Flock House Farm of Instruction has continued to provide farm training for its complement of forty-five trainees, and there is a considerable waiting list of entrants. The lecture course has been widened by calling in the Department's specialist officers, and the scope of the practical work has been enlarged by beginning land-improvement on the coastal sand country, which will provide experience in cultivation, fencing, and pasture and crop production. Increased attention has been given to farm side-lines and the poultry, garden, orchard, and apiary units now provide the requisite facilities for instruction.

The Station's farming operations were successful: approximately 1,000 acres were top-dressed, and with further top-dressing and pasture renewal the Station's present carrying capacity of 6,000 ewes should be considerably improved.

Young Farmers' Clubs

In the Young Farmers' Clubs movement during the year there has been general improvement in club work and activities. Eighteen new clubs were formed and 14 clubs were closed. There were 310 active clubs at the end of the year, with a membership of 9,000 and an advisory and honorary membership of 1,500. The numbers of clubs in the four council areas in the past two years were :—

Council.	1947–48.	1948–49.
Auckland	108	115
Wellington	97	95
Canterbury	54	53
Otago-Southland	47	47
	306	310

The usual club activities of lectures, debates, discussions, field-days, &c., have been generally well organized. Parties of young farmers have travelled to see farming in other districts, and during the year eleven tours were arranged. A national ploughing match was held at Waimate, South Canterbury. Shearing contests were held on a district scale in a number of areas and on a council scale in Wellington. Clubs have also continued co-operative experimental work with the Division. The usual debating and stock-judging competitions were held on a national scale.

An innovation as a council activity during the past year was leadership training, the emphasis being directed especially towards club chairmen and secretaries. In Wellington and Canterbury, councils' conferences lasting several days and attended by sixty or seventy delegates were held at Massey and Lincoln Colleges respectively. A similar conference was held at Balclutha for the Otago-Southland council, and the Auckland council arranged a series of one- and two-day district conferences.

The Country Girls' Clubs movement has been sponsored by the Young Farmers' Clubs Federation. The New Zealand Federation of Country Girls' Clubs was formed in August, 1948. There are now 10 clubs, 3 in the North Island and 7 in the South. The Rural Sociology Section of the Division has given assistance to the Country Girls' Clubs and field officers have given lectures and demonstrations and general assistance.

Show Exhibits

The Division is responsible for the organization of exhibits at summer and winter shows, and during the year a very comprehensive exhibit was staged at nineteen shows. Because a considerable number of shows were held on the same dates it was impossible to cover many centres with the main exhibit, but wherever possible a local exhibit was staged by the Extension and Horticulture Divisions. The exhibits proved of great interest to the farming community, and this phase of the Division's activities will be expanded next year.

Farm Engineering

A Farm Machinery Officer is now stationed in each Field Superintendent's district, and during the past year much useful instructional work has been carried out by visits to farms, radio talks, *Journal* articles, and show exhibits. A large number of technical inquiries from farmers about water-supplies, land-drainage, utilization of electric and water power, and machinery generally have been answered. Preparations have been made to intensify the instructional work next year, making safety a special feature. Investigational work has covered clover-seed harvesting (in relation to clover seed abnormals), low-volume spray equipment, and general cultivation implements. The Department's own engineering problems have received attention; six water-supply schemes for research farms have been planned and costed, proposals have been drawn up for vacuum fumigation plants and potato-starch extraction, and plans have been prepared for removal of fumes from the rabbit-poison depot.

The Farm Forestry Officer has continued regional study of farm plantations in Southland, South Otago, and the Bay of Plenty. Special reports were prepared on shelter in New Zealand (for a projected symposium on shelter planting drawn up jointly by the Imperial Forestry Bureau, Oxford, and the Horticultural Research Station, East Malling) and on farm plantations and erosion control on Puketiti Station (at the request of the Royal Commission on the sheep industry). Advisory work has covered *Journal* articles, visits to farms (at the special request of local Instructors), lectures to farm schools and Young Farmers' Clubs, and the preparation of exhibits at winter shows. Planting plans have been drawn up for several departmental farms.

Rural Sociology

A study of population trends in New Zealand has been begun by the Rural Sociologist.

Subjects receiving most attention in the work in home economics of field officers engaged in the preparation of *Journal* articles, lectures, and winter show exhibits have been nutrition, cookery, preserving, sewing, clothing, house alterations, room design, and furniture renovations. Apart from radio talks and demonstrations to Country Girls' Clubs, sixty-one lectures were given and fifty-three *Journal* articles published.

Two research projects, one on housing in Vincent County and the other on water-supply for farmhouses in South Canterbuty, are under way; field-work for the former is completed, and for the latter almost so.

The number of field officers doing extension work for country women has remained at six throughout the year. The growing volume of work necessitates an increased strength, but recruitment of suitable staff, who must be graduates in home science, is proving difficult.

Seed-production

Production of pasture seeds during 1948 has been affected by two major factors. The British import restrictions which have been operating since 1946 have had some effect in restricting the areas closed for seed-harvesting in 1948. In addition, the 1947–48 season in Canterbury was a much drier one than had been experienced for several seasons. This resulted in fewer areas being diverted for seed-production because of the feed-supply position, and also brought about lower seed yields. On the other hand, the drier weather prevented the development of the blind-seed-disease fungus attacking rye-grass-seed crops, so that seed germinations were much higher generally than was the case for a few years.

The harvest of Italian rye-grass seed in particular was affected by the British import restrictions and volume of production was only one-fifth that of the previous season. Cocksfoot-seed production also suffered a further check. The subsequent opening-up of the cocksfoot-seed export market has caught producers unawares, so that prices have increased markedly above the 1947 levels, without any appreciable increase as yet in the quantity of seed available for export.

The United Kingdom continues to provide the largest overseas market for New Zealand seeds, but importation is controlled under a policy of limiting the quantities being imported to the minimum necessary to meet requirements. European markets have again taken considerable quantities of seed which might otherwise have been a serious drag on the market.

Contract Growing of Seeds.—The Department of Agriculture has continued its programme of contract growing of various seeds. Under this programme nucleus lots of various selected strains and varieties supplied by the Department of Scientific and Industrial Research are multiplied and distributed into commerce. The extent of these operations during 1948 is shown in the following table:—

Kind of Seed.	Quantity Produced.	Purchase Value.
		£
Perennial rye-grass	2,401 bushels	2,546
Italian rye-grass	2,248 bushels	1,137
Short-rotation rye-grass	2,587 bushels	2,303
Timothy	1,827 lb.	434
White clover	2,327 lb.	481
Red clover	6,595 lb.	1,248
Lucerne	12,553 lb.	2,769
Oats	1,786 bushels	551
Rape	28,142 lb.	678
Swede	565 lb.	50
Lupins	301 bushels	180
Wheat	484 bushels	245
Peas	48 bushels	53

Most of the seed produced has already been distributed to selected seed-growers, the balance of the stocks being held to meet further orders coming to hand.

Seed Certification.—Coincident with the decline in pasture-seed production generally, declines are also shown in the quantities of certain of these species certified. The following table shows the quantities of the various seeds certified in 1947 and in 1948 respectively :—

Seed.	1947.	1948.
Perennial rye-grass ..	1,015,804 bushels	565,562 bushels.
Italian rye-grass ..	178,941 bushels	32,154 bushels.
Short-rotation rye-grass ..	174,443 bushels	83,225 bushels.
Cocksfoot	469,317 lb.	485,869 lb.
Brown-top	563,939 lb.	379,349 lb.
Timothy	37,505 lb.	15,031 lb.
White clover	3,182,936 lb.	2,993,090 lb.
Montgomery red clover ..	519,344 lb.	598,957 lb.
Cow-grass	303,607 lb.	693,760 lb.
Subterranean clover ..	34,337 lb.	155,898 lb.
Lucerne	2,194 lb.	20,105 lb.
Seed wheat	98,963 bushels	113,251 bushels.
*Seed maize	806 bushels	..
Rape	487,222 lb.	494,456 lb.
*Turnip	9,310 lb.	94,393 lb.
*Swede	295,255 lb.	340,491 lb.
Chou moellier	..	26,051 lb.
Onion seed	5,000 lb.	14,587 lb.
Seed potatoes	6,799 tons	8,515 tons.
*Kale	..	13,764 lb.

*This seed is termed "Government approved."

The falling-off in the quantities of the various rye-grass seeds certified can be attributed in part to the restricted opportunity for export in 1947 and in part to the seasonal conditions affecting yields.

The reduced supply of certified timothy seed is due in part to the ageing of the areas initially established. As further areas are sown out with the pedigree strain, increased production of certified seed may be expected.

The output of certified cow-grass seed has increased very considerably. This is likely to extend still further when supplies of the pedigree strain recently released become more widely distributed.

Some very heavy yields of subterranean-clover seed were experienced in the 1948 harvest, but most seasons are not so favourable to the harvesting of this seed. The increase in the production of certified lucerne seed reflects the wider distribution of the pedigree strain now being grown commercially.

Production of seed maize is confined to the growing of supplies of seed by the Department. The disastrous floods general in the Gisborne district in 1948 were responsible for ruining all supplies of Government approved seed maize being produced that season. Fluctuations in the quantity of Government approved turnip and swede seed produced are the result of adjustments in acreage to meet estimated requirements taking into account the stocks of each variety carried over from the previous harvest.

General.—The Agronomy Section provides the detailed supervision required by the Department in the export and import of agricultural seeds. In general, imports are restricted to the actual needs of the country, while the only restriction placed on exports is to ensure that local requirements are satisfactorily met. During the year, the Barley Advisory Committee, the Onion Marketing Advisory Committee, the Potato Advisory Committee, and the Small Seeds Advisory Committee continued their work and gave

valuable assistance both to the Department and growers of the crops. The Commercial Advisory Committee also continued to give valuable assistance in implementing controls which are still necessary in connection with the export and import of seeds.

Seed-testing Station

For the year ended December, 1948, over 45,500 tests were completed at the Seed-testing Station. In the first nine months of the year there were greater demands on the service than in the same period of 1947 (a record year), but during the last quarter fewer samples were received. The number of tests carried out during the past two years has been as follows :—

Test.	1947.	1948.
Purity	35,623	32,451
Germination	48,922	45,158
Ultra-violet ray	6,087	3,952
Picric acid	6,398	6,231

Staff.—Shortage of staff continues to hamper the work of the Station and the strength of the testing and clerical staffs is well below the level required for a complete and satisfactory service. The appointment of a Seed Research Officer fills a long-felt need, and further research officers will be appointed as suitable recruits can be secured.

Pre-harvest Examination of Rye-grass Seed.—Substations staffed by five officers of the Seed-testing Station were established at Christchurch and Timaru for the examination of blind-seed disease. A total of 1,371 samples was examined.

Seed-purchasing.—During the calendar year 1948, 698 requisitions were received and seed to a total value of £145,000 was purchased.

Instruction and Publicity.—Radio talks and lectures have done much to bring the work of the Station before the public. Exhibits were staged at various A. and P. shows. There has been a great increase in the number of students, seed-growers, and farmers visiting the Station.

Field Experimental Work

Expansion of the research activities of the Extension Division continues rapidly. In so far as the number of experiments conducted each year reflects this expansion, the following figures gave striking evidence of the progress made since the war years :—

Number of experiments open as at—	
31st March, 1945	268
31st March, 1946	331
31st March, 1947	578
31st March, 1948	872
31st March, 1949	1,105

However, these figures do not tell the whole story, for, in addition to this increase in numbers, there have been an increase in the complexity of the average trial and an improvement in the care and security with which it is conducted.

The majority of these experiments are located on farmers' properties and are being conducted under the farmers' co-operative experimental scheme throughout New Zealand. It has been found possible to conduct many complex experiments with annual crops in this manner, but for most pasture-measurement trials and those experiments which involve the management of farm stock it is necessary to conduct the work on research areas and demonstration farms. In the initial stages of an investigation special research areas are frequently essential.

Trials conducted at the Rukuhia Soil Fertility Research Station, Hamilton, are not included in this summary, but research work is in process at the Winchmore Irrigation Research Station, Ashburton, at the Marton Experimental Area, and at demonstration farms at Dargaville, Stratford, Waimate West, and Winton. There is a definite need for more research stations, particularly to serve those areas where important farming problems exist. The most important of these problems would seem to lie in the various classes of hill country of the North Island and in the tussock and depleted country of the South Island. It is in these directions that research work for the farmer must extend in future.

Nevertheless, it is clear that a determined effort is being made to meet the demands of the farming community for research work, and the expansion of such work is proceeding as rapidly as trained staff and materials will allow. Perhaps the most pressing shortage at present is one of adequate numbers of trained field staff, but it is hoped that this shortage will gradually be overcome.

(1) *Pasture Trials*

(*a*) *Pasture-production Measurement Trials.*—At the Marton Experimental Area 12 trials are now in progress. These include 3 technique trials which examine the differential responses of the clover and grass species of the sward to different phosphatic and lime dressings. Three trials compare various species and strains of pasture plants, 2 being essentially comparisons of perennial rye-grass strains and 1 of timothy strains. In the perennial rye-grass series the pedigree strains bred in New Zealand have shown to advantage over some comparable strains bred in England, and the New Zealand short-rotation rye-grass in particular is giving very encouraging results, particularly in winter and early-spring production. Of the fertilizer trials, 2 compare various forms of phosphates, in particular some concentrated products that would probably have certain advantages in back-country districts where freight charges are heavy and possibly also in fertilizer distribution from aeroplanes. One trial has now been under measurement for seventeen years, for the last nine of which no fertilizer or lime has been applied. Significant lime responses are still being recorded on this trial. One trial examines the effects of different fertilizer and lime placements when sowing to grass, 1 the effect of different methods of preparing the land for grass, and a comprehensive experiment on the effect on weed-control and pasture-production of some types of hormone weed-killers and of fertilizers has recently been started.

At the Dargaville Demonstration Farm 3 fertilizer trials to examine the effect on pasture-production and composition of various forms of phosphatic fertilizers, of potash, of lime, and of various " minor elements " on two of the soil types found in that district are in progress. Work is also being continued in 2 trials on the " ironstone " soil near Kerikeri, and it is hoped to expand this research in the near future to investigate means of bringing this apparently useless land into production. A trial of different forms and rates of phosphatic fertilizers and of lime and potash has recently been started on a pumice-soil type near Rotorua.

Changes in seasonal pasture growth rates are being recorded at a trial at the Waimate West Demonstration Farm. Of the mowing trials laid down at the Winchmore Irrigation Research Station, 1 is under measurement, and this has shown very marked responses to phosphatic fertilizers and the value of applying these materials adjacent to the newly-establishing seedling to obtain the most rapid early growth. At the Winton Demonstration Farm a critical trial comparing serpentine-superphosphate and reverted superphosphate as top-dressings on grassland has so far not shown any significant differences between these two materials.

(*b*) *Observational Top-dressing Trials.*—These trials continue as an important section of the experimental work of the Division, as they have been since shortly after the inception of the co-operative experimental scheme. Although simple in field layout,

they require a high degree of technical skill on the part of the observer. Supplemented by soil and plant chemical analyses, by more accurate sward-evaluation techniques, and by a comparison of results with those from comparable measurement trials, they have proved a valuable and reliable means of evaluating the responses of pastures to fertilizers. Including a survey of soil types of Taranaki for potash responses and various trials with "minor elements" on those soil types where the more commonly-used fertilizers have not given promising results, a total of 224 trials of this type is now open.

The majority of these trials continue the study of the responses shown by pastures on the various soil types as defined by officers of the Soil Bureau of the Department of Scientific and Industrial Research. As the soil surveys throughout New Zealand are able to classify and map the soil types of the farming districts it becomes possible, by adequate field experimentation, from soil and plant chemical analyses, and from botanical and geological studies, to classify and map farming-land throughout the Dominion according to its mineral requirements and likely responses to fertilizer and lime applications. As is the case with most other lines of field research work, the closest collaboration between the laboratory worker and the field worker is essential.

Other types of top-dressing trials include comparisons of various phosphatic fertilizers, in particular of serpentine-superphosphate, reverted superphosphate, and various concentrated and fused products, some of which are giving promising results and whose concentrated form is of particular merit where freight charges are heavy. A series of trials on peat soils is extending the results found by workers at the Rukuhia Soil Fertility Research Station into differing classes of peats. A number of trials are required each year to compare with standard fertilizers various types of proprietary fertilizers for which optimistic claims are frequently made but which rarely stand the acid test of the field experiment. Liming trials of various types, trials with nitrogenous fertilizers, and trials on seed-producing pastures are other types of experiments in progress. A new and interesting venture is the investigation of the pelleting of seed with various inert and fertilizing materials to improve establishment and early growth, more especially of surface-sown clovers.

(*c*) *Pasture Species and Strains.*—Investigations under this classification cover a diverse assortment of problems associated with the establishment and maintenance of a vigorous pasture sward under the various farming soil and climatic types of New Zealand. The production of such a sward not only results in increased carrying-capacity and increased primary production generally, but also is a direct and important means of assisting in the conservation of the soil.

Many trials are laid down with the co-operation and assistance of officers of the Grasslands Division, Department of Scientific and Industrial Research, and are a valuable means of demonstrating the value of improved strains of pasture plants to the farmer. Other experiments are of a more exploratory nature and may not reveal anything of immediate benefit to the farmer. A total of 256 trials is open at present, the majority (142) being trials of various strains and species and rates of seeding of pasture plants. The 22 pasture-establishment trials are of various types, but most are concerned with the establishment of a sward on hill country after the clearance of secondary growth or with the introduction of pasture species into some types of hill-country and tussock-land associations. Most of the 72 trials with surface-sown legumes have as an objective the improvement of hill-country swards deficient in clovers and are associated with different types of top-dressing treatments to achieve this end. It is felt that, although this work is achieving valuable results, there is a definite need to extend it on to large-scale experiments on which controlled grazing of stock can be made and the full value realized by the correct utilization of the feed produced. To do this it is probable that research areas will be required where the part that the animal plays in improving or depleting hill country can be adequately investigated in conjunction with other methods of improving hill-country pastures.

Field trials with short-rotation rye-grass have decreased to 16. This series has been most valuable in demonstrating the potentialities of the strain to farmers in various districts.

Although only 4 trials on depleted land in the South Island are now open, it is hoped to make a new approach to the problem of tussock-land deterioration in the immediate future, and for the first time for many years officers have been appointed who will make a specialized study of tussock-land problems. A block of some 50 acres of depleted country in the Hawea district has been made available to the Department for trials of various types, chiefly the surface sowing of a wide range of species both native and introduced. The Pisa Flat Experimental Area, in Central Otago, is being maintained chiefly as a nursery area where a wide range of introduced species is given preliminary trial. Another area has been established in the Cass district, and it is hoped to have a third near Tekapo in the near future.

(2) *Annual Crops*

(*a*) *Wheat.*—The investigation of the manurial requirements of wheat in relation to soil type and previous history was continued for a third year and the results of comprehensive series of trials are now available for detailed analysis. Wheat variety trials, which make up the majority (28) of the 44 wheat trials, are conducted at the request of the Wheat Research Institute and are the means of field testing the new wheat crosses that institution produces. The trials this year have been generally successful and good use has been made of special experimental header harvesters.

(*b*) *Oats.*—Eight oat variety trials have recently been harvested. The majority of these compared with standard varieties some new crosses bred by the Agronomy Division, Department of Scientific and Industrial Research. Close co-operation is maintained with the Agronomy Division in field trials with crops.

(*c*) *Barley.*—Practically all the 24 trials with barley are comparisons of malting barley varieties. Some new varieties introduced from England and Europe have shown some valuable characteristics for conditions in this country.

(*d*) *Cereal Green Feed.*—These trials compare the green-fodder and dry-matter production of different introduced varieties of oats, barley, and rye-corn. Certain of these varieties have shown special value for different circumstances; some are quick-growing types suitable for late sowing, whereas others are somewhat slower in initial growth but show a better recovery after cutting or grazing.

(*e*) *Brassicas.*—The majority of the 66 trials with brassicas are observational trials with turnip and swede varieties which include selections made in this country and a number of imported lines. Other trials are those with "club-root-resistant" rape, a variety that is to a considerable degree resistant to club-root disease, and 5 trials with chemicals incorporated into the fertilizer in an endeavour to control this disease. To date the most successful of these chemicals has been mercuric chloride. Eight manurial trials with reverted superphosphate are in progress.

(*f*) *Linen Flax.*—The four trials now open include 2 manurial trials, a trial of the value of certain seed dusts, and a rate of seeding trial.

(*g*) *Linseed.*—Trial work with linseed has increased in view of the growing importance of this crop. Eleven of the 12 trials now open are varietal trials, the field testing of a number of new introductions being urgently required, and there is 1 manurial trial. A further expansion of work with linseed is contemplated.

(*h*) *Sugar-beet.*—In a 10-acre field of sugar-beet in the Waimate district that has been sown to investigate the mechanical handling of the crop a variety trial and other miscellaneous trials have been established.

(*i*) *Onions.*—Two trials have been begun with preparations which have proved effective in delaying sprouting of potatoes to see if they will have a similar effect on onions.

(*j*) *Lucerne.*—Nine lucerne trials include comparisons of a selected strain of lucerne now being produced under certification with ordinary commercial strains and sowings of a special variety of lucerne reputed to be well adapted to grazing.

(*k*) *Lupins.*—The 7 lupin trials compare various "sweet" varieties of lupins with brassica crops such as rape and chou moellier in respect of their green-fodder production and their value as lamb-fattening crops. Sweet lupins would appear to be promising crops in those districts where for various reasons the brassica crops are difficult to grow satisfactorily.

(*l*) *Peas.*—A trial of the manuring of peas has been in progress in the Gisborne district.

(*m*) *Maize.*—Eight of the 13 trials now in progress compare various lines of hybrid maize from the United States, some of which have in past years yielded very well in comparison with local types. Five manurial trials are also open. Experimental work with maize is giving very promising results.

(*n*) *Potatoes.*—Of the 46 trials in progress, 27 are variety trials which compare a large number of well-known and newly-selected varieties in a wide range of soils and districts. These trials have been conducted over the past two seasons and are a most valuable series not only for the information they supply, but also as a means of demonstrating less-known varieties to both field officers and farmers. Six manurial trials compare various times of application of sulphate of ammonia, 5 "strains" trials compare the same variety of potato produced in different districts, 3 trials examine the effect of spacing of tubers and size of seed on the production of seed potatoes, 2 trials are of the sprout-inhibiting preparations which are showing promise, and 3 are of a tuber treatment said to control potato-scab disease.

(*o*) *Other Crops.*—These include trials with tangier pea, rye-corn, kudzu, chicory, and crop mixtures.

(3) *Miscellaneous Trials*

(*a*) *Pampas-grass.*—The 4 field trials include comparisons of so-called "strains" of pampas-grass, manurial treatments, intercultivation treatments, and the interplanting of pampas-grass with various species. A report has been published in the *Journal of Agriculture* of the results of a survey of farmers' pampas-grass plantations.

(*b*) *Weed Control.*—The growing importance of chemical methods of weed control after the introduction of the hormone type and other types of weed-killers is reflected in the 156 experiments now open. A comprehensive summary of the results of the Division's research to date, together with reports from other New Zealand research workers, was published in the *Journal of Agriculture.* A large field of research has been opened up with these new chemicals and they appear to be a promising line of attack on the weed problem. Nevertheless, it is felt that a more balanced approach to this most important problem is needed. Such an attack contemplates not only the use of chemicals in weed control, but also the control of weeds through stocking and farm management generally, by fire, by biological means, from the results of botanical studies,

and from plant-competition research. Specialists in weed-control research would appear to be necessary. The spectacular results sometimes achieved by chemical methods of weed control have frequently overshadowed other more practicable and less-costly means open to the farmer.

(*c*) *Cultivation Practices.*—This class includes a miscellany of trials such as the effect of burning of stubble from cereal crops before ploughing, placement of fertilizer trials, and methods of sowing pasture seeds.

(*d*) *Casting Worms.*—The 79 plantations of casting worms will be inspected during the coming year by a specialist officer of the Rukuhia Soil Fertility Research Station. To date the results from the majority of the plantations have not been encouraging.

(*e*) *Blind-seed Disease of Rye-grass.*—Research work on the control of this disease is being carried out in collaboration with other interested Departments. The trials of the Extension Division include the use of various therapeutants, the comparison of various manurial dressings, the effect of time of shutting up the pasture for seed, and the effect of different amounts of clover bottom growth in the sward. A comprehensive survey of field crops to investigate the factors associated with a high incidence of the disease has been conducted during the past season.

(*f*) *Insects and Insecticides.*—These trials include studies of the effects of the liberation of parasites of the weeds St. John's wort and bidi-bidi and trials with various insecticides against grass-grub, crickets, and other insects.

(*g*) *Abnormal Clover Seed Investigation.*—The investigation of the factors associated with a high proportion of red and white clover seeds giving abnormal growths in laboratory germination tests has involved the collection of seed samples from selected paddocks under a number of different conditions. A comprehensive trial has been conducted with various settings of the header harvester to examine the threshing operations likely to give high percentages of abnormal seeds. Various surveys have also been conducted. Most of the samples of seed are now awaiting detailed analysis at the Seed-testing Station, Palmerston North.

(4) *Soil Conservation Research*

A study of the foregoing lists of experiments conducted by officers of the Extension Division will show that a great number of trials could be classed as soil conservation research. This applies more particularly to top-dressing trials and oversowing trials on hill-country pastures. Research into problems associated with the production and maintenance of highly-productive hill-country pastures is also research into methods of conserving soil, for a vigorous turf is to a considerable degree a preventive of soil erosion. The long-range view of maintenance of soil fertility must involve the conservation of soil.

Nevertheless, there is a need for more extensive research work into hill-country problems, and this is planned for the future. Associated with the indirect means of soil conservation envisaged above, more attention will require to be paid in certain areas to direct methods of erosion control such as spaced tree-planting, gully control, and wind-erosion control.

Close collaboration is maintained with other interested bodies through the Soil Conservation and Rivers Control Council. The Field Crop Experimentalist is a member of research committees associated with that Council and a great deal of research work of a collaborative nature is being planned and conducted through the Council's organization. Fields Instructors as members of Catchment Boards are also actively assisting in the research activities of those Boards. A new and special study that is being closely followed up is the distribution of fertilizers from aeroplanes. A considerable amount of research associated with this project is being planned and conducted by the Extension Division.

SUMMARY OF NUMBERS OF EXPERIMENTS LAID DOWN, DISCONTINUED, AND CARRIED ON FOR THE PERIOD 1ST APRIL, 1948, TO 31ST MARCH, 1949

Nature of Trial.	As at 1st April, 1948.	Discontinued during Year.	Laid down during Year.	As at 31st March, 1949.
1. Pasture—				
(*a*) Pasture-production measurement ..	23	6	6	23
(*b*) Observational top-dressing	162	23	37	176
(*c*) Minor element	4	2	5	7
(*d*) Potash survey	20	3	24	41
(*e*) Pasture species and strains	96	15	61	142
(*f*) Pasture establishment (general) ..	15	3	10	22
(*g*) Surface-sown legumes	71	..	1	72
(*h*) Short-rotation rye-grass	22	6	..	16
(*i*) Depleted land	5	3	2	4
(*j*) Miscellaneous	..	..	11	11
2. Crops—				
(*a*) Wheat manurial	9	10	15	14
(*b*) Wheat variety	22	23	29	28
(*c*) Wheat, other	3	3	2	2
(*d*) Oats	9	9	8	8
(*e*) Barley	19	21	26	24
(*f*) Cereal green feed	6	9	13	10
(*g*) Brassicas	43	43	66	66
(*h*) Linen flax	4	6	6	4
(*i*) Linseed	4	5	13	12
(*j*) Sugar-beet	3	3	3	3
(*k*) Onions	..	..	2	2
(*l*) Lucerne	9	..	..	9
(*m*) Lupins	7	8	8	7
(*n*) Peas	1	1	1	1
(*o*) Maize	8	8	13	13
(*p*) Potatoes	42	43	47	46
(*q*) Other crop trials	7	8	11	10
3. Miscellaneous—				
(*a*) Pampas	5	2	1	4
(*b*) Weed control	131	46	71	156
(*c*) Cultivation practices	15	..	1	16
(*d*) Casting worms	79	..	..	79
(*e*) Blind-seed disease of rye-grass ..	9	10	16	15
(*f*) Insects and insecticides	5	10	12	7
(*g*) Abnormal clover seed investigation ..	..	..	39	39
(*h*) Miscellaneous	14	11	13	16
Totals	872	340	573	1,105

RUKUHIA SOIL FERTILITY RESEARCH STATION

Work has progressed very satisfactorily at the Rukuhia Soil Fertility Research Station, both in research and in technical services to Instructors in Agriculture. The Soil Section has carried out a comprehensive investigation of alternate methods of soil analysis to determine those giving best correlation with the results of field trials and also suitable for use by Instructors without laboratory facilities. During the winter a course in the use and interpretation of these methods was given to sixteen Instructors. Kit sets embodying essential equipment have since been issued to these Instructors and also to four Instructors of the Horticulture Division. Further instructional courses will be held and the service extended as the demand arises. Steps have been taken during the year to increase the effectiveness of the chemical laboratory by providing equipment and training staff for two relatively new developments in analytical techniques. One is in the use of spectroscopic methods, which will enable large numbers of samples to be

analysed rapidly—for example for mineral nutrients. The other is the use of radio-active "tracer elements," which will enable accurate data to be obtained on problems presenting great difficulty by ordinary methods, such as attempting to trace the degree of utilization and the ultimate fate of a fertilizer when applied to permanent pasture.

Two factors which are hindering the full development and usefulness of the Station are lack of qualified applicants to fill vacancies and delay in erection of buildings.

Peat Development Experiments.—The experiments on peat land have been continued. Heavy dressings of lime, phosphate, and potash have changed very poor pastures dominant in either Yorkshire fog or brown-top, but with a sprinkling of clovers, into clover-dominant pastures within a year. During the second year the pastures developed into good mixed swards. Plots initially top-dressed two years ago were re-top-dressed last year to determine minimum quantities required to maintain the improvements previously effected; $1\frac{1}{4}$ cwt. of serpentine-superphosphate and $1\frac{1}{4}$ cwt. of muriate of potash per acre were sufficient.

In the development of peat land one of the most important factors is the correct regulation of the water-table, and trials are being extended to investigate methods of controlled drainage.

Spray Irrigation.—The spray irrigation trials have been continued, but the well-distributed rainfall during the summer made frequent irrigation unnecessary. Farmers are taking increasing interest in the possibilities of spray irrigation and the information gained at the Station is being made available through Instructors, field-days, and articles.

Lysimeter Studies.—The lysimeter studies continue to provide interesting information. The amount of drainage water lost during the year represents about 40 per cent. of the rainfall. The annual losses of minerals in terms of fertilizers have been as follows:—

Manure.	Pounds Per Acre.
Calcium carbonate	107
Magnesium carbonate	113
Potassium sulphate	4·8
Superphosphate	1·0
Nitrate of soda	48·5

During the year the loss by evaporation and transpiration from the grass surface was roughly equal to that from an open water surface.

Limestone.—Agricultural lime varies considerably in quality from one district to another according to available sources of supply. A measure of control is exercised over this variability through constant sampling and analysis and the provisions of the lime transport assistance regulations. An investigation is under way to evaluate the importance of the effectiveness of ground limestone when applied to the soil, and hence its relative value. Three principal factors are involved: carbonate of lime content or purity, fineness of grinding, and the essential nature of the stone which determines its hardness and "reactivity." Laboratory studies and pot experiments have shown that fineness of grinding is more important than extreme purity, and that hardness and reactivity (closely-allied properties, the softer stones being more reactive) are important only when the stone is not finely ground. An attempt is being made to express the combination of these factors for any particular commercial lime product as a single numerical value. Before finality is reached it is necessary to check the laboratory findings with large-scale field trials, and these are now being established.

Microbiology Laboratory.—During the past year further soils have been plated, with particular reference to the number of samples required for statistical significance so that a survey of different soils and treatments may be adequately made. Further work was continued on the clover nodule organism in relation to peat soils and the

evaluation of efficient strains. The decomposition of cellulose has also been studied with the object of improving the rate of decomposition of the excess organic matter in peat.

Earthworms.—During the year an investigation was begun on earthworms in relation to agriculture. Preliminary ecological studies have yielded information concerning the habits, breeding cycle, and distribution of the species commonly found. The number of worms in the area so far examined vary between 1,800,000 and 4,800,000 per acre, which figures are considerably higher than those reported for overseas permanent pastures. Gross weights of earthworms are estimated to range between 1,000 lb. and 2,600 lb. per acre.

Control of Weeds.—The Station carried out initial trials with weed-killers as a preliminary to general field trials by Instructors in Agriculture. In regard to the control of the hard-to-kill weeds, gorse and blackberry, no real advances can be reported. Ragwort studies indicate that the application of adequate quantities of sodium chlorate to individual plants gives a high percentage of kills, but that in practice the control of this weed in naturally-occurring infestations requires repeated applications of sodium chlorate, hormone-type weed-killers, or arsenicals.

Laboratory Services.—The routine analytical work covering soil, fertilizer, and limestone samples and pasture dry matter and herbage dissection has expanded during the year. During the year 500 samples of soil were received from field officers of the Extension and Horticulture Divisions and a similar number from field trials as well as some 300 from the research plots at the Station. In general, the samples were treated by quick-test methods. Approximately 100 samples of fertilizers were analysed and 162 samples of commercial agricultural lime as well as 121 samples of limestone were tested. The laboratory also made dry-weather determinations on 2,600 herbage samples and carried out 1,000 herbage dissections.

Plant Analysis Section.—Further information on the reliability of sap-test methods for the diagnosis of deficiencies in pasture and annual crops has been collected during the year. A simple technique for the diagnosis of nitrogen deficiency has been found to give good predictions of responses to nitrogenous fertilizers, especially in crops, and methods for phosphate and potash requirements of pasture and crops have proved useful to supplement soil tests.

Fertilizers and Lime

The rationing of phosphatic fertilizers has been continued during the 1948–49 season and the allocations both for top-dressing and annual crops have been the same as for 1947–48. Appeals were dealt with as formerly. Supplies of organic fertilizers have been controlled and priority given for use in market gardens, nurseries, vineyards, and orchards.

Phosphate rock supplies from Nauru and Ocean Islands have been more plentiful, and with supplies from Makatea the importations of rock will be adequate for maximum production of 600,000 tons of superphosphate from works. For the year ended 31st December, 1948, imports of basic slag were approximately 15,000 tons and of North African phosphate 40,000 tons. Recently the International Emergency Food Committee recommended the deallocation of fertilizers, and thus larger supplies of both nitrate of soda and sulphate of ammonia should become available in future.

The use of lime continued to increase during the year. In pre-war years the annual output of lime for agricultural purposes was in the vicinity of 500,000 tons; the output for 1948 was 1,092,139 tons. Lime transport assistance continued on the same basis as the previous year. Approximately one-third of all lime used is now being carted direct from the works to the farm, and an expanding portion is being handled unbagged.

Irrigation

Development work on the Winchmore Irrigation Station has continued. Cottages for the senior workmen are now almost completed, and when the men are in residence farm-work should improve in efficiency. The dairy-farm has now all the necessary buildings, and full-scale irrigation has been carried out during the year. Steps are being taken to improve the dairy herd through the introduction of cattle from the Ruakura Animal Research Station. The first batch of heifer calves from Ruakura was carried by air, and this method of transport proved highly satisfactory. Good progress has been made with the mixed farm, and development work on this area, which should be completed shortly, should supply important data on the economics of irrigation farming during the coming season. Field-work on the research area has progressed satisfactorily, but fundamental work on irrigation problems has been held up on account of lack of buildings. The research area covers both an irrigation and a dry-land area, and pasture and annual crop, fertilizer, and lime trials are being conducted in both areas.

Demonstration Farms

The Division has continued to be associated with the work of the Northern Wairoa (Dargaville), Stratford, and Waimate West Demonstration Farms, and experimental work on these farms is being revived. The Winton Experimental Farm has been used for pasture, fertilizer, and annual crop trials. The need of the Division for further demonstration areas, particularly in relation to hill-country improvement and marginal land development, is now being investigated.

Land-utilization and Land-improvement

The Division has given increased attention to the problems of land utilization and improvement. Its officers are represented on Catchment Boards and have devoted considerable time to the problems of soil conservation. The Division has also been associated with land-settlement work through representation on the Land Settlement Board (Lands Department) and Farm Advisory Committee (Rehabilitation Board). The Division itself has been mainly concerned with the problems of hill-country pasture-land improvement, land-utilization studies, and the improvement of the over-all volume of primary production.

For many years only spasmodic interest has been taken in the improvement of the 13,000,000 acres of tussock grassland in the South Island. In general the investigations carried out have been done by Instructors who have been able to devote only a small part of their time to the work. Three officers have now been appointed whose main work will be centred on tussock-grassland improvement: the officers are stationed in Central Otago, Mackenzie country, and the upper Waimakariri basin.

The main work in North Island surface-sown hill-country pasture-improvement has been in the demonstration of the efficiency of over-sowing clovers and phosphatic top-dressing. During the year some work on seed pelleting—surrounding the seeds with fertilizer—has been carried out. It is expected that this pelleting will greatly increase the efficiency of both the seed and fertilizer used at the first introduction of clovers to surface-sown pastures. The Division has also been associated with the trials in aerial top-dressing and has investigated the spread of the fertilizers.

A start was made during the year to collect data on farm-management practices and the manner in which land is used in selected counties. The soil maps compiled by the Soil Survey Bureau of the Department of Scientific and Industrial Research were used as the basis of the surveys, and a study was made of the systems of farming carried out in each soil type. So far three counties in Canterbury have been surveyed and a start made in one Otago county and two Auckland counties.

The wheat-production surveys which were begun in the 1945–46 season to collect data on wheat-production practices have been continued in the two areas selected, (*a*) Templeton, Yaldhurst, Prebbleton, and Lincoln districts, and (*b*) Ashburton district, and an analysis has been made of the results to date. This showed that for the area near Christchurch the most important and consistent factor over the three seasons was the history of the field immediately before the wheat crop, differences of up to 38 bushels per acre being obtained between crops after another cereal crop and crops after a fallow. Autumn-sown crops were never poorer than spring-sown, being from 0 bushels to 23 bushels per acre better according to the seasonal conditions in the autumn. The varieties considered, Cross 7 and Tuscan types, showed a net result of no difference over the three seasons. The soil groups, which really differed only in moisture-retaining capacity, showed differences of zero in a good year and 20 bushels per acre in a dry year. The mean yields of all fields for the three years were 34, 39, and 43 bushels per acre.

In the Ashburton area the results, available for one year only, showed differences of a much smaller order. The largest was between crops in fields of different histories. Crops after cereals gave mean yields of 8 bushels per acre more than crops out of grass, contrary to the Christchurch results. This seems to be associated with the extra amount of cultivation required to eradicate the weeds present in old pastures. No other factors produced a significant effect. The mean yield for all fields in the district was 33·5 bushels per acre.

It is yet too soon to draw any definite conclusions, but after the work has been continued in both areas for a further period it should be possible to provide information of considerable value to farmers growing wheat in the areas.

Farm Management and Economics

Because of shortage of staff the Farm Management and Economics Section had to confine its activities to cost-of-production studies and minor investigations.

During the year the Statistical Section analysed the data for five cost-of-production surveys—namely, early potatoes, onions, tomatoes, raspberries, and pig-meat. In addition, the report of the apple and pear cost survey (1947) was finalized and a revision made of the main-crop-potato costing (1947) survey. In addition to the apple and pear cost survey, a comprehensive analysis of apple and pear crop statistics, collected by the Horticulture Division, was completed. A tractor-operating cost survey carried out in Canterbury was analysed and summarized by the Statistical Section. The regular compiling work on butterfat-production, live-stock slaughtering statistics, &c., was carried on, and other statistical work previously carried out by the Fields Division was taken over by the Statistical Section.

Nassella Tussock

The Nassella Tussock Boards operating in North Canterbury and Marlborough continued their work in controlling nassella tussock. Up to the present these control measures have involved inspection of properties, the contacting of farmers for individual control purposes, the grubbing of nassella by a mobile gang on certain heavily-infested properties, and the provision of subsidies for tree-planting on badly-infested areas.

It is intended that some properties which are very heavily infested with the weed should be wholly planted in trees either by the Boards or by the State Forest Service. An amendment to the Nassella Tussock Act passed during the year enabled the acquisition of such land by the Crown for tree-planting. Two areas, one in each Board's territory, have so far been acquired, and will be planted in the near future.

Farmers' Field Competitions

The Division assisted in the organization and judging of farmers' field competitions in all Field Superintendents' districts. Pasture competitions are now becoming more important than annual crop competitions, and hay and silage competitions are being revived. Field-days in connection with the judging of the competitions have been well attended.

Phormium Tenax

With the payment of a guaranteed price, more interest is being taken in the *Phormium tenax* industry and a considerable increase has been made in production, which for the year ended 31st January, 1949, was as follows:—

	Tons.
Fibre	1,820
Tow	320
Unscutched fibre (straw)	3,028
Slipper strips	365
	5,533

Production for the year ended 31st January, 1948, was 4,643 tons, so that there has been an increase of 860 tons for the year under review. Government loans to millers to assist phormium production are still available and three applications for assistance have been investigated.

From 1st March, 1949, the Division took over control of the Moutoa and Makerua Estates from the Department of Industries and Commerce. A management committee under the chairmanship of the Director-General has been set up to supervise the development work and to assist officers of the Department of Scientific and Industrial Research in research work on yellow leaf and other problems at Moutoa.

Food and Agriculture Organization

The supplying of information to the Food and Agriculture Organization of the United Nations has been continued by the Statistical and Economic Section of the Extension Division, though the expanding scope of the work has required at times the co-operation of specialist officers of other Divisions, as well as of other State Departments and relevant organizations.

The major work in connection with FAO is the preparation of the annual progress and programme report, in which details are given of current production and nutritional levels, estimates for the immediate future, and an indication of long-range production programmes. In addition, factual detail is supplied of research, the application of research findings, extension and advisory services, and any other work which will assist in implementing production programmes.

FAO now issues a monthly *Statistical Bulletin*, and this involves the completion of a monthly questionnaire on the latest live-stock, crop, production, and price statistics. During the year food balance-sheets were prepared for a pre-war period and 1947 for inclusion in a special FAO study on nutrition in selected countries. Information was also supplied on a number of other topics, including fertilizers, regulations regarding the importation of plants and plant products into New Zealand, cattle-breeding in New Zealand, and the possibility of establishing a world catalogue of genetic plant stocks.

The improvement in the world food situation over the year has resulted in a considerable curtailment in the activities of the International Emergency Food Council, which is now a council of FAO, but questionnaires on the production and utilization of cereals and oils and fats were completed during the year as well as information on grass and clover-seed production and requirements.

The Division has continued to act as a link between FAO and other Departments, especially the State Forest Service and the Marine Department, with which FAO has to make contact. It has also been responsible for the dissemination of information from FAO, principally through the distribution of reports and documents prepared by the Organization and through statements and articles in the *New Zealand Journal of Agriculture*.

DAIRY DIVISION

REPORT OF H. A. FOY, DIRECTOR

The Season

Practically all districts of the Dominion in which dairying is an important feature of primary production have been favoured with exceedingly favourable climatic conditions. North Auckland, which now produces almost one-fifth of the Dominion's butter, has experienced two very good years, compensating in some degree for the disastrously dry season of 1945–46. South Auckland has been favoured with ample rain and sunshine and little cold weather until recent weeks. Conditions have been similar in Taranaki, Manawatu, and Hawkes Bay; and the Wairarapa, although somewhat short of rainfall in the new year, has since recovered after beneficial rains. Canterbury has suffered somewhat from dry conditions, which, although not so detrimental to other forms of agriculture common to that area, are not at all conducive to butterfat-production. The Southland area, which is the main cheese-producing district of the South Island, has enjoyed favourable climatic conditions for dairying.

The effect on dairy production has been marked and in the season 1948–49 almost record figures for butterfat output will be reached. Though precise figures are not available, there is evidence of a continuing upward trend in numbers of cows in milk. The increases are not large, but the trend does indicate confidence in the dairy industry and augurs well.

Export Values

The total value, for Customs purposes, of all dairy-produce exported during the year ended 31st December, 1948, was £47,839,484, an increase of £5,304,391 over the 1947 valuation of £42,535,093. The products included in this trade are butter, cheese, casein, dried milk, sugar of milk, and condensed milk and cream.

Butter exported during the year was valued at £33,758,188 and cheese at £11,197,024, the values for the previous calender year being £28,835,878 and £11,621,068 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

Following are 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.
1949	138,469	+4·30	90,440	+6·05	150,857	+4·71
1948	132,758	+11·45	85,274	−1·55	144,072	+8·13
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

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.
1949	138,469	93·541	88·16	51·89	11·77	0·06
1948	132,758	93·507	86·89	47·64	12·98	0·12
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

WHEY BUTTER GRADED FOR EXPORT

Year ended 31st March,	Tons.	Average Grade Points.	First Grade.
			Per Cent.
1949	2,526	88·377	83·84
1948	2,414	88·399	81·03
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

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.
1949	90,440	92·249	29·59	67·71	2·69
1948	85,274	92·182	28·35	67·69	3·95
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

The year has been one of considerable development because of diversification in the manufacture of dairy products which has already taken place or is likely to eventuate in the near future. Several butter-factories, particularly in the Auckland district, are now manufacturing buttermilk powder, and consideration is also being given by a number of dairy companies to the manufacture of whole-milk and skimmed-milk powders.

Early in the season the grading and testing of processed cheese and a quantity of buttermilk powder was undertaken, which has given the officers concerned some experience in this work in preparation for any future developments in this sphere.

The grading of these products is largely of an analytical nature, which will entail a considerable amount of extra work in the laboratory and testing-rooms and will require additional technical staff and equipment.

Grading Standards.—The standard of grading at the various ports is on uniform lines and all Graders are performing their duties capably and conscientiously. With the number of officers employed in this work some variation in the standard must be expected, but it is thought that these differences are gradually lessening. Graders generally are becoming more appreciative of uniform standards and realize that individual tastes should be subordinated to this end.

Quality.—The quality of both butter and cheese has been satisfactory. When there is a good season for production, conditions for manufacture are sometimes a little more difficult, but even with the substantial increase in quantity the percentages of both products graded Finest have exceeded those of last season. The percentage of butter graded Finest is the highest for the past ten years and the cheese in this category shows an increase of 1·24 per cent. over last year's figure.

Though defects in colour which occurred at varying periods detracted from some of the Auckland butters, the bulk has been of good quality and there has been a small increase in the average grade over the previous year. Butter passing through the port of Wellington has shown a general improvement, one pleasing feature being less evidence of harshness in flavour.

In the South Island, Taranaki, Wanganui, Gisborne, and Hawkes Bay areas the quality of the butter has also been well maintained, with an improvement in some cases. Some brands of butter in these districts are of outstanding quality, being well made and attractive in flavour.

With the exception of Auckland, the quality of whey butter has been acceptable. The bulk of the whey butter made in Taranaki is of good Grade 1 standard, with some brands outstanding for this type of butter. Although some of the Auckland whey butters are satisfactory, there is room for considerable improvement in some brands.

Some districts show a slight falling off in the percentage of cheese graded Finest, but others have improved. In South Taranaki and to a less degree in the Wellington area cheese in the Finest class has been less in evidence, mainly because of open texture. On the other hand, there has been more cheese graded Finest at New Plymouth, and in Auckland there has been an all-round improvement, one pleasing feature being a reduction in the quantity of lower-scoring lines and also that the cheese has been more uniform in character at this port.

The body of the early-spring cheese lacked the desired smoothness, being somewhat on the sweet side with a tendency to toughness. This was more apparent in the cheese seen at Patea and the Bluff and to some extent in the cheese at Lyttelton and Timaru. Late in the season open texture of the " slitty " type developed and this defect was the cause of keeping many lines out of the Finest grade.

Under all the circumstances with which dairy companies have had to contend, directors and managers are to be congratulated on having improved the quality of their products during a season of increased production, particularly as some falling off in quality could reasonably be expected.

Examination of Stored Butter.—During the season butter was examined after storage at both Auckland and Wellington. The Wellington butters turned out very satisfactory, the points allotted at the regrading being in line with the original classification. The results at Auckland were not as pleasing and it was disappointing to see a number of

brands of butter which had been originally classed as Premium not satisfactory in that class at re-examination. In both cases the period of storage was approximately three months.

Analytical Work.—All officers recognize this work as being essential to the grading system and that care and attention are necessary to obtain accurate results. The need for uniformity in taking samples is of major importance, and though in the past there has been some variation between ports, the general trend is now toward uniformity.

During the season the testing of processed cheese and buttermilk powder was inaugurated, and consignments of processed cheese are now graded and analysed at some of the ports regularly. At present Auckland is the only port receiving buttermilk powder, but with the development likely to occur in the manufacture of milk-powder products the question of facilities and equipment for other grading-stores will have to be kept in view.

Testing rooms and appliances have always been found neat and clean and the work is being performed conscientiously.

Finish and Packing of Butter and Cheese.—Though there have been occasions when the finish and appearance of both butter and cheese could have been better, the outturn of the bulk of the produce has been generally satisfactory.

Apart from the imperfect impression of the Fernleaf brand on the surface of the block of butter, the finish has been neat and the butter well packed. Though the use of the carton container does perhaps tend to cause some obliteration of the brand, a little more attention on the part of the factory operator would result in considerable improvement.

The appearance and finish of the bulk of the cheese have been mainly satisfactory and the rinds, with few exceptions, clean and free from mould. Attention has sometimes been drawn to defective lips and cracked crowns and rinds, but the resultant lowering of the grade is usually sufficient to make the factory concerned pay more attention to this important detail.

Butter and Cheese Packages.—Wooden butter-boxes are very rare, particularly in the North Island. The sub-standard white-pine box is still used by factories in the Gisborne district and in the South Island, and it is also used for whey butter in some areas.

The fibre-board container is generally proving satisfactory, and very little complaint can be made about this box when it is made from material of the required wet and dry bursting strength. An undesirable odour taint imparted to the surface of the butter from one particular brand of cartons used during the season has been the subject of complaint. No specific cause of the trouble could be found, but, as it has arisen, it would appear desirable for a more complete odour standard to be included in the specifications of these boxes. The system under which samples of material are submitted for testing has proved beneficial and as a result many manufacturers have considerably improved the material from which the carton container is made.

Cheese-crates generally have been up to standard and some graders have remarked that the timber generally has improved this season. *Pinus radiata* timber makes a strong and serviceable cheese-crate if the timber is sound and free from knots. In the South Island, beech timber is still used fairly extensively, though in Canterbury most factories are now using cheese crates made of *Pinus radiata* timber.

Processed Cheese.—The grading and testing of this class of cheese for export has been carried out during the season at some ports. Regulations have not yet been drafted to cover the standards of composition, but the work already carried out will prove helpful when this is being done. From information obtained during this period the regulations covering the manufacture and grading of this product can be finalized.

Milk Powders, Including Buttermilk Powder.—During the season some knowledge has been gained by Auckland officers in the testing and grading of various types of milk powders. The manufacture of milk-powder products has developed or is developing so rapidly, particularly in the Waikato and North Auckland districts, that considerable work will be involved in grading all milk powder for export, and it will be difficult to devise the best method of sampling for grading. Some work has been done in the drafting of composition standards for all the different types of milk powder, but a good deal remains to be done to evolve a scheme which is not too cumbersome and yet is efficient.

Dairy-produce Grading Charges.—To meet the present increased costs of providing the grading service the Division found it necessary to increase its charges from the previous rates of 1d. per box of butter and 1⅓d. per crate of cheese graded to 0·0263d. per pound of butter and 0·0124d. per pound of cheese manufactured, the new charges to be payable on total manufacture as disclosed in the annual accounts and balance-sheets of dairy companies.

The old rates and system of charging had remained unaltered since 1932 and over recent years there had been an increasing loss to the Department through the increasing cost of providing the service.

At its meeting in August, 1948, the New Zealand Dairy Board, on behalf of the industry, agreed to the increased rates and to the change in principle by charging on total manufacture instead of on produce graded.

The changes in rates and system operated from 1st August, 1948. Authority for the change was given in the Dairy-produce Regulations 1938, Amendment No. 3 (Serial number 1949/13), which completely replaced Regulation 35 of the old regulations.

Butter Instruction

Manufacture.—The greater part of butter manufactured was of a good standard and seemed to possess sound keeping-qualities.

Feed flavours, notably land cress, were more prevalent this spring, and in the Waikato and Bay of Plenty districts, where the taint imparted to cream was most pronounced, butter manufactured during that period was not up to the usual standard of quality.

Irregular colour in butter from some districts has been more evident and has been responsible for a lowering of the grade. It is obvious that this trouble has increased with the more speedy handling of cream, the speeding-up of the buttermaking process, and the more general use of large churns. Faults in colour are undoubtedly primarily connected with the solubility and incorporation of salt, but this is by no means the only factor, and temperature control, both at churning and earlier during cream treatment, is a relevant factor. The companies who have least trouble are those where the above points are watched carefully and where due care and attention are given to churning technique.

Unwashed Butter.—Several factories have not been washing butter. This appeals to some managers because it increases yields, saves time, saves refrigeration, and because the flavour of unwashed fresh butter is generally better.

One company does not wash its butter because the water-supply is unsatisfactory.

Although experiments in New Zealand have proved that unwashed butter does at times keep as well as washed butter, it is considered that it would be dangerous if butter were not generally washed. New Zealand's reputation for quality dairy-produce has been built on factory practice which included the thorough washing of butter, from which it is considered there should be no departure at the risk of losing that reputation. Every opportunity of discouraging the production of unwashed butter is therefore taken and the assurance of managers that it will be discontinued has been obtained.

Moisture and Salt in Butter.—The same high degree of skill in butter-manufacture continues to be exercised and average moisture contents of 15·7 per cent. to 15·8 per cent. are common.

The salt content of butters ranges from approximately 1·3 per cent. to 1·5 per cent. Where there is an increase above 1·5 per cent., a tendency to bitterness has been noted. With the exception of those cases where spotted colour was evident, salting has generally been satisfactory.

Quality and Grading of Cream.—The general quality of cream received at creameries was sounder than last year and could be further improved if more attention were given to cooling immediately after separation. The importance of this is being continually stressed by field officers, and in many instances where trouble has been experienced with quality the adoption of cooling has resulted in a higher grade.

A correct standard of grading is generally recognized as being in the interests of butter quality, and at most creameries the standard set by Dairy Instructors is being observed. There are, however, exceptions in those areas where there is competition for supply.

In those districts some companies are reluctant to adhere to the standard set and resort to lenient grading. In such cases frequent checks on the standard of grading are made by officers of the Division to ensure that it is uniform between dairy companies.

Dairy-factory Staffing.—The staff position at the majority of creameries can now be considered serious. As very few young assistants are entering the industry, an increasing number of unskilled workers have to be engaged. The trend is anything but satisfactory and a solution of the problem has yet to be discovered.

Cheese Instruction

Starters.—With the exception of Canterbury and Otago, where most factories use mixed-strain starters, practically all cheese-factories throughout the Dominion are using single-strain cultures mainly run on the rotational system.

Though a good deal of success has been achieved in the running of these starters because of the improved apparatus and more careful technique, there is still much to be learnt about the keeping of these cultures active, as none of the systems yet evolved can be claimed to be perfect.

During the season there has been some trouble in every district with dead vats and thin starters. This is to be regretted, as the resultant cheese can be described only as very poor and in most cases fit only for processing. The first few seasons when single-strain starters were used there was no doubt they did assist in the manufacture of a closer cheese in a shorter time, but the feeling is now growing among managers that these starters are not as vigorous as they were and that it is more difficult to make as close a cheese as previously.

Starter failures have been more common in Southland this season, and managers now find that where it was possible to keep one single-strain culture going indefinitely they have to run eight starters on the rotational system to try to avoid trouble.

Penicillin.—A number of managers think that the extensive use of penicillin by suppliers may be a factor in accentuating the problem of dead vats and thin starters. To obtain information on this, Cheese Instructors were circularized during December, and in Taranaki and Southland some evidence was disclosed which substantiated the contention that penicillin was responsible in a few cases for the acid slowing up in the vats. In Waikato, Manawatu, Wairarapa, Canterbury, and Otago no direct evidence could be produced that the use of penicillin had been the cause of either dead vats or failing starters. However, unless milk from cows under treatment is kept out of the cans for forty-eight hours there is a definite danger that the starter and acid development in the vats will be affected by the use of this drug.

Manufacturing Methods.—Methods of manufacture at the majority of factories are generally on sound lines, but there is a tendency at a number of factories to hurry the manufacture too much both in the whey and also before salting. Although in most cases good cheese is being made under these methods, even better results would be obtained if more time were given to the curd at all stages of manufacture. Many managers do not appear to realize that one of the main essentials in making good Cheddar cheese is that the curd must be well cooked and firmed up in the last of the whey.

More attention is being given to the setting temperature of the milk and the temperature of the curd at hooping-time, both important details that have an influence on the body of the cheese.

Milk Grading.—Although milk grading is generally being carried out satisfactorily, there is, unfortunately, still evidence that some companies are grading too leniently, and in spite of repeated instructions to managers to grade according to the standards set, there are some who obviously take the line of least resistance by classifying what should be second grade as passable first.

Though there has been improvement during the past few years, much more could be done at some factories. Some of the faults noted when checking milk grading are : too much methylene blue being used, samples too soft when draining the whey off, samples too cold when grading, and in many cases the grading being carried out too soon.

However, by constant checking on the delinquent managers it is hoped that more favourable results will be obtained.

Curing-rooms.—On visits to factories special notice has been taken of the condition of the curing-rooms and the way cheese were being looked after on the shelves. In most cases the cheese were free from mould and were being looked after better than they were a few seasons ago. In factories equipped with temperature- and humidity-control units there is very little trouble in keeping cheese clean and free from mould.

Temperature control of curing-rooms appears to be gaining in favour, especially in the Wairarapa, where Dalefield, Featherston, Belvedere, and others have been equipped with plants to control the temperature and humidity in their rooms.

Labour in Cheese-factories.—Although shortage of labour was still a problem during the flush of the season in a number of factories, the position was not quite as acute as in past seasons. The class of labour offering has, however, been far from satisfactory, and it is a pity that a better type of young man cannot be induced to adopt cheesemaking as a career.

Inspection of Dairy-produce in Britain

The London office continues to fulfil an important place in the activities of the Division, providing the final link in the Division's association with milk and cream produced on the farm and the Dominion's dairy-produce on the counter of the retailer in the United Kingdom or Europe. Close contact is maintained with all developments of interest to the New Zealand dairy industry, including research, technology, administration, marketing, and distribution. The following are extracts from the reports of the Inspectors of Dairy Products :—

London Report by F. H. Taylor

Continental Visits.—In May, at the request of the Marketing Commission, I visited Switzerland to ascertain the condition of a shipment of unsalted butter which was delivered for that country and transhipped through Antwerp. I was pleased to find the produce had arrived in a satisfactory condition, both in regard to the packages themselves and to the quality of the butter. Samples were forwarded to the town of Vevey, where a conference of Swiss buttermakers was to be held. Swiss butters were taken from cold stores and examined ; some samples of New Zealand butter were also tried and scored according to Swiss pointings. These showed that our butter compared more than

favourably with the Swiss stored commodity. It must be admitted that the high colour of our produce called forth some comment; it was thought that colouring-matter had been added. After my return to London I received some figures from the Chief Government Grader, Dr. Stussi, which indicated that the butters had been submitted to bacteriological tests and that in a number of these the results showed a count which gave some cause for concern. In view of what has recently come to light about a later shipment of unsalted butter forwarded to Belgium, one is inclined to wonder whether we are getting contamination of our butter from a source which has hitherto been unsuspected.

It is quite evident that in future some understanding will have to be arrived at by an International Standards Committee to say just what the total count of infection may be which shall make a product unfit for commercial trading. Unless the spores found can be proved to be of an infectious type and dangerous to the consuming public, surely the keeping-quality of the article should be its guarantee, coupled with its palatability, aroma, &c. This is a subject which could well be taken up by the International Dairy Federation. At the same time, it behoves New Zealand to take every precaution to safeguard its dairy-produce from contamination and from extraneous matter. Instances are not wanting to show that some factories could be more careful in preventing foreign matter being shipped in dairy-produce.

In June I attended a meeting of the Permanent Bureau of the International Dairy Congress which was held in Paris to discuss matters pertaining to the classification and standards to be accepted by the Congress for cheese of varying types; also to prepare for the discussion on the nomenclature of cheese which will come before the Conference to be held in Sweden in August, 1949.

In November a further meeting was called in Copenhagen to formulate plans for the Swedish meeting, and the various committees discussed proposed standards and methods of analysis, &c., of the different dairy products. This meeting was called to coincide with the Danish Royal Dairy Show, which was the first exhibition held since pre-war days. It was a most instructive show; large entries of butter and cheese were in competition, and every facility was afforded to those interested to sample the winning exhibits. New types of dairy machinery were displayed. My interest was attracted to the number of makes of metal churns for buttermaking.

Fibre-board Butter-containers.—These are arriving in increasing quantities and the trade now appears to have accepted them as a standard package. To safeguard the quality of the material used in the construction of fibre-board butter-containers, your office in London has forwarded to Princes Risborough during the past year some sixty-one samples of board. These have been arriving in increasing quantities of late from U.S.A. and Canada. This I regard as a necessary safeguard in order that our source of supply shall not be confined to Scandinavian countries. Recent indications are that the United Kingdom may before long enter the field of competition, for I have had one or two agents calling on me for information about specifications, &c. I am at a loss to know how they can hope to obtain pulp supplies to compete with such countries as Canada, Sweden, &c. However, they state they have every confidence of being able to do so. Incidentally, the testing of these box samples has involved your London office in an expenditure of £149 1s. for testing fees, &c. Personally, I consider the expenditure worth while, for samples of board submitted have shown that it would be easy to forward unsatisfactory material both in regard to wet bursting strength and also from the viewpoint of taint-imparting qualities. I visualize the day when New Zealand will manufacture her own fibre-board and establish a testing-station of her own.

Experimental Cheese.—During the past twelve months consignments of Cheshire-type cheese have been forwarded to Great Britain. A substantial shipment from the Cambridge Dairy Co. was examined within the past few days. From reports from the different merchants to whom these cheese were distributed it would appear that the Massey and Dalefield produce met with considerable approval. However, it must be admitted that some reports are anything but flattering. With the present methods of distribution it is most difficult to get anything very authentic or to be able to follow the distribution of this experimental cheese down to the actual consumer.

I feel that if we can get down to a type of New Zealand cheese similar to Cheshire, it will meet with a good reception in its proper locality. I can appreciate that to make these experiments in small quantities probably involves the dairy company in added labour problems; however, I consider it undesirable for a dairy factory to manufacture a large quantity of produce when the technique of manufacture is not fully acquired. Apart from the difficulty of sorting out all the different vat dates when labour is in such an unsatisfactory state as at present there is always the possibility that the produce will turn out in an unsuitable condition and involve some serious loss.

Returning to the quality of the experimental-type cheese, I appreciate that it will take a long time to evolve a cheese which will meet all our requirements. We have a natural obstacle in our shipping. Cheese must be sufficiently firm to enable them to carry two months on their sides. On the other hand, they must not make too much acid in transit. It may take exhaustive trials to arrive at the ideal cheese, but I think it worth while, and now is the most opportune time for finding this type. The shortage of meat places cheese in a favourable position and a new type would meet with less comment if not altogether satisfactory than at a later period when meat-supplies are more normal.

Australia is also experimenting with new types and several shipments of blue-veined Gorgonzola and similar cheese are being forwarded. The shipments are small as yet and not always satisfactory, but they are on the lookout for something different and doubtless will persevere.

Experimental Butters.—Consignments of butter manufactured by the Swedish Alfa process unit which was recently installed in New Zealand have arrived in London and have been inspected by your officers and Ministry of Food officials. Some interesting features of this product have shown up which give some cause for speculation as to the future prospects of this method of producing butter.

In the main, I think it would be correct to state that up to date this new process does not show any outstanding feature which would make it attractive to New Zealand. In saying this I do not wish to convey the impression that I consider the Alfa process has no future ; on the contrary, I think that in many countries it will be adopted. As I see it, the future of the system will be linked up with the direct packaging of butter into small retail pats, &c., and may possibly be confined to large town dairies which have a retail trade.

The butter presents one or two features which are not common to churn butter. The flavour is somewhat lacking, inclined to be fatty, and in some cases has a scorched taste.

Two of these Alfa machines are now installed in the south of England, and it will be interesting to watch progress and the use to which these machines are finally detailed. We have not been advised of the arrival in this country of any Australian butters made under the Alfa process. It would appear that they are disposing of this butter locally.

Casein.—Two visits have been made to British Plastics factory to examine casein which had been forwarded from New Zealand. The complaint was due to the alleged hardness of the New Zealand produce which resulted in defects in the finished plastics. On our recent visit some comment was made about dirt specks in the New Zealand product ; this will have to be safeguarded against, as these minute spots show up in the finished article. Some satisfaction was expressed by the management about the improvement effected in the quality of the casein which has recently arrived in so far as the hardness of the product and its general outturn are concerned. This, I think, is due to the improved technique in New Zealand factory manufacture.

The Future.—The recent Budget has shown that the Ministry is not prepared to continue for very much longer the subsidies on foodstuffs. In consequence, both butter and cheese have been advanced in price to the consuming public. A table recently published in *The Grocer* shows that if the subsidies existing to-day were removed the position would be somewhat as follows :—

Commodity.	Unit.	Complete Removal.	Retail Price Under Subsidy.
		s. d.	s. d.
Butter	lb.	2 $7\frac{1}{2}$	1 6
Cheese	lb.	1 $10\frac{3}{4}$	1 2
Margarine	lb.	1 $1\frac{1}{2}$	0 10

In the case of butter one wonders what the war years have done to the consuming public in regard to their appreciation of margarine. It is problematic. But how many will pay the high figure for butter when and if we are able to supply the commodity in 1 lb. pats to the customer? The small portion now available has possibly lulled the purchasing public into the fact that on a 2 oz. ration it is only a fractional sum involved and therefore not jibbed at. Will they balk at the larger sum ? Without doubt only the choicest of butters will be able to demand this premium over the price of margarine, and it behoves New Zealand to strive to produce only the Finest quality butter, with outstanding qualities which remove it entirely from the blended margarine which will ultimately be in competition with our butter.

In regard to cheese, apart from the dollar situation the outlook appears reasonably secure for a number of years. The world shortage of meat should secure a firm demand for cheese. The present weekly meat ration in Great Britain of 8d. per person is quite inadequate, and cheese would appear to be the only reasonable substitute for manual labourers. A considerable quantity of cheese of varying types has reached this country from the Continent, mostly blue-veined such as Danish Blue, French Camembert, and Gorgonzola. These are meeting with a ready acceptance at present, but I have noted that some of the most enthusiastic supporters of this variety of cheese have indicated that they are unable to maintain their cheese diet entirely upon this veined cheese. In other words, they get sick of it.

A good tasty Cheddar will hold its own with most of them, but it must be good.

Until meat is in reasonable supply, cheese must be in firm demand. As with butter, once the position becomes more normal Cheddar-cheese consumption will largely depend upon its quality and its appeal to the public. If it is lacking in its characteristic flavour, I feel that the public will turn toward the process varieties and the numerous Continental cheese. As a cheese-producer, Canada would seem to be a diminishing supplier to the English market.

LONDON REPORT BY G. V. WERE

Creamery Butter.—The average quality of our butter, when inspected on discharge, was good. Rarely did we find a brand which had not maintained its grade classification. New Zealand butter is considered by the trade to be the most uniform and reliable butter imported into Britain. This well-merited reputation is the result of many years' effort to achieve perfection. Although we have not reached perfection, our buttermakers have produced a commodity of high quality and uniformity,

A very considerable percentage of our butter is now being distributed in packet form. The packeting of butter is a growing practice and has several advantages from the retailer's point of view. The chief merit in packet butter is its uniformity; no one gets more than his share of the outside of the block, which is often less palatable than the butter underneath. This variable degree of surface taint does not appreciably affect the quality of the butter when mixed into a homogeneous mass for quick consumption; the reworking of butter makes it more plastic and spreadable; it can be salted to suit the taste of different districts; and it saves the grocer's time.

Up to the time I left England all butter was being sold as "National," which in effect means that the consumer may be served with the rationed quantity from any country whose butter may be available or a blend of butter from different countries of origin.

Packages.—The fibre-board carton now occupies the premier position as a butter-container from the point of view of quantity. The best solid fibre-board carton makes an excellent package; it provides adequate protection to its contents, it is light in weight, and occupies a minimum of space. Managers of butter-patting plants in England have informed me that they prefer the fibre carton to any other type of package because of ease in handling and fewer breakages than with wood or saranac boxes.

Cheese.—New Zealand enjoys the reputation of supplying to Britain the most uniform-quality cheese imported from any source. As there is a wide variety of taste in respect to cheese, it is not surprising that our cheese does not suit every-one's palate, but I am of the opinion that a reasonably-clean, mild-flavoured cheese will meet with approval from a larger selection of the community than would cheese more highly flavoured.

Much of our cheese is consumed before it reaches its best condition. This was generally due to shortage of supply, which often necessitated distribution immediately after discharge from ship.

The inspection of New Zealand cheese as a whole is an easy matter, but to examine sufficient vat dates of individual brands to make a report worth while is very difficult under conditions of bulk stowage. I see no prospect of obtaining more cheese reports while this commodity is rationed and is handled in bulk by the Ministry of Food.

Special Cheese (Cheshire Type).—The quality of some of the "Specials" manufactured by the Dalefield Dairy Co. reached a commendable standard of quality. Comparing the best of Dalefield's "Special" with good-quality home-produced Cheshires, which are so popular in the north of England and North Wales, where approximately half the population of Britain reside, is perhaps not quite a true guide to the merits of the respective products.

The comparatively-high fat content of our "Special" cheese tends to produce a body rather too smooth and inclined to be pasty, in comparison with the drier, harsher rub of good-quality Cheshires.

Because we may not be able exactly to imitate a particular type of cheese known as "Cheshire" because of the difference in the composition of milk produced in England and that produced in New Zealand, and our own geographical position, it does not mean that we should abandon hope of securing a fair share of the Cheshire-cheese trade when control and rationing cease.

My experience leads me to believe that New Zealand can produce a cheese which would serve as an excellent substitute for Cheshire during the season from October to March, when the supply of home produce is small.

To any one who has lived in the Cheshire area there can be no doubt about the marked preference of the population for Cheshire cheese.

It may not be generally known to people in New Zealand that all Cheshire cheese does not measure up to a high standard of quality. As a matter of fact, the quality of Cheshire is very variable, and much of it may be described as only mediocre.

LONDON REPORT BY M. H. WALLACE

Routine Inspection Work.—Routine inspection work has been greatly facilitated, as the Ministry of Food office now furnishes us with details of allocations of each ship's cargo to various cool stores throughout the country. We thus have the privilege of being able to choose for our inspection work the most suitable and convenient store listed in the allocation.

The proportion of dairy-produce shipped to main ports for 1948–49 is, approximately: London, 30 per cent.; Bristol, 25 per cent.; Hull and Newcastle, 20 per cent.; Liverpool and Manchester, 15 per cent.; Glasgow, 10 per cent.

Proprietors of cool stores are generally co-operative and helpful, but because of the Ministry's policy of wide dispersal of shipments—small lots to small stores—it is difficult to see as much cheese as we would wish.

Quality of Butter.—So far the quality of this season's make has been very satisfactory and is second to none coming to, or made in, this country. Last week I was privileged to inspect Australian butter from Queensland, Victoria, and Tasmania. Although some of it was very good-flavoured butter, I do not think it is as uniform or fresh in flavour as ours. We must continue, however, to strive to improve our quality. If, therefore, we can impart a little more lactic flavour to the butter without endangering its keeping-quality, the result would be a distinct advantage.

Quality of Cheese.—From Otago and Southland districts ex the s.s. "Port Chalmers" I recently inspected the best and most uniform line of cheese I have seen in this country. They were close boring with firm, waxy bodies and on the whole were very-good-flavoured cheese. However, though in the majority of cases the cheese when ironed conforms in quality to that indicated by the grade stamp, there still appear to be few brands that can retain for more than very short intervals a Finest classification. Unfortunately, a large number of cheese when ironed show web-like fractures in texture which are defined by paler seamy patterns across the plug. In the shops I have seen these fractures or seams open up and the colour-blemish greatly magnified. I should say this is one of the principal defects in our cheese, and generally it seems to be more pronounced this dairying season.

A few consignments of previously-stored old cheese, some of which had developed strong sulphide and other foreign flavour, were, in the main, used for processing.

Market Milk

This report covers the second year of the introduction of the Dairy Division into the market milk industry, during which there has been a marked improvement in the control and treatment of market milk.

Organization.—Dairy Instructors continue to act as local field men for the treating-houses, the Market Milk Instructor at Palmerston North has regularly visited treating-houses throughout the Dominion, and the Superintendent has visited areas which warranted the attendance of a Head Office official. The system continues to work satisfactorily and, because of the improvement in conditions at treating-houses, the Market Milk Instructor has lately been able to make more frequent special visits to difficult areas.

Other Authorities.—Special efforts have been made this year to maintain both a close liaison and a cordial relationship with the other authorities in the market-milk industry. On the production side every effort has been made to encourage the treating-houses and the producer co-operatives to use to great advantage the services of the Live-stock Inspectors. On the retail side efforts have been aimed at co-operating with the Health Inspectors of the local bodies and of the Department of Health, and good results and cordial relationships have been the outcome. Dairy Instructors and Head Office officials have acted in close liaison with the milk authorities and the Milk Committees of the Borough Councils. Where Dairy Instructors are appointees to milk authorities they have generally watched the Division's interests.

Developments.—The major development during the year was the opening of a new milk-treatment station in Dunedin which superseded the old depot in King Street where market milk had been treated for nearly fifty years.

The new station is equipped to handle up to 5,000 gallons of milk a day by considerably-improved methods and there has been a substantial improvement in the supply of treated milk in the district. The station at present can handle only half the total consumption for Dunedin. Aluminium capping and the use of the 38 mm. milk-bottle were introduced to the Dominion (at Palmerston North) in March this year. Despite preliminary troubles, mainly because of slight faults in the design of the milk-bottles, the introduction has filled a long-felt need for a more sanitary type of bottle-cap. The Dairy Division has been largely instrumental in introducing this cap to the Dominion and considerable time has been spent during the year in making its introduction satisfactory.

Another introduction in which the Division had a part during the year was vacuum bottle-filling. The result of the work will be clearly evident over the years in satisfactory reduction in milk wastage in bottle-filling operations in milk-treatment stations.

In the period under review milk-tankers have been introduced into the market-milk scheme. The Wellington City Council now has two articulated stainless-steel road tankers operating between its country depot at Otaki and its milk-treatment station at Wellington. It is probable that this method of bulk cartage of market milk will increase, particularly in Wellington, but to a less extent in some of the provincial areas where balancing quantities of winter milk are drawn by town milk-treatment stations from nearby country creameries or cheese-factories.

Major remodelling and re-equipping have proceeded during the year at Palmerston North, and a new depot in Hastings is almost ready for the installation of the new equipment. Major re-equipping of existing premises has taken place in New Plymouth (bottle-washing, bottle-filling), Gisborne (pasteurizing plant, bottle-washing, bottle-filling), Wairoa (bottle-washing), Balclutha (bottle-washing), Tauranga (pasteurizing, bottle-washing, bottle-filling), and Stratford (bottle-washing, bottle-filling). A small depot was completed in Opotiki.

Milk Quality.—No further progress has been made in the formulation of a grading scheme for market milk and a practical and universal scheme has not yet been introduced to interested parties. To a certain extent lack of adequate laboratory facilities in milk-treatment stations has caused the delay. During the year, however, efforts have been made to have milk-treatment-station operators carry out more frequently the methylene blue test on producers' incoming milks. It is to this testing that much of the credit for the improvement in the finished product can be attributed, particularly as a closer degree of co-operation with the Live-stock Division has resulted in the results of such tests leading the live-stock officers toward those producers whose methods of production have been unsatisfactory.

The appointment by the Live-stock Division of a Supervising Dairy Inspector has assisted this closer co-operation, and this use of the methylene blue testing system should be of some assistance in the introduction of the market milk grading scheme.

Although not directly related to quality of the milk, a general shortage of caustic soda has had an effect on the washing of bottles and thus on milk quality. In many cases when complaints were made about the sterility of the washed bottle the excuse offered was that the shortage of caustic soda prevented a satisfactory job being done in the bottle-washing machine. More caustic soda is gradually becoming available.

Liaison with Milk Division, Marketing Department.—A close liaison has been maintained between this Division and the Milk Division of the Marketing Department.

Technical and General.—Last year's report referred to the increasing tendency to change over from Batch pasteurization to the high-temperature short-time (or H.T.S.T.) method. At present fifteen milk-treatment stations in the Dominion are operating H.T.S.T. plants (six having changed over from the Batch system during the year), eighteen are operating the Batch system (it is expected that four of them will change over during next year to the H.T.S.T. system), and four plants still operate the continuous holder method.

The Dairy Division and trade interests have discussed tentatively alternatives to the caps formed from aluminium-foil. A weakness in this method of aluminium-cap making is that the cap press is mounted directly on the bottle-filling machine, where it is vulnerable to damage by water, steam, and hot detergent. Development would appear to be toward a pre-formed paper-lined steel or aluminium cap being supplied direct to milk-treatment stations in pre-packed cartridge form.

Dairy Laboratory, Wallaceville

The laboratory work during the past year has been slightly more diversified. As some minor investigations have been undertaken, the total number of routine samples is slightly lower. The total figure is 3,447, of which 3,106 are bacteriological and 341 chemical.

Bacteriological.—The principal work carried out in the bacteriological section has again been the micro-biological analysis of butter samples supplied by grading-stores. The results suggest that factories are like suppliers; a few are consistently clean, others are consistently dirty, and the remainder are consistently inconsistent. As this has been observed and commented upon for several years, some means should be found of enforcing a reasonable standard of sanitation of butter-factory equipment. During the past year serious complaints arose about the quality of butter after a long period of storage in Britain. The deterioration was evidently caused by the growth of bacteria, and particularly mould. In another case unsalted butter sent to Belgium was reported on unfavourably because of its content of coliform organisms, the presence of which in large numbers was evident before the butter left New Zealand. Such occurrences emphasize the necessity for a much higher standard of factory hygiene.

A small number of water samples have been examined, and as the results obtained reveal a need for improvement in factory water-supplies generally, an extension of this work is planned as soon as staff and facilities are available. A few starters for cheese-making have been supplied to factories and samples returned tested for contamination.

Chemical.—The principal chemical work has been the examination of a large number of butter samples for copper and iron contamination. Similar analyses have been done on cream samples, and especially on whey cream, to assist Instructors in locating the source of metallic contamination in butter. This work has enabled improvements to be made in some factories, but the high metallic content of a number of samples indicates that there is scope for a good deal more of this work.

A few factory water-supplies have been examined and suggestions made for improvement. The results obtained indicate the need for a great deal more of this work, accompanied by efforts to get the recommendations put into practice. Chemical examinations have also been made of a small number of farm waters which were the subject of complaint. The results show that unsatisfactory features might be easily remedied if simple measures for treatment were applied.

Oxidative changes are important as the cause of defects in butter, and several methods of studying these have been developed in various laboratories, but most methods are of use only after the defects are quite evident. Ascorbic acid (vitamin C) is one of the most easily oxidizable substances in milk and cream, so the behaviour of this in freshly-made butter seemed worth investigating. A series of preliminary experiments showed that ascorbic acid is very quickly oxidized in butter, so quickly in fact that as much as 50 per cent. might be lost while the butter was being melted. Even during the short time required to melt a small sample of about 10 grammes, at least 10 per cent. might be lost. To study these changes a micro-titration method was developed and was used for several series of "kinetic" experiments. The object was to study the rate of oxidation of ascorbic acid in butter serum at different temperatures and in the presence of very small amounts of copper and iron. Very striking results were obtained, and a paper describing this work has been prepared for publication in the *Journal of Dairy Research*.

The market available for dried-milk products has encouraged a number of dairy factories to dry buttermilk by the roller process and also to use the same equipment for drying skimmed or whole milk. The Dairy Division has been asked to exercise some control over these products, and this has involved extension of the laboratory work,

especially at Auckland. The gathering of information about the methods and apparatus required has taken some time, and more attention will be needed as the work develops. Besides the simple compositional analysis of the product, it will be necessary to devote a considerable amount of time to methods capable of indicating the actual quality of the product, including particularly its ability to retain its quality during storage. As distinct from methods for compositional analysis, which are fairly straightforward, methods for assessing and controlling the actual quality are not so well known, because of various factors associated with trade secrets of manufacture. If the essential points of this undisclosed information are to be obtained to avoid the manufacture of an inferior product, there is urgent need for the employment of additional staff who have the highest chemical and bacteriological qualifications for undertaking the required investigational work and for linking it up with factory practice.

Analytical Tests

pH Testing.—During the year 5,992 tests were made, compared with 5,095 the previous year, an increase of 897. The testing was done at nine grading-stores and the number of tests for each was as follows: Auckland, 3,179; Wellington, 1,143; Patea, 290; New Plymouth, 823; Wanganui, 174; Lyttelton, 227; Gisborne, 100; Napier, 33; Bluff, 23. The purpose of these tests is to reveal any tendency toward over-neutralization, which would impart a flat or alkaline flavour to butter.

Bacteriological and Chemical.—The number of samples from grading-stores submitted to chemical and bacteriological examination was as follows: Auckland, 3,229; Gisborne, 172; Lyttelton, 358; Patea, 316; New Plymouth, 823; Wellington, 1,075; Wanganui, 119; Napier, 53; making a total of 6,145, compared with 5,506 for the previous year. As in the past, all samples from ports other than Auckland were forwarded to the Division's Dairy Laboratory at Wallaceville for examination.

Moisture.—Some 120,999 churnings of butter were tested for moisture, and of these only 0·24 per cent. were found to exceed the legal limit of 16 per cent. Churnings tested during the previous year totalled 120,558, of which 0·25 per cent. were found to be too moist. The average moisture content of New Zealand butter graded for export during the past season is estimated to have been 15·684 per cent. This is a most satisfactory achievement and reflects credit on buttermakers for the skill exercised in the operation of manufacturing equipment.

Salt.—Samples of butter tested for salt totalled 119,879, of which only 0·06 per cent. failed to comply with the regulations. For the previous year 120,115 samples were tested, 0·05 per cent. being found to infringe the regulations.

Farm Dairy Instruction

During the year, Farm Dairy Instructors made 117,658 visits of inspection and instruction to supplying dairies, an average of 1,548 visits per officer.

The percentage of milking-sheds classified as good was 19·87, with 54·12 in the fair class and 26·00 as bad; 24·48 per cent. of milking-machines were classed as good, 50·69 per cent. as fair, and 24·82 per cent. as bad. It is evident from these figures that the sanitary conditions of many sheds and machines could be improved. New milking-sheds erected during the year totalled 1,141, and the number substantially reconstructed was 838, compared with 1,109 and 990 respectively for the previous year.

Repairs and renovations to milking-sheds have again been hampered by the shortage of cement, and to ensure that quantities which were available would be utilized to the best advantage priority certificates were issued by Farm Dairy Instructors in accordance with the urgency of the work to be done. This practice was the cause of criticism in some districts, but generally the scheme worked very well.

To improve the farm dairy instruction service, reforms calculated to impress on those producing milk and cream the need for greater attention to the hygienic condition of milking-machines and dairy equipment were introduced two years ago. The changes in policy providing for a more positive approach to uncleanliness are progressing very satisfactorily and a tighter standard is evident in all areas under supervision. Farm Dairy Instructors with more confidence have implemented this policy thoroughly; others have made a slower and less satisfactory response. Nevertheless, the tighter policy as expressed by the serving of notices to ensure immediate cleanliness is expanding rapidly and can be expected to develop further as confidence develops. Such notices, and the temporary prohibition of supply in appropriate cases, have been served in all supervision areas during the year, and the Dominion total of notices served (about 4,000) and prohibitions of supply (about 150) will be approximately double the total of the previous year.

This more positive policy of farm dairy instruction has generally had an enthusiastic reception by the industry, and many dairy companies have commented on the effectiveness of this approach to improving dairy-produce quality. Some dairy companies have not only supported the present practice, but have suggested that the policy could be tightened still further. Several companies have expressed their appreciation of the apparent improvement in milk and cream quality, which they believe is due to the more direct attack on uncleanliness in supplying dairies.

The farming community has also accepted the new policy in a reasonable manner, and despite the serving of about 4,000 notices and 150 prohibitions of the removal of dairy-produce from dairies, only two cases in which action was disputed are known. This says a great deal for the respect in which Farm Dairy Instructors and the system of farm dairy instruction are held and for the tact and discretion of officers who make these enforcements. If such enforcements are made fairly and tactfully, an uncompromising attitude to uncleanliness will be readily accepted by the industry and will have the support of dairy companies and their suppliers.

Rotational inspection, which was adopted at the same time as other innovations, has been justified and has resulted in an increased number of visits to dairies with a reduction in the mileage travelled per visit.

Caustic soda, which is generally used for cleaning dairy equipment, is still in short supply, and though other detergents have been used as substitutes, the results obtained from some have not been altogether satisfactory.

To meet the present increased costs of providing the farm dairy instruction service, the Division found it necessary to increase its charges. On the basis of the industry meeting three-fifths of the cost, rates of 0·008d. per pound of butterfat credited to suppliers and 4s. per supplier had been levied on dairy companies from the inception of the national farm dairy instruction scheme in 1938. Because of increasing costs over recent years these rates had proved too low for the purpose of recovering the industry's share of the costs, and increased rates became necessary. The new rates were fixed at 0·012d. per pound of butterfat and 6s. per supplier and came into operation on 1st August, 1948. Authority for the increase was given in the Farm-dairy Instruction Regulations 1949 (Serial number 1949/14), which replaced the Farm-dairy Instruction Regulations 1938 and amendments.

Progress has been made toward the objective of farm dairy instruction of maintaining and promoting the quality of farm dairy production. Though there has been greater emphasis on the inspectorial aspect of the work, instruction has not been lost sight of, and methods of education complementary to the work in the field are being considered.

Milking-machines

During the year 1,456 new and 953 used milking-machines, a total of 2,409 machines, were installed. In the previous year the figures were 1,425, 995 and 2,420 respectively.

Check Testing of Milk and Cream Samples

This work was continued as part of the routine duties of Dairy Instructors and Special Inspectors, who during the year checked the factory testing at 736 visits and checked 4,547 samples. The check testing revealed that with few exceptions the work had been carried out accurately and conscientiously. Warnings about compliance with the regulations were issued where necessary.

Check on Yields and Overruns

The check on yields and overruns is of great interest to the dairy industry, as it involves the reocrded payout of dairy companies.

The Division carries out fat analyses on all butter and cheese submitted for grading and is thus able to assess butterfat received compared with that credited at dairy factories. The competitive element in the industry is not lacking and tends to cause some short-crediting; some yields and overruns cannot be substantiated by analyses. By constant contact between divisional officers and dairy-factory managers the position is being kept reasonably well in hand.

Crediting by butter-factories is not unsatisfactory. A number of returns show slight under-crediting, and efforts are made to reduce the incidence of this. Yields of cheese-factories present much more difficulty, as they involve assessment of a greater number of variables in losses of manufacture, and, more particularly, variation in sampling methods. Some cheese-factories show short-credits and others over-credits, which illustrates how difficult solution of the problem is. Milk-sampling investigations by the Division's Instructors with the aid of the Dairy Chemist have continued, and though a great deal of information has been obtained, the problem of correct milk sampling is not yet solved.

At the request of the company a large amount of work was carried out at a Taranaki cheese-factory to investigate alleged faulty sampling methods. Litigation on short-crediting of butterfat between a supplier and the dairy company is pending and the Division's findings in the investigation are likely to be prominent in the hearing of the case.

The whole question of yields and overruns requires further investigation, and it is clear that under-crediting is not necessarily deliberate.

Government Herd Recording

The year has been noteworthy because of changes in the system of preparing and issuing monthly returns and also because of some extension to the Division's service to testing breeders. There has, however, been little improvement in staff numbers and transport, and it has been difficult to cope with the continued increase in entries.

During the year 697 breeders were listed, compared with 642 the previous year. Cows on C.O.R. test number 1,257 and cows on O.H.T. 12,452, compared with 1,419 and 9,649 respectively for 1947, a decrease of 162 cows for C.O.R. and an increase of 2,803 cows for O.H.T. The total number of cows on test, 13,709, is a record and an increase of 403 per cent. over the pre-war period.

It was necessary during the year to ask approval for an increase of 6 in the staff of Milk-testers, and the present establishment is 52. The number employed at 31st March, 1949, was 45. The testing staff is constantly changing, and of the 20 appointments made during the year, 15 were required to fill vacancies because of resignations and 5 as an increase to staff. Many of the programmes are too large and necessitate too much overtime and leave insufficient time for special checks, but some of the necessary further appointments cannot be made until more motor-vehicles are available. The introduction of the "all-cow" rule, which is considered fairly urgent, also depends on the additional transport required being available.

A major change in routine was the preparation of monthly Government official herd test returns by testing officers and their checking and issue in the Department's offices at Palmerston North and Hamilton. It is too early to say whether the change has increased efficiency, but the arrangement has enabled the monthly official herd test returns to be brought up to date. The relief to Head Office clerical staff has in turn enabled C.O.R. returns to be brought almost up to date.

A start has been made on a lifetime production merit service for cows. This has long been needed and the introduction of the service has been commended by breeders. It should assist to maintain and possibly increase membership. Requests for a sire survey service continue to be received, and this service should be introduced as soon as there is sufficient staff.

New Buttermaking Processes

The trial with the Alfa continuous buttermaking unit which was begun in the Waharoa branch of the New Zealand Co-operative Dairy Co., Ltd., in October, 1947, was continued until February of this year.

The Buttermaking Processes Committee, which is representative of dairy organizations, was in control of the investigations throughout the trial, and the Technical Subcommittee continued direct supervision of the investigation on behalf of the Buttermaking Processes Committee. Nearly all the cream used in the trial was vacuum-pasteurized, and because of the dilution which occurs with this method it was seldon found possible during the winter and spring to manufacture butter of legal composition because of moisture-control difficulties. It was also found that where the moisture content of heavy cream was reduced below 16 per cent. by the concentrator there was a drift in the moisture content of the cream which at times amounted to a variation of more than 1 per cent. moisture in the butter. In an endeavour to overcome the difficulties of moisture control, various adjustments to the concentrator were made, one of which was to reduce the throughput of cream treated to the minimum, but even this did not have the desired effect. Three shipments, each of 20 tons, of Alfa butter have been sent to London, and reports received from officers of the Dairy Division there and others associated with the trade indicate that because of the difference in body character from standard butter and a tendency to become oily in warm weather it does not compare favourably with butter manufactured by the orthodox churning process. The body of the butter, on examination in Britain, was in a shattered condition and it separated in layers as the parchment paper in which it was wrapped was being removed for inspection. Butter in that condition is unsatisfactory for patting and, besides the detraction from its general appearance, handling difficulties are increased.

The quality of fresh Alfa butter is considered less attractive than that of churned butter, and the keeping-quality appears inferior to that of standard butter.

The yield of Alfa butter, because of the lower percentage fat loss and higher curd content, is somewhat higher than that of churned butter, but this does not apply when washing of churned butter in granular form is omitted.

In manufacturing-costs the process appears to have little saving to offer in power, refrigeration, or labour. At 31st March all phases of the Alfa trial were completed and the plant was dismantled and stored. The Buttermaking Processes Committee will later consider whether further tests will be conducted or the whole trial concluded.

The Senn machine, which was expected from Switzerland last spring, has not yet arrived, and delivery has been deferred until tests now being made have proved its efficiency.

Milk Powder and Processed Milk

As indicated in this report last year, a number of butter-manufacturing companies were displaying an interest in buttermilk powder and skim powder made by the roller process.

Companies have naturally sought to establish their drying ventures on a long-term basis, and as the United Kingdom Ministry of Food is prepared to engage in long-term contracts through the Dairy Products Marketing Commission it is likely that twenty-two units will be making buttermilk powder during the 1949–50 season. Some of these dairy companies will undertake roller skim powder production through their buttermilk-drying units.

It has been shown that in New Zealand, where daily-collected sweet cream is available, buttermilk powder of good quality can be produced. In the past buttermilk powder has been considered fit only for cattle-feeding, and this is still the general opinion in the Northern Hemisphere. The New Zealand product is suitable for confectionery, baking, and other industrial uses, and there promises to be a future for it.

Quality, however, is very important, and the Ministry of Food has made it a condition of the offer of contract that all buttermilk powder and roller skim powder should be covered by Government quality and composition certification.

This responsibility has been accepted by the Dairy Division and will involve the grading and analysis of all shipments of these products. In addition, the Division has undertaken to provide instruction in manufacture, a service already keenly sought. This is an extension of the functions of the Dairy Division and is in line with a long association with butter and cheese. The Dairy Division is also responsible for the administration of the Dairy Factories (Licensing) Regulations 1936 and Dairy-produce Regulations 1938 to ensure, as far as practicable, that there will not be a redundancy of units and that those established will be in conformity with suitable standards of construction and equipment.

It is expected that upward of 2,500 tons each of buttermilk powder and roller skim powder will be available to the United Kingdom Ministry of Food for the coming season.

Casein.—Approximately the same quantity of casein was manufactured this season as last. Regular instruction was given to companies manufacturing casein. All the export surplus of both lactic and rennet casein was shipped to the United Kingdom Board of Trade.

A good standard of quality has been maintained in the production of lactic casein, orthodox methods of manufacture being adhered to. Although the quality of the rennet casein has not been quite as satisfactory because of its hard and lumpy texture, it is hoped with the aid of more modern plant and by making some adjustments in manufacture to produce an article which will be more acceptable to overseas users.

Dairy Industry Developments

Products Other Than Butter and Cheese.—Though butter and cheese remain the staple products of the dairy industry, interest in other products has grown, and in the 1949–50 season there will be a major increase in milk-powder manufacture. The large sugar-of milk factory at Kapuni, in Taranaki, is now in full operation, dealing with the whey from a group of large cheese-factories and using efficiently an important milk constituent most of which was formerly wasted.

Dairy Products Marketing Commission.—The Division continues in close liaison with the Commission, particularly in relation to the Division's responsibility for quality of all manufactured dairy products and storage and shipment conditions. The marketing of products other than butter and cheese now undertaken by the Commission has further developed the association between the Commission and the Dairy Division.

Mechanization of Cheese-manufacture.—Financed jointly by the dairy industry and the Government, the Dairy Board has set up a committee to investigate, sponsor, and develop means by which the labour burden in the manufacture of cheese can be

eased through further mechanical aids. Although the committee has been functioning less than a year, it has considered a number of proposals and has already decided to sponsor a mechanical device for the handling of cheese curd. This machine will assist in one of the most laborious phases of cheese-manufacture and should also provide a means of encouraging the right type of young man to this important industry. The Director of the Dairy Division represents the Government on this committee.

Cheese from Reduced Fat.—The increasingly-high fat content of much of the milk available for cheesemaking is again causing the industry some concern. The New Zealand Dairy Board, representing the industry, has asked for some trials to be made in the manufacture of cheese from milk from which some of the fat has been removed. These trials are being considered, and all interests have in mind the knowledge gained from the previous experience of standardized cheese during 1929 to 1931.

Dairy Factory Supply Regulations.—These regulations, which cover the zoning of supply to dairy factories, were for a number of years administered by the Executive Commission of Agriculture, of which the late Sir Francis Frazer was Deputy Chairman. The death of Sir Francis necessitated a change in administration, and since 20th October, 1948, the New Zealand Dairy Board, with whom the Director of the Dairy Division is associated in an advisory capacity, has been the zoning Authority. These zoning regulations are of importance to the dairy industry, and the new administration has already dealt with a number of matters within the scope of the regulations.

Committee on Dairy Legislation

As a result of approaches to the Hon. the Minister by the New Zealand Dairy Board, after discussions at the National Dairy Federation and Dominion Dairy Conference in 1947, a Committee was set up by Cabinet on 5th February, 1948, to investigate dry shareholding in co-operative dairy companies and to ascertain the adequacy of existing articles of association to provide for immediate and future developments of the dairy industry and, if necessary, to prepare a model set of articles of association for the industry.

The Committee comprised Mr. H. A. Foy, Director of the Dairy Division, Chairman; Mr. C. H. Courtney, Secretary, New Zealand Dairy Board; Mr. F. W. Groom, Office Solicitor, New Zealand Co-operative Dairy Co., Ltd., representing the industry; and Mr. E. C. Adams, District Land Registrar, Wellington, representing the Registrar of Companies.

Preliminary meetings of the Committee were held in Wellington, and to obtain necessary statistical data a circular was sent to every company by the Chairman of the Dairy Board. Much information and many worth-while suggestions and recommendations were received, and the Committee decided to summarize the principal suggestions and submit them to all companies so that the industry's opinions might be obtained. As a result, more information and suggestions were received.

The Committee, after considering all suggestions and recommendations, formed an opinion on some major principles as a means of remedying the position. It then visited Whangarei, Palmerston North, Stratford, Hamilton, Gisborne, Carterton, Blenheim, Christchurch, Invercargill, and Dunedin to discuss the whole question with representatives of each company. Meetings were arranged in each centre visited and every company in the area was invited to be represented at the meeting. After each general meeting individual companies were also invited to meet the Committee in private for a discussion of their own particular problems. The interest shown by the industry in the matters before the Committee is indicated by the fact that over 200 of the 262 companies operating in New Zealand were represented at these meetings.

The Committee met finally in Wellington to consider what recommendations should be made and for the drafting of its report. This report was handed to the Hon. the Minister on 31st January, and approval has been given to the printing and circulation of the report to interested parties. The report is at present being printed, and it is hoped to circulate it in the near future.

Dairy Industry Scholarships and Bursaries

During the year arrangements were completed for the following scheme to be operated by the New Zealand Dairy Board out of a special fund to which the Government and Board each contributes £1,360 per annum :—

(1) The award annually of—

(*a*) One degree (Bachelor of Agricultural Science—Dairy Technology) scholarship of £280, of which £100 shall be paid during the first professional year and £60 during each of the three succeeding years of the professional course.

(*b*) Twenty-five Diploma in Dairying bursaries of £100 each, payable £30 within a fortnight after commencing Stage I of the course for the Diploma in Dairying, £35 within a fortnight after commencing Stage II, and £35 within a fortnight after commencing stage III.

(2) The scholarships and bursaries to be tenable only at Massey Agricultural College, Palmerston North.

(3) Degree scholars and diploma bursaries to be selected by a committee comprising the personnel of the Dairy Factory Managers' Registration Board and a representative of the Education Department.

By providing financial assistance to selected dairy-factory workers the scheme will assist in the qualification of key personnel in the industry and will give encouragement to younger men to equip themselves for managerial and other administrative positions.

Redundant Cheese Plant

Officers of the Dairy Division, in conjunction with representatives of the National Dairy Association, are still trying to clear the equipment still remaining from the cheese plant which became redundant as a result of the change back to butter in 1942. The original list value of the plant was £64,000, but this has been reduced considerably by disposals over the past years. The few items now remaining unsold naturally have a greatly-reduced market value and are proving difficult to sell. When the account is closed a substantial loss in realization will undoubtedly be revealed, but when the special nature of the plant and the fact that in the main it could be of use only in cheese-factories are considered the results will not be unsatisfactory. It is expected that the redundant cheese plant accounts will be cleared up within the forthcoming year.

Dairy Factory Managers' Registration Board

New applications for registration dealt with by the Board for the year under review totalled 39, certificates being granted in 26 cases. There are at present 653 holders of certificates on the register ; 226 hold creamery managers' certificates, 362 cheese-factory managers' certificates, 7 first-class cheese and second-class butter, 1 first-class butter and second-class cheese, and 57 first-class certificates for both butter and cheese.

LIVE-STOCK DIVISION

REPORT OF W. C. BARRY, DIRECTOR

Climatic Conditions

The production season has been a very favourable one in all respects. Although parts of Wellington Province were affected with a drought in April, 1948, rain fell during the month, resulting in good grass growth, and this prevented some loss of stock and much loss of condition in dairy herds.

Fortunately the winter was mild, and stock losses, though serious for some owners, were not as heavy as expected. However, many animals had to be removed from the Taihape, Feilding, and Wanganui area to other districts where feed was more plentiful. At that time the outlook for the winter was not promising in the districts most seriously affected.

The flooding in the Gisborne district during May resulted in the loss of some thousands of sheep and other crop and pasture damage. The winter and spring were mild, and with an evenly-distributed rainfall a very good season has been experienced. Large amounts of hay and silage have been saved in all North Island districts and the winter prospects are quite good.

In the first quarter of the year in many parts of Canterbury April, May, and June were drier than usual. The weather was mild and hay and chaff were used extensively in the feeding of stock. A mild winter followed and in July pastures freshened remarkably. A fairly even rainfall month by month ensured a good season for the sheep-farmer. Lambs did very well, but some were sent to the works without being properly finished because of scarcity of feed.

Wool prices reached record levels at some sales and stock prices remained at a high level throughout the year.

The seasonal report from Otago was also a favourable one. Sheep had wintered well in one of the mildest winters on record. A very good lambing percentage followed, and the feed prospects were good. With the exception of North Otago, where conditions were dry, the rest of the province as well as Southland had a good rainfall and a good grass season.

Because of a very evenly-distributed rainfall the production season has been good for the sheep-farmer and the dairy-farmer. It is expected that an increase in the output of butter and cheese will be recorded. The health of live-stock has remained good in all districts.

Health of Live-stock

HORSES

No serious disease of horses has been recorded during the year. Steadily-increasing use of tractors has resulted in the breeding of farm horses falling away, and it is now difficult to purchase animals suitable for farm-work. There is continued interest in light horses and ponies and the breeding of thoroughbred horses.

CATTLE

Diseases Scheduled Under the Stock Act

The number of cattle condemned under the Stock Act during the year for tuberculosis amounted to 6,295; 5,477 were condemned on clinical symptoms and 769 as reactors to the tuberculin test, and an additional 49 positive tests were carried out by club veterinarians. In each case compensation was paid in accordance with the provisions of the Act. The tuberculin test was applied by Departmental veterinarians to 18,265 cattle, of which 769 reacted, giving a percentage of 4·2.

The total number of cattle, exclusive of calves, examined at the various abattoirs and meat-export slaughterhouses was 596,881, a decrease of 90,501 on last year's figures. Of these, 37,793, or 6·3 per cent., were found to be affected with tuberculosis in varying degree, a large percentage being only slightly affected. This indicates an increase of 0·2 per cent. infection among cattle slaughtered in these premises.

The testing of dairy herds supplying milk for town supply has been practically in abeyance during the year, as the basis of compensation to be paid to dairy-farmers for reactor animals has not been settled.

A total of 3,724 dairy cattle in herds registered for town supply were tested and 274 reactors were found. In addition, 11,311 cattle were tested at the owners' request and 2,514 head of stock were tested at the various Government farms under the control of several Departments. The balance of 716 comprised tests applied to cattle for export, imports, &c.

Actinomycosis (and Actinobacillosis).—During the year 530 animals were condemned for this disease, while a large number of animals were successfully treated with iodides.

Malignant Growth.—The number of stock condemned was 150, a decrease of 68 on the figure recorded the previous year. Compensation was paid in accordance with the Stock Act.

Johne's Disease.—A total of 244 animals were condemned for this disease under the Stock Act, the majority of the animals being in the Taranaki district. The control of spread of this disease has presented many problems, and a start has been made in the vaccination of calves against the disease. The vaccination of calves on six farms in Taranaki and three farms in the Waikato has been carried out. The results will be carefully watched by the Department.

Anthrax.—No cases of anthrax occurred during the year. Protective vaccination of herds on farms previously infected is giving very good results.

Blackleg.—The numbers of calves vaccinated against this disease in the affected areas were: Taranaki, 25,732, and Auckland, 34,647, making a total of 60,379.

There is an increase of 1,732 in the number of calves vaccinated in Taranaki, whereas the Auckland figures show a decrease of 1,999 when compared with the figures for last year.

There were 267 outbreaks in the Auckland district, compared with 280 the previous year. This involved the vaccination of 6,146 calves on 267 farms. In addition, 28,501 calves were vaccinated on 1,425 farms as a preventive measure.

Non-scheduled Diseases

Mastitis.—Field officers of this Division have co-operated with research officers on the work being carried out with penicillin in the treatment of mastitis in dairy herds.

The major change during the year has been the wide distribution of penicillin cerate and its general use by farmers in the treatment of mastitis. Field veterinarians throughout the Dominion organized a series of demonstrations on the correct method of use of penicillin, and in all districts these demonstrations were attended by large numbers of dairy-farmers. The demonstrations resulted in a wide distribution of penicillin to farmers. Observations and reports indicate that the results have been remarkably good. This is the most efficacious remedy for mastitis ever introduced. Reports obtained from four or five reliable users in each district are summarized as follows:—

Quarters Treated.	Cured.	Remained Light.	Dried Up.	No Response.
880	721	107	28	21

The effect of this excellent result on culling is already evident. One farmer who, over the previous three years, culled 100 cows for mastitis, this year lost none. It is suggested that a lessened demand in Taranaki this year from the Waikato for yearlings is due to reduced culling in the Waikato herds. This trend may become more apparent.

Contagious Abortion.—Vaccination of heifers against this disease has been carried out again this year. In the Wellington district field officers vaccinated about 31,000 calves during the year. Applications for the vaccination of 67,643 calves have been made in the Auckland district. A very heavy programme of vaccination work has been carried out by field officers in all parts of Auckland Province. Even in Canterbury, 6,173 calves were vaccinated. The use of the vaccine in herds in Otago and Southland is increasing.

Temporary Sterility.—Some field officers describe this trouble in dairy herds as delayed conception or temporary infertility. In many field investigations there is little of a pathological nature to account for the cows returning in heat, and a careful examination has been made for trichomoniasis. It is significant that from one district reports show less trouble this year, probably because of an abundance of green feed throughout the season, whereas from another district the trouble was more prevalent, coinciding with a particularly dry season in which pasture growth was more or less dormant.

Grass Staggers.—The incidence of this disease in dairy herds was low last spring, the season being favourable in all respects. On the west coast of the South Island this trouble occurred in a more serious form than in normal years. After a mild winter, grass growth was rapid and farmers did not continue feeding out hay. Veterinary assistance was provided in dealing with the disease.

Milk-fever.—Because of a good grass season after a mild winter, few cases of milk-fever were seen in the early spring. The incidence increased in some of the later-calving cows. This disease responds well to modern treatment.

Mortalities from Poisoning.—All mortalities in stock are investigated by field officers. During the year mortalities occurred from a number of causes. In the Lumsden district a number of cattle died after access to fescue-seed cleanings from a seed-dressing plant. Another large mortality was investigated on the west coast of the South Island, where the deaths were attributed to fern poisoning. Poisoning outbreaks caused by arsenic and lead have been confirmed in several districts. A number of pigs were poisoned after access to rabbit carcasses poisoned by phosphorus.

Parasitic Disease of Young Cattle.—Parasite trouble in young calves was prevalent on the west coast of the South Island. Although it is rather well controlled by the use of phenothiazine worm medicine, parasitic trouble requires to be carefully watched by all farmers.

SHEEP

Climatic conditions were very good and pasture growth in most districts excellent. Sheep flocks wintered well in one of the mildest winters on record. Lambing percentages were high, ewe flocks being flushed at tupping-time. Seasonal conditions favoured good birth weight in lambs, and the climate in the spring was in every way favourable. It is generally expected that the average weight of fat lambs killed will be slightly heavier than that recorded the previous year. In a few districts, however, because of markedly dry conditions, lambs were sent forward to the works in an unfinished condition, lambs being light and consequently grading out a bigger percentage of seconds than normally. The North Otago district was very seriously affected in this way during the summer.

Shearing operations were carried out under favourable weather conditions, the wool-price being a record in some districts. Dipping was generally successful and no serious loss or mortality resulted. There was no recurrence of the post-dipping lameness which occurred in some flocks the previous year. The measures taken to prevent lameness have been in every way satisfactory.

Dipping has been effective in the control of lice and keds, but some pens of infested sheep have been found in saleyards. Inquiry into the reasons for these infestations invariably reveals that the sheep have not been dipped for a variety of reasons.

Lymphadenitis.—The incidence of infection found in mutton carcasses in the South Island is at the same level as that recorded last year.

Pregnancy Toxaemia.—The incidence of this disease in ewe flocks last spring was remarkably low, and there was a similarly low incidence of bearing trouble. The winter was one of the mildest on record in many districts and green feed was available practically throughout the winter. There were no severe snowstorms or series of frosts such as might cause a check in the feed-supply, and although ewes had to "work" on the short green feed, they arrived at the lambing stage in excellent condition. As they approached lambing and afterward, the feed-supply gradually improved.

Milk-fever or Hypocalcaemia.—Because of the excellent winter it was not surprising to find an increase in the incidence of this trouble in ewes at lambing-time. Cases occurred in ewes both before and after lambing, and in some parts of Southland the number of ewes affected was a big increase on figures of previous years in that district. Very good results were obtained from the use of calcium borogluconate as a subcutaneous injection.

An increased number of ewes was affected with the disease in many parts of Canterbury.

Parasitic Gastro-enteritis.—Hoggets wintered well and a minimum of parasitic trouble was experienced in most districts. The season was favourable to young sheep and many owners are using phenothiazine worm medicine as a routine procedure.

Contagious Ecthyma.—In those districts where this disease is known to occur it is being well controlled by vaccination. The vaccine is supplied from the Animal Research Station, Wallaceville, at the request of owners.

Facial Eczema.—Because of a spell of warm, dry weather during the summer there was considerable anxiety about the possibility of an outbreak of this disease after rain. Examination of livers of lambs and sheep at meat-works indicated that liver damage was taking place in stock from a fairly wide area. Actual clinical cases of eczema have not been numerous, though sheep grazed on short pasture at such places as showgrounds or sports-grounds were quite seriously affected with the disease. On these special areas grass lawns had been mown during the year and subsequent pasture growth could be expected to be particularly dangerous.

Even though many clinical cases do not show up in a season of the type just passed, there is a feeling that damage to the livers of many sheep has been caused.

In another district 75 per cent. of a small flock showed clinical symptoms. Here again there were special features of local pasture and climatic conditions.

Blackleg in Sheep.—The incidence of blackleg in sheep in several districts is increasing. An increasing amount of vaccination of sheep against the disease is being carried out by stock-owners. Even in South Island districts blackleg has been shown to be the cause of mortalities in areas where the disease was previously unknown. The organism has been isolated from sheep of all ages from very young lambs to ewes at lambing-time.

Although the disease is preventable by vaccination, it is disturbing to sheep-owners to find that more vaccination of their flocks has to be carried out if losses from this disease are to be controlled. In his report on this disease the Live-stock Superintendent, Dunedin, writes :—

The disease is widespread throughout the district and particularly in the West Otago, South Otago, and Southland areas, in localities where the concentration of sheep is highest.

Losses in both hoggets and older sheep have occurred associated with crutching, shearing, lambing, and dipping. Other cases do occur unassociated with any of these operations where no visible macroscopic lesion is seen. In these cases small microscopic lesions could be present, dental changes may be responsible, and there is also the possibility of so-called idiopathic cases of blackleg.

Large numbers of sheep have been vaccinated with the blackleg vaccine supplied by the Animal Research Station, Wallaceville, and though the vaccine has not been used under exact control conditions, results have been apparently good. Several thousand sheep were vaccinated. The exact figures are not available, but as an example 18,000 were vaccinated in the Tapanui district, 19,000 in the Balclutha district, and 11,000 in the Gore district.

With the extension of this work it is obvious that vaccination will have to be done largely by the farmers themselves. Every endeavour will be made by field officers to hold demonstrations of the procedure and to assist in other advisory ways. Considerable care is necessary to avoid losses due to infection at the time of vaccination.

Tetanus.—This anærobic infection of lambs has increased at marking-time. Although tetanus infection was always a risk when lambs were being marked and docked, field reports tend to show that larger numbers of lambs have died on infected farms. Further inquiries require to be made into the incidence of this infection.

Transit Tetany.—A rather unusual incidence of this disease affecting lambs is described by the Live-stock Superintendent, Christchurch, as follows :—

A line of lambs brought from Kaikoura and sold in Addington saleyards were railed to Ashburton. When they were taken off the train they were kept overnight in the railway yards. When driven on the roads next morning quite a number went down, a total of 33 being affected. Eight died, and of the remainder that were treated with calcium borogluconate by subcutaenous injection 21 recovered.

PIGS

The number of pigs slaughtered for the season 1948–49 at premises under inspection was 615,148, a decrease of 9,475 on last year's figures.

Inspection of the carcasses at time of slaughter revealed that 84,570 carcasses were affected with tuberculosis in varying degree, the percentage being 13·7. This is an increase of 0·4 per cent. as compared with last year.

Diseases of Pigs

Suipestifer Infection.—This disease of pigs crops up year after year on many properties. No very serious losses have been suffered by individual pig-owners, but collectively the disease is responsible for a lowered output of pigs.

Tuberculosis in Pigs.—One or two heavy incidences of tuberculosis in pigs were found on meat inspection, and inquiry at the source tended to show that the producers concerned had been feeding inadequately-cooked garbage and offal.

The susceptibility of the pig to tuberculosis has been stressed on numerous occasions and all producers must know of the risk involved when pigs get access to food of doubtful quality. If there is any reason to suspect garbage or other food, it should be sterilized by boiling before use or eliminated from the food-supply for pigs. It is an offence under the Meat Act to allow pigs to be fed with any diseased meat or to allow them to be fed with any part of the carcass of any animal that has not been boiled. The boiling of garbage before use is also compulsory as a protective measure against pig diseases.

Kidney-worm Infestation.—Examination of specimens at the Wallaceville Laboratory showed that 2 sows out of 21 on one property were harbouring this parasite.

Other Diseases.—A type of lameness in pigs, described as foot-rot, is being investigated in the field and at the laboratory. It appears that pigs kept in confinement on concrete are much more susceptible to the disease than pigs that run at pasture.

Losses of pigs because of faulty husbandry rather than of any specific disease occur from time to time.

Swine Husbandry

Pig-meat Production.—In spite of changes in operation of a number of dairy factories during 1947 and 1948 which involved the drying of increasing quantities of skimmed milk and buttermilk, the sow population of the Dominion appears to have reached its lowest figure in 1947 and the number of sows one year old and upward on farms at 31st January, 1948, showed an increase of 416 to 68,354. The decline in sow numbers had been continuous over the previous eleven years.

The apparent stabilizing of the sow population indicated a pig-meat production of about the same volume as last year. In all important dairy-farming districts, however, the dairying season has been an outstandingly good one, with the result that food-supplies available for pigs are up by approximately 7·5 per cent. to the end of March as compared with the same period last year.

The number of pigs killed in the year ended 31st March, 1949, compared with the previous year is as follows :—

PIGS SLAUGHTERED, TWELVE MONTHS ENDED 31ST MARCH (INCLUDING ESTIMATED FARM AND RURAL SLAUGHTERHOUSE KILLINGS)

Year.	Porkers.	Baconers.	Choppers.	Total.
1948	198,142	437,296	22,585	658,023
1949	189,000	437,332	22,276	648,608

The drop in number slaughtered for the season up to 31st March is represented almost entirely by the lower porker kill. This can be taken as a direct reflection of the feed-supply in the two years, the dry autumn in 1947–48 forcing farmers to finish a larger proportion of their pigs as porkers. It is expected that for the meat year ended 30th September the deficiency will be more than made good.

A summary of the sow population and pig-production to 30th September each year over the past seven years is as follows :—

Year.	Breeding-sows (as at 31st. January).	Total Pigs Slaughtered, Year Ended 30th September.	Pigs per Sow.	Slaughtered as—			Total Weight of Pig-meat in Carcass Form. (Tons).
				Porkers, 40–120 lb.	Baconers, 121–200 lb.	Choppers, over 200 lb.	
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	9·3	256,821	385,782	21,672	38,437
1947	67,938	645,728	9·3	198,631	423,368	23,729	39,491
1948	68,354	650,464	9·5	195,903	432,299	22,262	40,384

Because of a good dairying season, particularly in the earlier months, the higher average weight of pigs killed contributed more to the increase in tonnage than did the increase in number of pigs slaughtered, which was only 0·7 per cent.

The Department is conducting a survey of costs of production of pig-meat on dairy-farms at the request of the National Pig Industry Council.

Grading.—Without an effective grading system the industry lacks a very important plank in its policy of expansion and improvement. The National Pig Industry Council has so far failed to reach agreement on the subject of introduction of grading standards which will be more selective than those in operation to-day and which will enable a worth-while premium to be paid on the desirable type of pig. A trial of the system recommended by a committee set up by the National Council for the purpose is being conducted at eighteen freezing-works this season, and it is hoped that all parties will agree to action being taken along the lines of introducing an effective system in the near future.

Feed-supply.—Although there has been an exceptionally good dairying season, the pig-feed supply has lacked balance because of the scarcity of concentrated foods. Although prices for barleymeal have been up to £22 per ton, it has still been economic to use limited quantities for creep feeding and generally for sows and other pigs in periods of shortage of dairy by-products. Much more would have been used had it been available. The change back to shipping more meat in carcass form has resulted in less meatmeal manufacture in the current meat year, and this has further affected supplies of pig-feed. The two lowest grades of tallow, "K" and "L," have been released for pig-feed over the winter, and will again be available over the coming winter. This will enable the successful wintering of many more pigs than would otherwise have been possible.

Pedigree Sow Recording.—Seventy-three litters were officially recorded during the year (excluding those withdrawn before completion). It is disappointing that the sow-recording scheme is not made use of by pedigree breeders to anything like the extent that is desirable. That it is a symptom of the general lack of interest in pig-production at the moment is no consolation to those who are trying to administer schemes to increase the efficiency of the industry. Field officers whose duties include the weighing of litters feel that the sporadic type of recording they are called on to carry out is of little value, and efforts are being made to indicate the need for more consistent and more widespread recording of pedigree stock to assist breeders in developing their improvement methods.

Carcass-quality Scheme.—This scheme, designed to assist both the breeder and commercial pig-raiser in the selection of breeding-stock of the most suitable type and the management of fattening pigs so that the most desirable carcass is produced, has suffered because of lack of incentive, which should operate through an effective grading system. The total number of pigs reported on during the year was 55.

National Advisory Service.—The National Pig Industry Council has continued to control the advisory service to producers through District Pig Councils. The decline in pig killings forced the Council to recommend an increase in the pig levy to 6d. per head, and this became operative from 1st October, 1948. It is hoped that the fund obtained from the increased levy will enable an extension of the work at present carried out.

Survey Work.—In the meantime, with the assistance of the Department, survey work is being undertaken in the industry. In addition to the survey of costs of production already mentioned, a husbandry survey aimed at discovering the main reasons why the industry over the past five years has produced only 9·3 fat pigs per sow per year is being carried out. District Pig Council Supervisors are carrying out the field-work of this survey, and the organization and analysis are the responsibility of the Department. This survey is planned as the first of a series of investigations into problems of the industry which can be tackled by the industry's own advisory service in co-operation with the Department.

Meat Inspection and Slaughter of Stock

There was considerable difficulty in maintaining the efficiency of meat-works during the war because of scarcity of material for new buildings and extensions. Many extensions and improvements are now being carried out as more material becomes available. The enlarged buildings will provide better facilities for the handling of stock, for general staffing at works, and for the accommodation of employees.

Little difficulty was experienced in obtaining labour during the season, but in some cases it was necessary to provide accommodation for single men.

The following table shows the number of stock slaughtered at registered premises during the year ended 31st March, 1949 :—

Class of Stock.	Abattoirs.	Meat-export Slaughterhouses.	Total Slaughterings Under Direct Inspection.	Plus Rural Slaughterhouses.	Total at Registered Premises.
Cattle	180,877	416,004	596,881	64,397	661,278
Calves	40,302	1,120,501	1,160,803	733	1,161,536
Sheep	843,838	3,206,370	4,050,208	246,216	4,296,424
Lambs	142,276	12,228,754	12,371,030	18,698	12,389,728
Pigs	110,487	504,661	615,148	11,818	626,966

Of the animals shown in the table as slaughtered at meat-export slaughterhouses, the following have gone into consumption within the Dominion: cattle, 61,954; calves, 44,496; sheep, 415,903; lambs, 238,056; pigs, 238,095.

The following table compares the numbers of stock slaughtered during the past three years at meat-export slaughterhouses only :—

Class of Stock.	Year Ended			Increase or Decrease Compared with 1948.
	31st March, 1947.	31st March, 1948.	31st March, 1949.	
Cattle	438,095	516,660	416,004	100,656 (decrease).
Calves	999,526	1,065,037	1,120,501	55,464 (increase).
Sheep	3,659,296	3,383,099	3,206,370	176,729 (decrease).
Lambs	11,620,861	12,595,950	12,228,754	367,196 ,,
Pigs	481,545	520,250	504,661	15,589 ,,

The following table shows killings of sheep and lambs at meat-export slaughterhouses for four seasons, 1st October to 31st March (six months only) :—

Stock.	1945–46.	1946–47.	1947–48.	1948–49.
Sheep	2,594,571	2,348,620	2,232,301	2,300,880
Of which ewes were	1,967,187	1,729,109	1,703,989	1,875,339
Lambs	8,735,367	8,246,064	9,243,204	9,294,635

Compensation Paid for Stock and Meat Condemned

Compensation amounting to £20,124 was payable during the year for animals condemned in the field under the provisions of the Stock Act, and £16,917 16s. 9d. for carcasses or parts of carcasses condemend 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, 82; sheep, 433; pigs, 4; horses, 114 (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, 89; sheep, 43; pigs, 4.

Exportation of Stock

During the year the following animals were exported: cattle, 163; sheep, 596; pigs, 221; horses, 278. Of this total of horses, the movement of thoroughbred horses to Australia accounted for 255 animals, the remaining 23 animals being trotting stock.

Dairy Inspection

The registration of town-milk-supply premises is carried out by officers of the Division in the various centres. The supervision of these town-supply producers requires constant inspection, and frequent visits are necessary if a high standard of production is to be maintained throughout the year.

It is generally accepted that the maintenance of a supply of high-grade milk is more difficult in the warm summer months, during which many problems quite apart from the production of good milk at the farm arise. There are adequate cooling to ensure the keeping-quality and twice-daily collection to be considered; also the treatment and distribution of the treated product to the consumer.

To supervise and co-ordinate some of these problems in the various supplying districts a Supervising Dairy Inspector was appointed during the year. This officer has given assistance in dealing with pure-milk production in many districts and has assisted very materially in his contacts with the several interested authorities. Thus, the discussions with the milk authorities, the producers' associations, the treating houses, and other interested parties have proved of distinct benefit to all concerned. On the whole, the standard of production has been good, and the supervision of milk-supply for local consumption is being closely watched.

Many new sheds have been erected during the year. Field officers are concentrating on instruction and advice on up-to-date and hygienic methods of milk-production, and the handling of milk is receiving attention at all stages.

Poultry

The general position in the poultry industry has not changed substantially as compared with 1948. The demand for eggs still exceeds the supply, except during the "flush" period of production in the spring. Once again supplies of poultry-food have not permitted any expansion in the industry. It became necessary during the past year to import appreciable quantities of fowl-wheat from Australia into the South Island to supplement supplies of wheat grown there and released to poultry-producers. Poultry-producers again claim that egg-production has been affected adversely by food-supplies. There appears to be foundation for this claim in the North Island, mainly because of the irregularity with which wheat consignments arrived from Australia and the consequent necessity for changes in the rations fed. Egg-production was affected by these circumstances in particular during the winter. Birds react adversely to food changes more rapidly in winter than at any other time.

There are, however, indications of the food position improving during next year. No appreciable improvement in production will take place until poultry-breeders hold and mate increased numbers of birds for the breeding season. It is doubtful whether the prospects of an improved food situation influenced poultry-producers sufficiently to affect the breeding season which starts next July.

An important change in policy occured during the past year. The subsidy of 2s. 9d. per bushel on fowl-wheat has been removed and the price of wheat to the poultry-producer increased proportionately. To offset this increased cost in production the subsidy on eggs passing through authorized egg floors has been increased by 3½d. per dozen. It is too early yet to assess the effect of this change, but the increase in the price of wheat and mash as a result of removal of this subsidy is more apparent to many producers than the increase in egg-prices. On the other hand, the increased egg subsidy will tend to draw more eggs on to egg floors and to assist the equitable distribution of supplies available.

No serious trouble has been experienced in maintaining an adequate supply of poultry mashes in all districts. With prospects of an improved food-supply, consideration is now being given to increasing the food value of standard mashes by including additional wheatmeal. This will be appreciated by poultry-producers, and should be of marked benefit to laying pullets during the winter.

Contrary to the position in 1947, when power cuts caused trouble during the incubation and rearing season, poultry-producers experienced a good hatching and rearing season in 1948.

New Zealand Poultry Flock Improvement Plan.—Further progress has been made with the Poultry Flock Improvement Plan. The following table indicates the development of this plan since it was started in 1945 :—

—	1945.	1946.	1947.	1948.
Number of flocks accredited ..	28	71	105	142
Number of breeders accredited ..	5,508	15,428	26,783	41,862

The conditions under which the plan operates are controlled by a committee the members of which own accredited flocks. These conditions are administered in the field by officers of the Department. There are indications that the plan is resulting in improved stock on the farms included under this scheme.

Poultry-diseases.—Losses from disease continue among poultry flocks and the disease causing most concern is leucosis (including big-liver disease and fowl paralysis). Poultry-producers are making increased use of the diagnostic service offered by the Animal Reserach Station, Wallaceville. The addition to the field staff of a whole-time Poultry Veterinary Officer has been appreciated, and the amount of work offering for this officer has been greater than he could cover satisfactorily. A second full-time field Poultry Veterinarian has now been appointed, which makes available an officer for this class of work in each Island.

The service given by the Department in testing prospective breeding birds for pullorum disease has been expanded. Approximately 140,000 birds were tested for the presence of this disease in 1947, and the number has increased to nearly 200,000 for 1948.

The Poultry Demonstration Plant, Upper Hutt.—Marked progress has been made at the Poultry Demonstration Plant, Upper Hutt, during 1948. The shortage of poultry-foods rendered it necessary, since the establishment of this plant, to restrict the number of birds raised and maintained, but with the recent improvement in food-supplies it became possible to rear more pullets this year. After an excellent rearing season, therefore, both the pedigree breeding and the experimental laying sections have been fully stocked. During the rearing season it was found possible to carry out initial feeding tests using livermeal. Livermeal has a high riboflavin content, and in spite of its present high price it may well prove to be a valuable and economical form of protein concentrate for chick-rearing. The initial experiments will be repeated in 1949–50 before any results are published.

A mash containing livermeal was fed to breeding-stock to ascertain the effect, if any, of this meal upon hatchability of eggs. This experiment also will be repeated during the period July–October, 1949.

On 28th March, 1949, a breeders' laying trial was started at the plant. This consists of pens of 20 pullets each of any breed entered by poultry-breeders from any part of the Dominion. Egg-laying trials in the past have been for single birds or for entries of 5 pullets and run largely upon a competitive basis. This new trial is designed to afford poultry breeders the facilities for testing 20 pullets for future breeding purposes based on egg-production, egg size, and the quality of the birds as prospective breeders. It is not being conducted upon a competitive basis. It will be appreciated that from 20 carefully-selected birds the owner has an excellent chance of obtaining a breeding-pen of between 10 and 15 birds which prove to have the desired egg-production and qualities of a breeding-bird. Accommodation for twenty-four entries only was available this year, and fifteen entries, representing 300 pullets, were received. As this was an innovation in egg-laying trials, a quiet start was anticipated. The trial lasts for forty-eight weeks (until February, 1950), and if reasonable results are obtained there are indications that many more entries will be forthcoming next year. By establishing this new breeders' trial the Department is adding to the facilities offered to poultry-breeders to improve the poultry stocks of the Dominion. The trial will be closely linked with the New Zealand Poultry Flock Improvement Plan.

Wool

The Market for Wool.—The outstanding feature of the past season has been the maintenance of record prices for almost all grades of wool. So marked has been this feature that returns to farmers have been as good or better than during the previous season, in spite of the alteration in the exchange-rate. The large stocks of wool accumulated during the war are being disposed of at a very satisfactory rate, and according to the most reliable estimates world consumption of wool is outstripping world production by 27 per cent. at present. The only danger is that if this shortage becomes chronic and prices remain very high a great stimulus will be given to the production of cheaper and ever-improving wool substitutes.

Experiments and Investigations.—This season work has been concentrated on tests for the efficient use of spray dips. Power-spray dips have rapidly become popular in New Zealand and a large number have already been installed. The Department is concerned with seeing that they are used efficiently, and to this end a number of tests have been carried out. There are a number of variable factors concerned which all have a bearing on the efficiency of wetting of the sheep, among which are length of wool, time of immersion, and pressure with which the dip is sprayed on to the sheep. These factors and a number of others have been checked and recorded with a view to advising users of spray dips on their efficient operation. Each district Sheep and Wool Instructor has now been supplied with a gauge for testing pump pressures on spray-dipping installations and can thus render a useful service to owners.

The problem of moth damage to stored wool is no longer acute, as most of the old stocks of wool are being rapidly reduced and there has been no further necessity to fumigate stores with "Gammexane" smoke generators.

Wool-marking Preparations.—A steady demand continues for testing new wool-marking preparations for scourability. Manufacturers still seem to be having difficulty in securing certain pigments and are having to make up preparations containing alternatives. This would also explain the relatively-high proportion which failed to pass the Department's test for scourability and so did not obtain approval for manufacture and sale. A total of 58 samples were tested and 35 of them were successful and were approved.

A few complaints are still being received from woollen-mills and buyers about harmful non-scouring branding-fluids. There are three likely sources of these—namely, old stock-pile wools, old stocks of non-approved branding-materials still in the hands of farmers, and home-made non-scourable branding preparations made up by farmers themselves or approved substances which have been spoilt by the addition of such ingredients as linseed-oil, spirits of turpentine, &c. The first two sources of trouble will automatically right themselves with the passage of time, but the other will be a continuing problem. It appears that, in spite of the publicity given the matter, there are still many who are unaware that it is against the law to use anything other than approved wool-marking preparations. All Inspectors of Stock are now fully aware of this, and their aid has been enlisted in an educational campaign to farmers.

The Wool-clip.—The clip for 1948–49 has been for the most part better grown than last year because of the mild climatic conditions over most of the country.

Prices for wool have again been good, with an increasing demand from Canada, India, Russia, Germany, and Japan creating good competition along with better-known clients from England, France, and the United States of America.

Late shearing has been responsible for the number of acquired faults such as seed, burr, and water stain which have shown in later offerings, but growers have not taken as much trouble to skirt or class their clips as in previous years, no doubt because of lack of trained personnel to do the job.

It is very noticeable that when wool which was reasonably well skirted and classed was offered there was very animated competition for it.

North Island: The Auckland clip opened up very well for the first sale. The wool was light in condition and for the most part well grown. There was not much seed or discoloration present, except in the skirtings. The wool from then on, however, acquired faults, the main ones being seed and discoloration, and it was apparent that growers were not taking as much care in the preparation of the clip as previously.

Napier: The first sale at Napier was a two-day one and a very large amount of wool was offered. The "trade" was most enthusiastic about the wool, remarking that it was the best offering for many years. The clip was well grown, light in condition, and of a good colour. Burr was the only fault in some fleece lines and skirtings. At later sales the wool, though still well grown, was dusty and heavier in condition and the seed and burr, which is a curse in Hawkes Bay and Poverty Bay, was very noticeable and depreciated values to some extent.

Wanganui: Wool from the Wanganui district has never had the colour or condition of clips from other districts because there are such a wide diversity of farms and farming methods and such extreme variations in soil types, pastures, and climatic conditions. However, the amount of good wool is improving each year, though many farmers still practice the out-of-date "all in" method when selling their wool.

The wool opened up in fair condition and colour, though most lines were touched with seed and the wool was not well got up for market. The oddments showed seed and water stain from some of the wetter districts.

Wellington: The wool opened up for the first sale at the beginning of December, 1948, in very good condition and colour and with very little vegetable fault. Woolly hoggets were sound in stable and the lambs' wool was attractive but rather short. Except for some inferior clips from the Nelson district, later sales have maintained this record, and growers in the Wellington district have had an excellent year for wool-prices. The oddments were quite good and showed very little seed.

Christchurch: Merino, half-bred, and crossbred clips are well represented in this district, and all types were well grown and light in condition and showing only slight vegetable fault. As the season advanced, however, and the later-shorn clips came in they were found to be dusty and were touched with burr. Oddments were good to average but touched with burr.

Timaru: This district, embracing as it does most of the large Merino sheep-runs, shows some very good Merino wool each year, and this year has been no exception, the wool being well grown and showing plenty of quality. Half-bred wool was also well grown and even in quality, though these wools were not as attractive as were earlier offerings from other districts. Crossbreds opened up disappointingly, being inclined to be "mushy" and heavy in condition. Oddments were good to average from all types of wool.

Dunedin: It has been a good wool season for this district. The sales have shown that the offering was good- to average-style wools in all qualities. The wool was well grown and was exceptionally sound in all crossbred wools, and the oddments of the clips were good. Merino and quarter-bred wools were a little heavy in condition but were soft handling and even in quality. In the first sale the hogget wools were very sound in staple, but later these inclined to be a bit tender.

Invercargill: In previous years the ewe and wether wool from this district has been weak in the staple, but this year that fault was very little in evidence. The selection this year was well grown, bright and light in condition, and the oddments of the clip were of good to average grading and at least 2 per cent. higher yielding than last season.

A table showing New Zealand sales, weights, and values for the last five years follows; no figures are yet available for the 1948–49 period:—

Season.	Number of Bales sold.	Net Weight.	Gross Value.	Average per Bale.	Average per Pound.
		lb.	£	£ s. d.	d.
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
1946–47	934,730	308,347,839	23,136,014	24 15 0	18·00
1947–48	844,522	286,004,976	29,868,425	35 7 4	25·06

Rabbit Nuisance

As predicted in last year's report, the Rabbit Destruction Council, which came into office on 5th April, 1948, has already proved of inestimable value in fostering the constitution of additional rabbit districts. During the past year 16 new districts were constituted, involving a total area of 2,382,000 acres. Some 122 Rabbit Boards are now operating, covering an area of 20,729,367 acres and concerning approximately 23,761 ratepayers. The fact that rabbit districts have been constituted voluntarily in the Central Otago and Mackenzie districts, where previously little progress in this direction was made, augurs well for the ultimate complete coverage by rabbit districts of all rabbit-infested areas in the Dominion. Previously it was found impossible to form rabbit districts in back-country areas of low stock production, mainly because the land was not capable of standing an incidence of rating to return sufficient revenue to enable a "killer" policy to be carried out by a Rabbit Board. These areas were usually worked by free-lance rabbiters, who confined their activities to the late autumn and winter, when the skins were most valuable. This system simply tended to perpetuate the rabbit in these areas. The recent statutory provision for the payment of

grants to needy Boards from the proceeds of a levy on rabbit-skins produced and sold in New Zealand, in addition to the Government subsidy on rates levied and collected has facilitated the establishment of rabbit districts in these low-production areas.

On the recommendation of the Rabbit Destruction Council a 10-per-cent. levy on the market value of rabbit-skins operated from 16th June, 1948. For the period ended 31st March, 1949, the sum of £36,536 was collected and credited to a special deposit account in Treasury. Of this sum, £29,458 has been paid out to Rabbit Boards by way of grants on the recommendation of the Council. In addition, further grants were made from the Consolidated Fund totalling £21,690. Subsidies paid to Boards on rates collected amounted to £136,303. This makes a grand total of £187,451 paid to Boards to assist them in their campaign for the elimination of the rabbit.

The Council has been encouraging the amalgamation of small contiguous rabbit districts, and indications are that considerable progress in this direction is being made. One amalgamation concerning three districts has been completed during the year. These amalgamations are desirable, as they provide greater efficiency in rabbit-control measures and reduce administration costs.

In terms of section 21 (1) of the 1947 amending Act, the Rabbit Destruction Council recommended that only three Boards be authorized to continue conducting an inspectorial policy.

Inspectors of Stock have continued to play an important part in rabbit-district formation, and their initiating action in many cases has been instrumental in additional districts being formed. They have co-operated fully with the Rabbit Destruction Council, and the value of this assistance has been freely acknowledged by the Council.

With the assistance of the Wheat Controller, better-quality pollard was made available during the year to those (including the Department) who manufacture phosphorized pollard. As a result it has been possible to manufacture a satisfactory mixture. Strychnine and rabbit-traps have continued in good supply.

There has been a marked increase in the rabbit population in areas outside Board control. The winter in all districts was particularly mild and breeding was practically continuous. As a result of the steady fall in skin prices beginning in August and the effect of the exchange adjustment, free-lance rabbiters working on the basis of "skins-in" ceased operating much earlier than usual and little or no work has been done by land occupiers in the interim. Unless these areas are brought under Board control, no permanent improvement in the position can be expected. The occupiers are now appreciating the real value of Board control and the constitution of new rabbit districts is expected. Labour and accommodation problems have confronted a number of Boards, but generally splendid work has been accomplished by Boards and the pest is under firm control.

Noxious Weeds

Again little work has been done by land occupiers to clear their lands of noxious weeds. Although chlorate weedicides have been in short supply, various hormones which are effective on a wide variety of weeds have been available. Labour has been a limiting factor in weed control in some districts. Generally local authorities administering the Act have continued to do good work, particularly with ragwort. Grants have been made to enable weeds to be attended to on Crown and Maori lands.

It was expected that the Noxious Weeds Act, 1928, would be amended by incorporating the principal recommendations made by the Special Noxious Weeds Committee, but this was not found possible. The new proposals when brought into effect should materially assist in bringing about an improvement in the noxious-weeds position on farm lands through the agency of County Councils.

ANIMAL RESEARCH DIVISION

REPORT OF J. F. FILMER, DIRECTOR

There has been a steady development in the work of the Animal Research Division during the year and this has been accompanied by a marked growth of public interest in the Wallaceville, Ruakura, and Manutuke Research Stations. At Ruakura especially the number of visitors and the demands on the time of the research staff have become quite embarrassing. The collaboration of farmers' organizations is being enlisted with a view to arranging an annual farmers' week in addition to a few field-days to enable the maximum number of stockowners to discuss the investigations with research workers with a minimum disturbance of the work. In order to reach the much larger number of farmers who cannot visit the research stations, conferences of extension workers are held and these officers are then able to pass on the latest results of the investigations. During the year the second annual conference of departmental veterinarians was held at Wallaceville, the main theme being extension work. An extra-mural course of two weeks was provided at Wallaceville for eighteen final-year veterinary students.

Diagnostic Services

There was a very marked increase in the work of the Diagnostic Section at Wallaceville, as shown in the following table, in which the 1947–48 figures are given in parentheses :—

Numbers and Types of Specimens Examined, 1st April, 1948, to 31st March, 1949

Species.	Cases Submitted.	Samples Examined.	
Cattle—			
Blood samples	419	1,978	
Milk samples	217	1,558	(4,563)
Miscellaneous samples	705	1,659	
Sheep	647	1,623	(599)
Pigs	194	464	(202)
Fowls	777	1,868	(1,302)
Horses	93	219	(109)
Dogs	90	145	(48)
Bees	..	126	(162)
Miscellaneous	275	574	(278)
Totals	3,417 (2,657)	10,214	(7,263)

The following vaccines were prepared and issued free, last year's production being given in parentheses :—

	Doses.	
Blackleg vaccine—		
Cattle	78,000	(70,000)
Sheep	172,500	(79,200)
"Scabby mouth" vaccine	470,000	(329,000)

The Diagnostic Section, in addition to assisting veterinarians in the diagnosis of ailments, is ideally situated to locate new diseases and make preliminary investigation of them. During the year the following observations were made :—

Toxic Heart-disease in Poultry.—Routine histological examination of heart muscle in cases of this disease showed the presence of intra-nuclear inclusion bodies, which suggest that the disease may be due to infection with a filterable virus.

Fowl Cholera was diagnosed in North Otago in the virulent form for the first time in New Zealand. Treatment with sulphonamides, which has proved successful overseas, gave disappointing results.

Moniliasis.—This disease was diagnosed in poultry for the first time. The crop was usually involved and, though no serious mortality occurred, it probably had some adverse effects on chick-raising.

Diverticulosis in Pigs.—A substantial loss in one Waikato piggery was found to be due to the presence of diverticula in the small intestine which in a proportion of cases became infected with subsequent rupture, leading to fatal peritonitis.

Research Work

Sheep-breeding Projects

Inheritance of Count.—Three years' experimental results are available from the breeding experiment in which the object was to test claims made as to the high inheritance value of count of wool. In each year two groups of 50 ewes were selected for strong wool and fine wool respectively from a flock of approximately 1,000 ewes. Half of each group was mated to a strong-woolled ram and the remaining half to a fine-woolled ram. Mean count of fleeces for both ewes and rams was :—

Strong ewes	44's	Strong rams	40's
Fine ewes	50's	Fine rams	48's

Differences between the progeny of the two types of ram were not significant in any year : in the year when differences were greatest the progeny of the strong-woolled ram carried finer fleeces.

Ewe effects were generally greater, and strongly-significant differences occurred in progeny fleeces in the second year. In all years the count of wool of the progeny followed the count of the ewes, but with much smaller differences between progeny groups than between ewe groups. A difference of four count intervals in the ewes produced a difference of one count in progeny. The results indicate that progress in breeding for strong and fine wool as judged by "count" can be made by straight selection on the one side, but that strong regression to the mean must be expected. Improvement through selection of individual rams is likely to be erratic, since the actual count of the individual ram fleece may not be expressed in his progeny.

Influence of Ram on Weight and Quality of Fat Lambs.—In an intensive investigation, including complete dissection and chemical analysis of carcasses, the fat-lamb progeny of eight breeds of rams have been compared for three successive years. The following table shows the average carcass weights of the lambs produced by each breed of ram when crossed with Romney Marsh ewes which were run together from the end of tupping until drafting :—

	Mean Carcass Weights.		
	1946-47.	1947-48.	1948-49.
	lb.	lb.	lb.
Southdown	32·6	34·1	35·9
Ryeland	36·1	32·6	36·7
Dorset Horn	38·8	37·1	38·6
Suffolk	40·0	38·4	41·2
Border Leicester	38·8	36·7	40·9
English Leicester	36·7	34·4	39·1
Cheviot	36·3	35·3	35·7
Romney	36·4	34·0	35·1

Over the three years the Suffolk, Dorset Horn, and Border Leicester rams produced lambs whose carcasses averaged 5·7 lb., 4·0 lb., and 4·6 lb. respectively more than those sired by Southdown rams. Although the qualitative superiority of the Southdown cross lambs remains unchallenged, it is impossible to disregard such marked quantitative disparities during a world meat famine. The use of any of the three heavier breeds of rams by fat-lamb breeders would increase the annual output of fat lamb by approximately 10,000 tons. Even allowing for the slightly lower price per pound, due largely to the premium paid for light weights, the heavier breeds in this experiment returned more cash per lamb.

Nutrition of the Breeding-ewe.—In an experiment to measure the effect of nutrition during the latter stages of pregnancy, 185 mixed-aged Romney ewes which had been mated to Southdown rams and run together since tupping were divided into three groups five weeks before lambing was due to commence. These groups were grazed on very good, fair, and poor pasture, and gained 5·6 lb., 3·0 lb., and 0·0 lb. per week respectively up till lambing. From then on they were again run together on good pasture. The effect of the three treatments on the lambs is shown in the following table :—

——	Birth Weight.		Live Weight, 84 Days.	
	Singles.	Twins.	Singles.	Twins.
	lb.	lb.	lb.	lb.
High plane ..	10·2	9·3	56	48
Medium plane ..	10·2	8·8	54	47
Low plane ..	9·7	7·4	57	44

The lambs were slaughtered in three drafts, being picked as in normal fat-lamb practice. There was no difference between the groups in the proportion killed in each draft. Carcass weights and gradings were similar between groups, confirming the finding that growths of the lambs were little affected by the pre-lambing feeding of their mothers.

At shearing all fleeces were weighed (after skirting, but minus bellies), graded for character, measured for staple length, and graded for faults :—

——	High Plane.	Medium Plane.	Low Plane.
Fleece weight (lb.)	8·5	8·4	7·7
Staple length (in.)	4·8	4·6	4·1
Character—			
Percentage excellent ..	37	33	18
Percentage good	34	33	23
Percentage medium or poor ..	29	34	59

The low-plane treatment had a very detrimental effect on the wool-clip in all characters measured. The incidence of break was similar in all three groups, though the low group showed more bad breaks than fleeces from the other groups. Cotting was markedly affected, 3·4 per cent. of high, 8·67 per cent. of medium, and 21·7 per cent. of low plane fleeces respectively showing cotting.

From this preliminary study it would appear that poor feeding during the pre-lambing period has a more marked effect on the wool-production of the ewe than on the birth weight and growth rate of the lamb.

Sterility in Two-tooth Breeding-ewes.—A study of the reproduction performance in two-tooth ewes over two seasons indicates that barren animals may be considered to fall into two classes :—

(1) Ewes continuing to show recurrent œstrus cycles throughout the tupping season ; the majority of these appear to exhibit normal heats and normal ovulations, and in the first year 40 per cent. did eventually become pregnant when run with rams until July. In the second year some ewes with recurrent heats had blockages of the fallopian tubes, but the greater number had no abnormality. Presumably the fault in these animals lies in fertilization or implantation of the ovum, and the general impression is one of sub-fertility rather than actual sterility.

(2) Ewes which cease to come on heat as though successfully settled but later prove barren, or have resumed estrus cycles after the normal tupping season. It is suggested that barrenness of this type may be due to loss of the fœtus during the early months of pregnancy, though reliable evidence for this has not been obtained.

In 1947, 58 per cent. of the ewes failing to lamb were of the first type and 36 per cent. of the second type ; the remainder (2 animals) failed to show heat at all. Records for the following year for those ewes carried over showed that the proportion of ewes lambing as four-tooths was equally high in the two classes.

The records indicate that the proportion of dry ewes may vary widely from one season to another both among two-tooth and older ewes, and it is proposed to continue observations on a more general basis involving ewes of all ages rather than concentrating on two-tooths only.

Fecundity in Ewes.—In an experiment designed to test the inheritance of fecundity three flocks of ewes were selected on the basis of the previous incidence of twinning. The first year's results are summarized in the following table :

—	High-fertility Flock.	Low-fertility Flock.	Unselected Control Flock.
	Per Cent.	Per Cent.	Per Cent.
Ewes conceiving to first mating ..	81	76	67
Lambs born	125	98	107
Lambs alive one month ..	100	84	90
Dry ewes	4	11	8

Deaths in New-born Lambs.—At Ruakura, 231 ewes were kept under continuous observation during lambing. The following observations were made :—

(1) The interval between uneasiness and lambing varied as follows : +3 hours, 15 per cent. ; 2–3 hours, 15 per cent. ; 1–2 hours, 30 per cent. ; and —1 hour, 40 per cent.

(2) Older ewes tended to give less warning of approach of lambing than younger ewes.

(3) Bursting of the water-bag occurred within half an hour of delivery in the majority of cases.

(4) Labour before delivery required less than half an hour in 30 per cent. of ewes and less than one hour in over 70 per cent.

(5) The time interval between appearance and delivery of lamb varied from −15 minutes to +1 hour; 60 per cent. of ewes required less than half an hour. Of the 28 ewes (13 per cent.) requiring more than one hour, 22 were assisted in delivery.

(6) Distribution of lambing occurred very evenly over successive four-hour periods from 12 p.m. with the same distribution between night and day.

(7) Eight different types of presentations were recorded; 70 per cent. of lambs were presented in the "normal" manner (both forefeet and head together) and 30 per cent. "abnormally." Of these the majority had one forefoot retained (18 per cent.). Both forefeet were back in 6·5 per cent. of cases.

(8) The time between delivery and first suckling varied from under 50 minutes (18 per cent. of cases) to over 120 minutes (16 per cent. of cases). Approximately 60 per cent. suckled within the hour.

(9) The placentas were voided over intervals varying from under 1 hour (6 per cent.) to over 4 hours (9 per cent.) from delivery; 67 per cent. of ewes voided the placenta within 3 hours.

(10) Mothering ability of the ewe increased with age of ewe fairly consistently for each age from 2 to 6 years.

(11) Of 13 ewes with udder abnormalities, 3 had little or no milk, 8 had one blind and dry quarter (3 from shearing cuts), 1 had abnormally-large teats, and 1 a very pendulous udder.

(12) There was little or no relationship between the vigour of the lamb immediately after birth and the following factors: sex of lamb, age of ewe, birth weight, type of presentation, duration of birth, or mothering ability of ewe.

(13) *Lamb Mortality.*—Of the 231 ewes observed, 52 lambed twins, so that 283 lambs were born; 37 died either before or at birth or during the first month of life:—

	Number.	Percentage of Lambs Born.
Born dead	20	7·1
Died first week	7	2·5
Died 7–28 days	10	3·5
Totals	37	13·1

(14) More detailed classification of mortality gave the following results:—

Cause or Category.	Number.	Percentage of All Lambs.
Milk-fever	8	2·8
Died before birth	3	1·1
Malpresentations or difficult deliveries	8	2·8
Unsound udder	3	1·1
Death of ewe	2	0·7
Accidental death	6	2·1
Storm	2	0·7
No apparent cause	5	1·8
Totals	37	13·1

In a similar experiment at Manutuke 149 ewes lambed under observation, producing 177 lambs. The following observations were made :—

(1) Presentation was normal in 74 per cent. of ewes, one forefoot was back in 19 per cent., and both forefeet were back in 3 per cent. of cases.
(2) Assistance was rendered where no progress had been made 1 hour after bursting of the water-bag, and on this basis it was deemed necessary in 43 per cent. of ewes.
(3) Assistance was given to 35 per cent. of ewes bearing single lambs whose presentation was normal. The average weight of these lambs was 11·5 lb., compared with an average weight of 11·0 lb. for single lambs whose presentation was normal and who were born without assistance.
(4) It was considered necessary to remove the membranes from the noses of 32 per cent. of lambs after birth.
(5) Six lambs were born dead, all on account of malpresentation, and two other lambs died within forty-eight hours of birth, a total mortality of 4·5 per cent.
(6) Ninety-two lambs were born unobserved in the paddock and 14 (15 per cent.) of these were found dead. From the position and state of the lambs it was considered that 6 had been malpresentations and 3 others protracted lambings.
(7) Teats were classified as : large, 26 per cent. ; medium, 55 per cent., and small, 19 per cent. Some lambs, particularly small twins, had difficulty with large teats, but it was found that the size diminished materially if some milk was removed, and lambs then experienced no further difficulty. Some lambs found difficulty in holding small teats in their mouths. Teats of two ewes were so close to the leg that lambs could not suckle without assistance.
(8) Milk-supply was classified as poor in 2 per cent., medium in 39 per cent., and good in 59 per cent. of ewes.

From these two experiments and from field observations the following conclusions may be drawn :—

(1) Still-births and deaths during the first week probably account for 10 per cent. to 15 per cent. of all lambs born in New Zealand.
(2) The major cause of these losses is difficulty in lambing.
(3) Smothering by membranes is probably an important cause of loss in at least some flocks.
(4) It remains to be shown to what extent these losses can be prevented by careful attention by well-trained shepherds.
(5) Probably about 2 per cent. of lambs die of starvation because of inadequate milk-supply, and approximately the same percentage of lambs are lost because of defective teats. These losses could be greatly reduced by careful attention to udders and teats when culling and by assistance from shepherds to new-born lambs which experience difficulty in suckling.

Infertility Associated With Subterranean Clover.—Assays of clovers and grasses to determine if they contain the substance which causes infertility in ewes grazing almost pure swards of subterranean clover in Australia gave the following results : thirteen out of seventeen of the subterranean-clover samples gave positive assays ; these were obtained from Banks Peninsula, Hastings, Blenheim, Wairoa, Christchurch, Wanaka, and Whangarei. The remaining four samples, from Palmerston North, Whangarei, and Wanaka, gave a doubtful positive reaction. Two white-clover samples, from Manutuke and Ruakura, gave doubtful reactions and two others were negative. There has not been sufficient spread over the year to enable any observations to be made on seasonal variation. A number of pure species from the Plant Research Station, Palmerston North, was also examined. Two subterranean-clover samples gave positive results ; the remaining samples, which were negative, included strawberry clover, white clover, and various grasses.

This type of infertility has not been reported in New Zealand and no trouble is expected. The assay results indicate, however, that care should be taken to ensure that subterranean clover does not become completely dominant in sheep pastures.

Ketosis in Pregnant Ewes (Sleepy Sickness).—A further trial of the dicalcic phosphate, potassium iodide, linseed meal salt-lick was conducted at Shannon to compare its efficiency in preventing sleepy sickness with licks from which either the dicalcic phosphate or the potassium iodide had been omitted. Unfortunately the experiment was inconclusive because of the variation in pasture in the experimental paddocks and the considerable differences in lick intakes in the various groups.

Sheep Nutrition Projects

Comparison of Various Pastures for Ewes and Lambs.—The trials with special pasture mixtures in 1-acre paddocks have been continued at Manutuke. The good rainfall in the November–January period was particularly favourable to clover growth and in some paddocks this became too rank and could be controlled only by cutting for hay. In general the short-rotation-rye-grass – white-clover mixture continues to prove very satisfactory. The clover, which is more vigorous than in perennial-rye-grass – white-clover mixtures, provides excellent summer and autumn grazing. Even when the short-rotation rye-grass is allowed to seed, re-establishment in autumn is not always very good. Few short-rotation plants appear to live through the Poverty Bay summers in sheep paddocks. A mixture consisting of 25 lb. of short-rotation rye-grass, 10 lb. of perennial rye-grass, and 3 lb. each of Montgomery red, broad red, and white clovers sown in April, 1948, has provided magnificent pasture in the first year. In the paddock sown in 1946 with Italian rye-grass and Montgomery red and broad leaf red clovers the clovers became too rank and provided comparatively poor feed during the autumn. The paddock sown with cocksfoot and white clover in 1946 provided excellent grazing up till the end of December, but from then lambs neglected the cocksfoot, which became tufty, and the clover tended to become over grazed. All special-purpose pastures were stocked at the rate of seven ewes and seven lambs per acre from 10th September to 13th December. The daily rates of gain were from 0·5 lb. to 0·63 lb., and the Southdown Romney cross lambs killed at the end of the period had an average carcass weight of 41·4 lb.

From 18th January the paddocks were stocked with eight weaned lambs per acre. The January rains promoted such excellent growth that from 1st February the rate of stocking was increased to sixteen lambs per acre, and this was maintained up till 8th April in all paddocks in which the clover growth was good. Up to 31st March the rate of gain in the various paddocks has ranged from 0·17 lb. to 0·47 lb. per day and the average rate of gain for all lambs in the paddocks carrying a good growth of white clover has been 0·37 lb. per day. Pasture measurements from 13th July, 1948, to 31st March, 1949, have given the following results :—

	Pounds of Dry Matter Per Acre.
Short-rotation rye-grass, cocksfoot, Montgomery red and broad red and white clover sown 1946	12,843
Perennial rye-grass and white clover sown 1946 ..	10,535
Long-rotation rye-grass and white clover sown 1947 ..	12,945
Short-rotation rye-grass and white clover sown 1947 ..	12,258
Old permanent pasture	9,388

Supposed Rachitogenic Factor in Green Oats.—Attempts to confirm presence of the supposed rachitogenic (rickets-producing) factor in green oats have been continued along several lines, as follows :—

(1) *Feeding Experiments on Rats with Dried Oats.*—All attempts to produce rickets in rats by feeding diets including dried green oats, extracted and unextracted, have proved unsuccessful. It is thought that the amount of available phosphorous in the green

oats is sufficient to preclude development of rickets in the rat, an animal in which, even in the absence of vitamin D, rickets is shown only when the amount of available phosphorous in the diet is very low. It is concluded that the rat is unsuitable as an experimental animal for attempts to discover in green oats the factor rachitogenic to sheep.

(2) *Sheep-feeding Experiments.*—During the winter three groups of six Romney hoggets were grazed on green-feed Algerian oats, Italian rye-grass, and perennial rye-grass grown on Wallaceville Farm. Because of unfavourable growth of the green feeds, grazing did not begin until 3rd August, from which date it was continued for six weeks. Blood samples taken each week were analysed for calcium and phosphorous in serum. Calcium and phosphorous were normal in each group at the beginning of the experiment, and though in each a slight rise in both calcium and phosphorus took place during the experimental period, values were still well within the normal range at the end of the grazing period.

It is proposed to repeat feeding trials with sheep in the coming winter, when conditions may be more favourable to development of rickets.

(3) *Assay of Vitamin D in Green Oats :* Preliminary study of the vitamin D content of a petroleum-ether extract of green oats indicated a vitamin D content of at least 10 international units per 100 grammes of dry oats. Further assays were done using a chloroform extract of the oats (the fatty material extractable by chloroform being twice as much as that extracted by petroleum ether).

It was found extremely difficult to dose rats with dilutions of this extract, the material being apparently highly unpalatable. Further, calcification produced by higher doses of the extract was actually lower than that produced by low doses. It was suspected that in concentrated solution the material was not absorbed by the rat. Results obtained in repeated trials have been highly conflicting, and though in one assay using a 1 : 30 dilution of the extract most consistent figures were obtained, giving a calculated amount of 70 international units per 100 grammes of dry oats, a later assay has not confirmed this finding, and it is not yet possible to make a definite statement regarding the amount of vitamin D in green oats. It is now thought that attempts will have to be made to fractionate the extracted material before using it for assay on rats.

(4) *Effect of Feeding Dried Green Oats to Chicks :* As the presence in green oats of a rachitogenic factor has not been demonstrable in rats, an experiment was designed using chickens as experimental animals. The basal diet used was the AOAC ration for chick assays of vitamin D_3. This diet contains no vitamin D.

Sixty day-old chicks were housed in brooders and after twenty-one days' feeding the left tibias were removed and group ashed. Diets and results are as follows :—

Group.	Ration.	Bone Ash.	Average Weight at Killing.
		Per Cent.	Grammes.
1 ..	AOAC ration	32·7	120
2 ..	80 per cent. AOAC plus 20 per cent. oats	31·8	115
3 ..	70 per cent. AOAC plus 30 per cent. oats	31·4	87
4 ..	60 per cent. AOAC plus 40 per cent. oats	31·1	82

The steady decrease in bone ash with increasing amount of oats in the diet seems to indicate presence of a factor rachitogenic for the chick. On the other hand, it is obvious that any vitamin D present in the oats is not in a form available for the chick. In addition, the fall in weight with increase in amount of oats in the diet indicates either the presence of a growth-depressing factor in the oats or unassimilability of the oats for young chicks. Further experiments on chickens are in progress.

Sheep Disease Projects

Facial Eczema.—Fairly widespread outbreaks of facial eczema occurred during late February and March in the Waikato and a number of outbreaks were reported in Poverty Bay. A few flocks were affected in Hawkes Bay and Manawatu. In general only a small percentage of clinical cases occurred and many of those were not very severely affected. The experience of the last two years makes it obvious that the disease can follow a summer in which the pastures do not dry off. Some liver damage occurred on the experimental farm at Manutuke, but only two mild clinical cases developed. It is hoped that some of the pasture preserved this year may prove sufficiently toxic to be used for chemical fractionation. A spray irrigation plant has been installed at Manutuke with a view to determining the effect on the incidence of the disease of measured amounts of water applied at different times of the year. *Panicum miliaceum* (broom corn millet), which in three previous seasons has produced jaundice and photosensitization at Manutuke, this year proved non-toxic when it was sown later and on a different soil type.

Portal Streaming.—Brilliant green has been employed in a study of the streaming of blood from tributaries in the portal vein of sheep. A large degree of variation has been observed in the experiments so far conducted on twenty sheep.

*Blood-poisoning in Sheep (*Cl. chauvoei *Infection).*—The demand for vaccine for prevention of blood-poisoning in sheep has risen very considerably in the last two years, as shown by the following doses issued from Wallaceville :—

1945	27,000	1947	79,000
1946	29,000	1948	172,000

Although the results have generally been satisfactory, during the past two years there have been indications that in heavily-infected areas the vaccine did not always give complete protection. Experimental tests indicated that in the doses previously recommended the vaccine would not protect against heavy infection. Further investigations have shown that a vaccine prepared from cultures grown on a different medium (beef infusion cysteine H. Cl. broth) precipitated with alum is some 150 times as potent as the old vaccine. This new vaccine will be used in future and is expected to provide adequate protection.

In a preliminary experiment a group of ewes was vaccinated with the new vaccine three weeks before lambing. Lambs from these ewes proved to have a fairly satisfactory immunity against blood-poisoning up to the age of eight weeks. It is hoped that it may be possible by this method to reduce the losses from blood-poisoning which occur after lamb-marking in some flocks.

Hogget Mortalities on Turnips.—During the year investigations were initiated into the causes of hogget losses while feeding on turnips during late autumn, winter, and early spring in the South Otago and Southland districts. More precise information is being sought on the extent of these losses, their nature, the conditions associated with their incidence, and possible methods of control. The preliminary observations have suggested that *Cl. chauvoei* infection and enterotoxæmic conditions are responsible for a large proportion of these losses. Field and laboratory studies are being intensified and vaccination trials are in progress on selected properties.

Dairy Cattle Breeding Projects

Artificial Insemination at Ruakura.—Winter Mating Group : This group was again used for the training of technicians. Two hundred and eighty-two cows were inseminated in four herds and it was noted that there was a wide variation between herds in the conception rates, which were 45 per cent., 52 per cent., 59 per cent., and 87 per cent. for the individual herds. Opportunity was also taken to investigate whether storage in individual ampoules has any detrimental effect upon conception rate. In a small preliminary test with two groups of approximately 90 cows each, identical conception rates of 63 per cent. were obtained with semen stored in bulk and in ampoules.

Spring Mating Group.—The relative failure of the work in the long-distance transport group in the Manawatu in 1947–48 emphasized the need for checking all matters of technique and in particular of examining more closely the long-distance transport of semen. To overcome the difficulties of different herds and different technicians in transport comparisons when groups are located in different districts, and to see whether transport alone exerts any effect upon conception rate, samples of semen were transported 300 miles overnight by train and thereafter used in the Ruakura group in the same herds at the same time by the same technician in comparison with samples of the same material held at Ruakura.

Six comparisons, each involving 200 inseminations, were made. Results were as follows :—

Group.	Treatment.	Dose Rate (Million Sperm).	Conception Rate (Per Cent.).	
			All Cows.	Fertile Cows.
1 ..	Local, bulk-stored, ampouled laboratory ..	25	55	60
2 ..	Local, bulk-stored, ampouled field ..	25	48	54
3 ..	Transported in bulk, ampouled field ..	25	50	54
4 ..	Transported in ampoule	25	55	57
5 ..	Local, bulk-stored, ampouled laboratory (0·5 per cent. sulphanilamide)	25	62	64
6 ..	Local, bulk-stored, ampouled laboratory (0·5 per cent. sulphanilamide)	10	52	57

Services per conception based on cows holding three months after last service.

It would appear that transport does not cause any loss of fertility, that ampouling in the laboratory is slightly superior to ampouling in the field, and that the addition of sulphanilamide is an advantage, as has been suggested by American work. The results obtained with 10,000,000 sperms when sulphanilamide was added to the diluting medium are very satisfactory. At this dosage rate the semen collected from a fully-fertile bull in one day would be sufficient to inseminate approximately 1,000 cows. All semen was used before it was forty-eight hours old, but American results suggest that the use of sulphanilamide would allow storage over considerably longer periods.

The Pedigree Group : Work was continued with pedigree cows for the third successive year and pedigree breeders are collaborating readily. An over-all conception rate of 53 per cent. was obtained, and this is considered satisfactory in view of the peculiar difficulties involved in inseminating pedigree herds. The following table shows the pedigree cows which have conceived to merit sires as the result of artificial insemination :—

Pedigree Cows in Calf to Merit Bulls

Bull.	1946.	1947.	1948.	Total.
Jersey Glen Handsome Boy ..	134	139	64	337
Landsdowne Double Sam ..	..	83	110	193
Erinview Teddy	53	52	66	171
Fairymeadows Beau Geste ..	..	..	101	101
Muritai Oxford Lad	21	47	..	68
Total	208	321	341	870

The first crop of yearling bulls bred in this experiment came on to the market this year and sold readily at very good prices. Most of them have gone to testing herds and their performances under sire survey will be carefully followed. The first crop of two-year-old heifers will calve next season and their performances will also be tested.

Bull Fertility Studies.—In this work identical twin bulls have been used and their fertility has been measured by the exhaustion technique. Semen from ten successive services collected at fifteen-minute intervals is examined for live sperm concentration and for reduction time of methylene blue.

In the first series of experiments, bulls on a low-protein intake were compared with bulls receiving a high-protein intake derived in the first instance from meatmeal and linseedmeal and later from spring pasture. Neither the level of protein, which varied from 0·9 lb. to 3·36 lb. of digestible protein per day, nor the type of protein fed had any effect on either quantity or quality of semen as judged by the above tests.

Five pairs of bulls have been reared to the twelve-months stage on a high and low plane of nutrition, the pairs being split at weaning. Differences in body weight at this time were 270 lb. The animals will be used to study the effect of good and bad rearing upon sperm-production as yearlings and as two-year-olds. This work is incomplete, but preliminary data show large differences in both quantity and quality of semen between the two groups at the yearling stage.

Production of Artificially-bred Heifers by Merit Sires.—In the 1947–48 season a second crop of heifers by merit sires completed their first lactation on Ruakura and other farms in the Waikato. In addition, the first crop completed its second lactation. Results are summarized below :—

Herd.	Number of Heifers.	Production of Butterfat.		Production, Mature Cows.*
		Actual.	Mature Equivalent.	
Two-year-olds, 1947–48 Season				
		lb.	lb.	lb.
A	4	269	339	312
B	6	260	330	300
C	1	422	492	331
D	2	232	302	307
E	4	287	357	343
F	4	212	282	295
G	6	234	304	258
I	5	185	255	233
J	4	230	300	302
K	1	262	332	279
L	1	303	373	324
M	8	222	292	256
N	2	170	240	223
O	2	194	264	178
P	3	298	368	313
Q	3	199	269	270
Total, Waikato herds	56	240	310	280*
Ruakura	55	297	367	..
Three-year-olds, 1947–48 Season				
		lb.	lb.	lb.
A	10	275	310	312
B	12	298	333	300
C	6	255	290	331
D	11	278	313	307
E	7	329	364	343
F	3	306	341	295
G	7	204	239	258
Total, Waikato herds	56	277	312	307*
Ruakura	30	301	336	..

* Mature normal cows weighted according to the number of A.I. daughters in the herds.

A satisfactory basis of comparison with which to assess the standard of performance of the A.I. daughters is extremely difficult to obtain. That used is one of the best available and consists of comparing the production of the A.I. heifers in each herd, corrected to a maturity basis with the production of the mature cows in the herd. It is a method which bears heavily against the A.I. daughters, as the mature-cow figures are derived from a highly selected sample. On this basis the A.I. two-year-olds represent a gain of 30 lb. of butterfat per cow in producing ability. This figure is almost the same as that shown by the first crop in the 1946–47 season, where the difference between the production of A.I. two-year-olds and mature cows in the same herds averaged 33 lb. of butterfat in favour of the A.I. cattle.

The three-year-old performances were disappointing, showing an advantage over mature cows of only 5 lb. of fat in producing ability. This drop relative to their two-year-old performance is probably associated with the poorer dairy season of 1947–48. The cattle concerned actually produced less than they had done as two-year-olds. The second year's crop of two-year-olds averaged 47 lb. less than the first crop in 1946–47.

The performances of the different bulls in relation to their survey results are summarized below :—

MERIT SIRES

	Official Survey.			A. I. Daughters.		
	Number of Lacts.		Fat.	Number of Lacts.		Fat.
			lb.			lb.
Greencrofts Hopes Prince—						
Dams	41	..	346	12	16	348
Final daughters	41	..	374	12	16	389
All daughters	52	..	373	40	73	349
Kuku Butter-King—						
Dams	13	..	367	19	30	340
Final daughters	13	..	373	19	30	341
All daughters	..	..	..	49	81	342
Awatea Phill—						
Dams	14	..	388	9	12	324
Private final daughters	14	..	387	9	12	351
All daughters	16	..	384	27	50	330
Erinview Teddy—						
Dams	10	18	367	14	14	309
Final daughters	10	18	455	14	14	337
All daughters	18	38	451	25	25	347
Lockhart Golden Laddie—						
Dams	20	30	340	8	8	307
Final daughters	20	30	389	8	8	318
All daughters	49	88	377	27	27	325
Greencroft Anticipation—						
Dams	14	19	349	4	4	432
Final daughters	14	19	368	4	4	382
All daughters	26	59	358	12	12	342
McLucky—						
Dams	17	..	378	6	6	301
Intermediate daughters	17	..	388	6	6	327
All daughters	..	..	..	16	16	323

In every case the A.I. cattle yielded less than might be expected from the bulls' surveys. This might be explained on a basis of a generally poorer standard of efficiency of feeding and management in the commercial herds in which the A.I. daughters were placed, together with a poorer standard of dams. Investigations are proceeding to test the validity of these suggestions, but it seems abundantly clear that the use of a merit bull of a 400 lb. daughter standard will not automatically result in cattle of a 400 lb standard unless feeding and management are at a very high level.

Ruakura Grade Herd Project.—In this project the objective is to build up a herd of grade cows from a low standard to a 400 lb. butterfat per cow level by the continuous use of proven sires and artificial insemination.

In the 1947–48 season 19 two-year-old and 2 three-year-old daughters of merit bulls completed their lactations. Average production was as follows :—

——	Number.	Milk.	Butterfat.	Days.
		lb.	lb.	
Three-year-olds ..	2	7,410	429	275
Two-year-olds ..	19	5,484	290	284

On these figures, the average maturity equivalent for these cattle averages 369 lb. butterfat per cow in 283 days.

A further 26 two-year-old daughters of proven bulls calved during the current season in this herd.

Ruakura Pedigree Herd Project.—Here the objective is to see whether the proven-sire system of breeding is capable of maintaining a herd average of 400 lb. butterfat standard indefinitely. Production for the pedigree herd in the 1947–48 season was as follows :—

——	Number.	Milk.	Fat.	Days.
		lb.	lb.	
Mature cows ..	14	7,656	429	283
Two-year-olds ..	18	5,677	322	290
Herd averages ..	32	6,543	369	287

The maturity equivalent of the two-year-olds thus averaged 392 lb. butterfat. The maturity equivalent of the whole herd averaged 408 lb. butterfat. A further 6 pedigree two-year-old daughters of proven sires calved this season.

Identical Twins.—(*a*) *Collection :* A very successful season was experienced, 40 sets of heifers and 5 sets of bulls being located in a period of four weeks and mainly within the Waikato area. Five sets were transferred to the Dairy Research Institute. The total number located to date is 208 sets.

(*b*) *Unifomity Trials.—Production :* Further observations on the uniformity of identical twins under the same environmental conditions have been made. From these, efficiency values for production characters have been calculated. This value measures the number of animals selected at random to which one twin animal is equivalent, and thus provides a measure of the relative value of identical twins over randomly-selected cattle for experimental purposes. Emphasis must be placed on the value of the figures as guides rather than as absolute measures in this connection, as they have been obtained from only 9 sets :—

Milk yield	22
Butterfat yield	54
Butterfat test	15
Casein (per cent.)	10
Casein yield	50

A further 16 sets of twins have been milked under uniform conditions during the current season.

(*c*) *Uniformity Trials.—Grazing Behaviour:* Twins show very close similarity in their average grazing behaviour. The following table gives the mean grazing, loafing, and lying times per day for 6 sets :—

MEAN VALUE IN MINUTES FOR SEVEN SEPARATE TWENTY-FOUR-HOUR PERIODS

Twins.	Grazing.	Lying.	Loafing.	Distance Walked (Yards).
T. 1	403	592	189	3,041
T. 2	399	591	196	3,292
T. 11	460	544	181	3,284
T. 12	451	541	193	3,199
T. 13	387	607	191	2,760
T. 14	400	583	202	2,926
T. 17	482	542	161	3,040
T. 18	473	581	131	3,087
T. 23	338	596	252	2,621
T. 24	343	574	269	2,822
T. 31	400	603	182	3,262
T. 32	395	601	189	3,122

(*d*) *Uniformity Trials.—Live-weight Growth:* A large amount of data has been accumulated in this herd. The following illustrates the likeness of a few randomly-selected sets of twins in their rate of growth :—

LIVE WEIGHT OF TWIN PAIRS (POUNDS)

Sets.	Four Weeks.	Twenty-four Weeks.	Forty-eight Weeks.	Ninety-six Weeks.*
T. 1	63	245	410	723
T. 2	59	235	411	704
T. 3	59	287	431	642
T. 4	47	267	423	663
T. 7	60	285	425	667
T. 8	58	283	431	653
T. 11	51	276	408	637
T. 12	51	279	430	649
T. 13	72	299	465	643
T. 14	72	292	481	670
T. 17	89	315	543	780
T. 18	88	327	538	792
T. 19	86	312	474	723
T. 20	80	301	471	752
T. 23	69	283	441	721
T. 24	68	274	425	596
T. 25	66	301	449	671
T. 26	65	296	463	729
T. 29	71	263	439	653
T. 30	64	263	450	668

* In calf; uncorrected for pregnancy.

(*e*) *Uniformity Trials.—Blood Characteristics:* The possible usefulness of twins compared with ordinary cattle for studying variation in blood characteristics shown to be important in respect of certain metabolic disorders of cattle has been studied.

Uniformity within sets relative to non-twins is very good in blood magnesium, good in phosphorus, and only fair in calcium. In total acetone bodies and blood sugar, twins are hardly more uniform than unrelated cattle. Red-cell volume, hæmoglobin content, and red-cell count all show little variation within sets and a large variation between sets. Efficiency values calculated for these three characteristics are approximatley 10 in each case. Red-cell fragility shows a high degree of uniformity, the efficiency value being 15. In blood agglutination titres, against *Br. abortus* vaccine, twins are again fairly uniform, the relative efficiency value being 5.

(*f*) *Genetic Implications of Nutritional Levels on Production*: The interaction of environment and inheritance upon identical animals has been studied. Fifteen sets of twins have been placed on three widely different levels of nutrition so that twin pair comparisons are possible between each level. The three levels used have been as follows:—

Treatment A: Maximum grass plus concentrates. Hay and silage *ad lib.* when grass inadequate.

Treatment B: Maximum grass and hay plus silage *ad lib.* when grass inadequate.

Treatment C: Grass at 60 per cent. of the level of treatment B. Hay and silage at 60 per cent. of treatment B when needed.

Thus the treatment A cows have been fed to ensure production up to the maximum of their inherited capacity. The condition may be likened to those obtaining under selective testing of pedigree cows aiming at high records under C.O.R. test conditions. The treatment B cows have been fed to the limit possible under a high standard of efficiency of grassland farming. The nutrition level used may be likened to that of G.H.T. test conditions for pedigree cows on efficient grassland farms. The treatment C cows have had a restricted intake of grass and grass products by having access to only 60 per cent. of the area grazed by treatment B, the condition being comparable to G.H.T. test cattle on hard country.

The experiment has been designed to run a minimum of three years. Results for the first season (1947–48) are summarized below:—

AVERAGE PRODUCTION

(Mean of 5 sets of comparison)

——	Milk.	Butterfat.	Test.
	lb.	lb.	
Treatment A	7,699	402	5·2
Treatment B	6,047	305	5·0
Difference ..	1,652	97	0·2
Treatment B	5,135	266	5·2
Treatment C	4,749	237	5·0
Difference ..	386	29	0·2
Treatment A	6,019	316	5·3
Treatment C	3,605	179	5·0
Difference ..	2,414	137	0·3

The trends in results during the current season are very similar. Consideration of the genetic implications of this experiment necessitates detailed examination of the individual twin pairs. This will be done when the experiment has completed the third season. In the meantime the mean results at least suggest that an allowance of approximately 100 lb. of butterfat must be made in comparing the records of cows well fed on grass with those of cows whose diet is supplemented with concentrates to ensure maximum yields. This point is of considerable practical importance in the selection of bulls on the butterfat backing of their dams under New Zealand conditions.

Dairy Cow Nutrition

Calf-rearing.—Studies on the nutrition of the calf during the first fourteen weeks of life have been continued. Three systems of feeding were compared in the 1947–48 season, interest centring mainly on the relationship of feeding to the incidence of scours. The feeding comparisons were :—

(*a*) Milk daily on a 12-per-cent. body-weight scale.

(*b*) Milk daily on a 12-per-cent. body-weight scale, plus 25 per cent. added water.

(*c*) Milk daily on an 18-per-cent. body-weight scale.

In all groups colostrum was fed for the first three days after birth, followed by whole milk until a live weight of 70 lb. was reached. Thereafter the ration was gradually changed to skimmed milk by the time the calf reached 100 lb. These rations were continued for fourteen weeks.

In the 1948–49 season the experiment was repeated with the difference that the heavily-fed group was reduced in its daily intake to a 12-per-cent. body-weight basis once the calves reached 100 lb. live weight. Results in terms of live weight were as follows :—

Treatment.	1947–48.			1948–49.		
	Birth.	Six Weeks.	Fourteen Weeks.	Birth.	Six Weeks.	Fourteen Weeks.
	lb.	lb.	lb.	lb.	lb.	lb.
(*a*) ..	54	86	168	52	84	157
(*b*) ..	55	87	166	53	85	160
(*c*) ..	54	100	183	54	98	174

In both years the heavier milk ration was an advantage for the first six weeks but thereafter just as good gains resulted on the smaller ration. The addition of water to the smaller milk ration did not affect growth rates, but in both years it appeared to reduce the incidence of scours. All cases of scours yielded to treatment with sulpha drugs.

Lifetime Project.—The object of this project is to examine the effect of two types of pasture management on the lifetime performance of dairy cows. In one case the pasture is so controlled by rotational grazing, autumn saving of pasture, and maximum conservation of hay and silage as to provide an even, high level of nutrition, while in the other the diet of the cattle is controlled almost entirely by seasonal effects. The different treatments are applied in two groups for the whole lives of the cattle, and in the other two changes are made when the heifers calve for the first time. There are thus four groups, which are designated high-high (good nutrition throughout), low-low (poor

nutrition throughout), high-low (good nutrition to first calv ing and poor nutrition thereafter), and low-high (poor nutrition to first calving and goo·d nutrition thereafter). The results are reported in three stages, calf, yearling, and cow.

Calf Stage: Seasonal body weights of the well-reared (rotationally-grazed) and poorly-reared (set-stocked) calves for the last five years were as follows:—

BODY WEIGHTS AS AT 31ST MARCH

Seasons.	Well Reared.		Poorly Reared.		Difference.
	Number.	Weight.	Number.	Weight.	
		lb.		lb.	lb.
1944–49	94	385	104	288	97
1948–49	10	414	12	288	126
Twins (split) ..	12	408	10	325	83

Yearling Stage: Body-weight differences of the two groups of heifers were as follows:—

BODY WEIGHTS AS AT 31ST MARCH

Seasons.	Well Grown.		Poorly Grown.		Difference.
	Number.	Weight.	Number.	Weight.	
		lb.		lb.	lb.
1944–49	72	709	75	557	152
1948–49	10	753	12	543	210
Twins (split) ..	10	693	10	552	141

Cumulative data on reproduction behaviour are summarized below:—

REPRODUCTION BEHAVIOUR

——	Well Grown.	Poorly Grown.
Total number of heifers	80	83
Number showing heats before mating	78	60
Number of recorded heats before milking ..	336	141
Number of mating heats—		
Total	134	117
Fertile cows	107	113
Number in calf	71	81
Services per conception—		
Total	1·89	1·44
Fertile cows	1·51	1·40

The poorly-reared heifers still continue to show fewer animals coming into œstrus before mating, substantially fewer total œstrus periods before mating, fewer mating heats, and a better conception rate than their well-reared mates. Culling rate for empty heifers was only 2·4 per cent. in the poorly-reared group and 11·2 per cent. in the well-reared group.

Cow Stage : The two farms in this experiment are reaching the pasture condition characteristic of the two systems of management. The " controlled-grazing farm " shows considerable improvement on the peat areas and the general quality of the sward over the whole is now reasonably good. The poor soil type involved, however, imposes some restriction here, and it is unlikely that the area will ever be capable of being described as really first-class pasture land. The " uncontrolled-grazing farm " now shows plainly the effect of alternating complete and incomplete utilization. Summer growth during the dry period was good because of the protection afforded by long unused herbage from the good growth of the spring.

Weather during the season was good in winter and spring. The summer was relatively dry. Feeding out on the controlled farm began in early January and continued at a high level until the end of March. Autumn growth was only moderate. The uncontrolled area carried a fair amount of feed right through as a result of good spring growth. Pastures did not become bare and close grazed until mid-winter.

Production Results : These are very difficult to summarize and interpret at present. The cattle are still young and age distribution is abnormal. Results indicate trends only. Little weight can be given to actual differences. For the first time identical twins contribute to the data, 3 " well-grown " and 4 " poorly-grown " sets being split at two years to yield comparisons with identical animals between the treatments high-high and high-low and the treatments low-high and low-low. Because for all other comparisons their value is equivalent to that of non-twins, the group averages for each treatment include all cattle irrespective of whether they are twins or not. Treated in this way the twin pairs become " pilot groups " extracted from the whole data. Current season's data will provide four main group comparisons with identical twin material. The mean fat yield figures for the four groups are summarized below :—

MEAN FAT YIELDS (SEASONAL BASIS)*

Type of Nutrition.		1947–48 Season.		All Seasons.	
Pre-calving.	Post-calving.	Two Years.	Three Years.	Two Years.	Three Years.
		lb.	lb.	lb.	lb.
Well grown ..	High even (HH)	300 (10)	330 (10)	297 (22)	330 (10)
Poorly grown ..	High even (LH)	281 (11)	311 (10)	283 (23)	311 (10)
Well grown ..	Uneven (HL)	286 (12)	273 (8)	284 (22)	273 (8)
Poorly grown ..	Uneven (LL) ..	225 (12)	292 (6)	238 (22)	292 (6)

* From calving to 31st May.

Mean productions of the twin pairs on a group basis were as follows :—

MEAN FAT YIELDS (SEASONAL BASIS)

Type of Nutrition.		Fat Yield, Seasonal Basis.
Pre-calving.	Post-calving.	
		lb.
Well grown	High even (HH)	310 (3)
	Uneven (HL)	262 (3)
Poorly grown	High even (LH)	270 (4)
	Uneven (LL) ..	195 (4)

Three observations may be made concerning the trends discernible at this stage :—

(*a*) The advantage of good rearing over poor rearing when cattle are subsequently fed from first calving on a high even level of nutrition is of a relatively small order (plus 14 lb. B.F.). This is maintained to the three-year-old stage (plus 19 lb. B.F.).

(*b*) The advantage of good rearing as compared with poor rearing when cattle are subsequently fed unevenly under uncontrolled-grazing conditions is substantial in the first season (plus 46 lb. B.F.), but becomes a disadvantage in the second season in three-year-olds (minus 19 lb. B.F.).

(*c*) The advantage of good rearing combined with subsequent even feeding over poor rearing and subsequent uneven feeding is substantial in two-year-olds (plus 59 lb. B.F.), but is reduced at the three-year-old stage (plus 38 lb. B.F.).

These trends must be viewed with caution in view of the small numbers involved so far and the unknown effects of differential culling. Culling rates in low-low and high-low groups have been higher to date than in milking cattle on the controlled-grazing farm.

Live-weight Changes.—The following table sets out the mean live weights of each group at the end of the season (30th May), the figures being corrected for pregnancy :—

MEAN LIVE WEIGHTS, 1944–48

—	Group.	Two-year-old.	Three-year-old.
		lb.	lb.
Controlled farm	High-high ..	789	868
	Low-high ..	723	810
Uncontrolled farm	High-low ..	764	800
	Low-low ..	694	765

Though on the controlled-grazing farm the poorly-reared heifers have made up a large proportion of their initial handicap in live weight by the end of the first lactation, they are still nearly 60 lb. lighter than their well-reared mates at the end of the second lactation. In other words, the transfer of poorly-reared stock to controlled-grazing conditions has permitted these to make up some 60 per cent. of their initial disadvantage in weight.

On the uncontrolled-grazing farm the initial advantage of the well-reared heifers over their poorly-reared mates, though still apparent, has been largely lost by the end of the second lactation. It is also important that the initial difference at first calving between the two extremes of approximately 150 lb. is still about 100 lb. at the end of the second lactation.

Although the feeding system on the controlled-grazing area is such that the cattle are never short of food, quite marked fluctuations in live weight occur during the season. These are much less violent, however, than in the cattle on the uncontrolled-grazing farm.

Winter Nutrition Project.—Work on this project was completed during the season. Two further groups of cows (14 pairs) were again wintered during their dry period on high and low planes of nutrition. The mean length of the feeding period was shorter than in previous years, averaging nine weeks, against ten weeks in 1946–47 and thirteen weeks in 1945–46. Both groups entered the experiment at higher weights than in either of the first two years, partly because of the use of older cattle and partly because of the good feed conditions of the 1946–47 dairying season.

Feeding treatments were similar to those of previous years. The high plane was break grazed on autumn-saved pasture plus silage and hay. The low plane received a restricted ration of hay on a relatively close-grazed pasture yielding little food. Both groups were fed together after calving under *ad lib.* pasture conditions.

Results for the three years are summarized in the following table. Body-weight figures are corrected for gut content and for pregnancy and represent true body-weight changes.

	High Plane.			Low Plane.		
	1945–46.	1946–47.	1947–48.	1945–46.	1946–47.	1947–48.
Number of cows	13	18	14	13	18	14
Gain or loss before calving ..	+30	+66	+37	−83	−64	−97
Loss at calving	116	111	118	106	95	93
Weight of calf	59	57	55	56	52	49
Total milk	6,346	6,965	7,142	6,104	5,902	5,949
Total fat	330	376	372	304	313	310
Test	5·2	5·4	5·2	5·0	5·3	5·2
Days in milk	243	292	298	243	286	293

(All weights in pounds.)

The differences of 26 lb., 63 lb., and 62 lb. of fat in three successive years show clearly the importance of wintering dairy cattle well. Field observations indicate that the wintering method used and the condition at calving in the low-plane group are typical of a large proportion of dairy herds in the industry.

Measurement of Intake.—Work on the development of techniques for measuring the intake of pasture by the free-grazing animal has reached the stage of yielding promising results. Preliminary work on stalled animals has been carried to the field. In a trial with three dairy cows free grazing on autumn-saved pasture, estimates of intake of pasture have been made using the following three methods:—

(*a*) Estimates based on plucking grass within movable frames to same level as grazed by the cattle.

(*b*) Estimates based on total fæces voided and collected with bags, and the digestibility co-efficients of the pasture determined from sheep.

(*c*) Estimates based on fæces output determined by the marker technique and on digestibility co-efficients for the pasture determined from sheep.

MEAN INTAKE OF DRY MATTER PER DAY

(Successive five-day periods)

Five-day Periods.	Method. (*a*)	(*b*)	(*c*)	Dry Matter Digestibility.
	lb.	lb.	lb.	Per Cent.
First	8·3	15·8	16·0	..
Second	11·6	14·1	14·4	72·3
Third	13·9	24·3	23·5	79·9
Fourth	16·0	17·9	17·9	73·4
Fifth	19·6	19·9	18·9	73·5
Sixth	21·0	20·8	21·5	76·1
Seventh	22·9	22·6	22·6	77·6
Eighth	24·6	22·2	22·7	76·9

Except for the low figure of method (*a*) in the first period and the high figures for (*b*) and (*c*) in the third period, the three methods show very good agreement. These high estimates are largely accounted for by the abnormally-high digestibility co-efficient of the grass concerned. In this experiment the proportion of frames to total area in method (*a*) was very large, amounting to 10 per cent. to 12 per cent. This is much larger than could ever be used in practice on any scale using the frame technique, but it was justifiable here because interest lay mainly in checking method (*c*) as a possible practical method and highly-accurate figures with which to compare its estimates were necessary. From the detailed results obtained it is considered that method (*a*) after the first period gave very accurate estimates. The results from method (*c*) must be considered very encouraging.

The experiment also yielded considerable information on the problems of efficient application of the marker technique. It was found that the marker used (Cr_2O_3) could be quantitatively recovered over an extended period and that the concentration of marker in grab samples provided a reliable estimate of its concentration in total fæces. The measurement of fæces output under field conditions now centres on minimizing the field sampling difficulties and determining the most efficient form of bulking fæces to reduce chemical work and to give the desired accuracy.

Trials are in progress with 16 sets of identical twin cattle being rotationally grazed on pasture alone throughout the season to determine these points. Though this aspect of the work is still incomplete, the same animals have provided a further field test of method (*c*) compared with method (*a*). Results were as follows:—

Fortnightly Periods.	Mean Intake of Dry Matter Per Day.		Dry Matter Digestibility.
	Method (*a*).	Method (*c*).	
	lb.	lb.	Per Cent.
29/7–11/8	16·6	16·4	73·5
12/8–25/8	17·0	18·2	75·1
26/8–8/9	22·1	19·3	77·4
9/9–22/9	19·6	20·6	77·6
23/9–6/10	25·0	21·8	77·7
7/10–20/10	25·6	23·7	76·9
21/10–3/11	25·3	23·4	75·5
4/11–17/11	27·9	24·1	72·8
18/11–1/12	19·8	19·3	64·1
2/12–15/12	22·6	23·2	69·4
16/12–29/12	26·3	22·7	68·1
30/12–12/1	23·9	22·7	65·9
13/1–26/1	24·7	24·0	67·1

Very satisfactory agreement is shown in these data. The frame technique shows a tendency to yield slightly higher intake estimates than the marker technique. This work is still in progress, but in general terms the results indicate that when the digestibility of the pasture is known a simplified marker technique based on grab samples of fæces obtained twice daily at milking-time will give a sufficiently reliable estimate of fæces output to yield an accurate estimate of pasture intake, at least over fortnightly periods for individual cows and over five-day periods for groups of cows. Digestibility of the pasture has still to be determined by the relatively laborious digestibility trial, but it is hoped that the fæces nitrogen estimation method, or some alternative chemical method, may be developed to a stage which will still further reduce the labour of this class of work. If successful, the one series of analyses on a grab sample of fæces will give both fæces output and digestibility and thus yield the required intake estimate.

Studies of Milking Methods

Cleaning of Milking-machine Rubberware.—Work has been conducted on the cleaning of milking-machine rubberware. The results have shown that the removal of butterfat from rubber depends on saponification and not on a simple detergent action. This means that the use of quaternary ammonium detergents as cleansers for milking-machines will result in the efficiency of inflations falling off more than would be the case when caustic soda is used. When caustic soda is not obtainable, the use of sodium carbonate, sodium meta-silicate, or trisodium phosphate would be preferable to ammonium bases for maintaining the efficiency of milking-machine rubberware. In tests the quaternary base compounds removed less than 2 per cent. of contained butterfat from rubber samples after twenty-four hours' immersion, compared with 88 per cent. removed by caustic soda.

The Milking Efficiency of the Low-line Machine.—Since many farmers believe the bucket plant milks faster than the releaser type, with the additional advantages of a lower mastitis incidence, there has been much interest in the low-line type of milking-machine. Under carefully-controlled test conditions the two types, releaser and low-line, have been compared in their rate of milking the same cows. Mean values for rate of milking were as follows:

	Pounds Per Minute.
Releaser machine	2·618
Low-line machine	3·045
Difference	0·427

This work is being checked over a whole lactation.

Milking Methods: Temperature of Wash Water.—A trial was conducted of warm- and hot-water washing methods compared with the normal method at Ruakura of using cold water straight from a hose. No advantage was found in the use of warm or hot water. The experiment is reported fully in an article in the *Journal of Agriculture.*

Milk-ejection-recording Methods.—During the season the milk flow-recording apparatus has been gradually changed over to an improved system. The chief improvements are (1) the system is completely automatic, recording all milk-ejection curves at all milkings on a continuous strip of paper; (2) timing is automatic, the end-point of half a pound of milk per minute being automatically indicated by an all-electric unit, thus eliminating the personal errors inherent in the sight-glass; (3) the accuracy is double that of the earlier instrument, having 100 points on a full graph; (4) in cases in which the milk volume exceeds the full scale of the recorder the instrument resets automatically and continues the graph; (5) the apparatus is capable of operating with duplicate measuring units. This was necessary for the new high- versus low-line milking experiment.

A "Magnesyn" remote indicating system has been tried for the distant indication of milk weights.

Milking-machine Mechanics.—Relief Valves: Two new commercial relief valves have been tested. A new type of air-flow meter was used based on aircraft fuel-flow gauges. The new testing method is much simpler and quicker than the original method at Ruakura.

Vacuum Pumps: An improved field pump testing method has been developed. This is more convenient than that described earlier. Theoretical work on vacuum-pump design has been started. Already as a result of this work the inefficiency of present types of vacuum pump would appear to be due to poor design.

Pig-milking Machine: A machine for milking sows and measuring individual "quarter" yields has been designed and is under construction.

Teat-cup Vacuum: A special recording vacuum gauge and teat-cups have been made for the study of the vacuum changes right inside the inflation. This has been used in studying the effects of low- and high-line machine milking and in checking the action of moulded inflations. The new instrument has a small internal volume and so can give a precise indication of the changes inside the cups.

Milk Ejection Physiology.—Using an electric shock inhibition technique, evidence has been produced for the view that a cow can be stimulated to realease more than one lot of "let-down" hormone during a milking. This double let-down can be established as a result of conditioning, and the behaviour of "strippy" cows is explained in terms of a "double let-down" of milk.

Again using electric-shock inhibition, the "crawling" of the teat-cups up the teats to a degree which almost stops milk flow has been shown to occur before the milk is let down.

Film.—An educational film with sound track has been prepared in collaboration with the National Film Unit to assist in promoting efficient machine milking.

Cattle Disease Projects

Mastitis: Penicillin Treatment.—In a test with three injections at twenty-four-hour intervals of 25,000 units of penicillin in the form of penicillin cerate, 60 out of 90 quarters affected with clinical mastitis due to *Streptococcus agalactiae* showed clinical recovery and sterilization and a further 22 showed clinical recovery without sterilization. This is equivalent to a total of 90 per cent. clinical cure. These results are in line with those reported last year for penicillin in solution and mastic forms. Penicillin-cerate treatment has been very widely adopted in the industry, and reports show that it is giving very satisfactory results.

A field experiment has been conducted in collaboration with the Dairy Board and a number of veterinarians to test the efficacy of one tube of penicillin cerate containing 25,000 units injected at or after drying off. There are four groups of cows for which previous history of clinical mastitis is available. In group 1 all quarters affected during the season were treated; in group 2 all quarters in cows which had been affected during the season were treated; in group 3 all quarters of all cows were treated; in group 4 there was no treatment. It is hoped that the results, which are not yet available, will indicate the relative value of the various measures, both in the treatment of clinical cases and in the prevention of new cases by reducing the reservoir of infection.

The following results are available from smaller groups which were under more intensive observation:—

Fifty-five cows carrying latent infection of *Streptococcus agalactiae*, as determined by culture methods, were treated at drying off or while dry with one tube of 25,000 units of penicillin in the cerate form. Of these, 84 per cent. were clear of infection at calving and 73 per cent. remained clear for a further three months during which observations were continued. This compares well with the figure of 80 per cent. to 90 per cent. calving clear of infection last year, when treated in a similar way, but with three infusions of 25,000 units in the solution form.

It was possible to obtain reliable milk samples for cultural examination from 616 cows in eleven herds in which all quarters of all cows were treated at drying off or while dry with one tube of 25,000 units of penicillin. Only three herds calved down free of infection, the average incidence of cows infected in all herds being 4·8 per cent. and of quarters infected 1·4 per cent. Since the average normal rate of infection is approximately 24 per cent. of cows, it would appear that wholesale treatment of all dry cows with penicillin should substantially lower, though not eliminate, mastitis infection. It may be noted that the reduction from the average incidence figure of 24 per cent. to 4·8 per cent. suggests that approximately 80 per cent. of infected cows calved clear of infection, a figure which agrees closely with the more carefully-controlled work noted above.

Reservoirs of Infection During Dry Period.—As a means of possibly reducing the risk of subsequent reinfection of treated cows, various possible sources of infection during the dry period have been investigated.

Agalactiæ organisms have been found in vaginal discharge of one New Zealand cow, confirming a similar finding in Great Britain. Organisms were also found on the teats of dry cows, some 45 cows out of 316 examined harbouring agalactiæ on the outside of the teats. Seven herds were involved in this investigation and all contained cows with infected teats. The need for efficient teat disinfection is obvious, and various methods are under study.

Shed fittings in a dairy well above average in its general efficiency from a cleanliness point of view were tested during the dry period for presence of agalactiæ. Apart from the handle of one strip cup, all fittings gave negative results. Data are being sought from the average and below-average sheds.

Studies of Penicillin Concentration and Distribution in the Udder.—Work mainly with cerate has been carried out to assess the period during which a satisfactory concentration of penicillin can be maintained in the udder by various dosages in lactating, drying-off, and dry cattle. Marked variations occur between quarters of the same cow and between cows. In general, with lactating cows three injections with 25,000 units of cerate penicillin at twenty-four hour intervals maintained a satisfactory level for four days and was superior to other systems tested. With drying-off cows a single injection with a cerate tube could not be relied on to maintain a satisfactory level for more than forty-eight hours. With dry cattle a similar single injection maintained desirable concentration for five to six days.

In a preliminary experiment with cerate penicillin in which cows were slaughtered after treatment it was shown that twenty-four hours after injection the level of penicillin was lower in the distal portion of the udder than in the main ducts; at forty-eight hours the levels were approximately equal; from forty-eight hours to seventy-two hours the distal concentrations fell markedly. These observations were made on slaughtered cows. The results indicate that the milk sample from an udder gives only an approximate index of penicillin concentration within the udder system as a whole. This situation is probably exaggerated in lactating cattle.

Penicillin Sensitivity and Resistance.—The testing of sensitivity of mastitis organism to penicillin has not been entirely satisfactory, but it appears that the bacterio-static level of *Streptococcus agalactiae* is about 1 unit per millilitre. Samples from 167 cows reported not to be responding to penicillin were obtained from herds under supervision. These have been classified as follows: 64 samples showed no organisms and normal cell counts; 27 samples showed no organisms but high cell counts. The most common organism was *Streptococcus agalactiae* (33 samples), but under test these did not appear to be of enhanced resistance. It would appear that the problem of "resistance" of agalactiæ is more one of host or methods of treatment than of parasite. Fourteen samples showed a "greening" streptococcus which demonstrated true resistance to penicillin, and a further 14 cases carried organisms which could not be expected to be affected by penicillin. Fifteen samples yielded indeterminate results because of possible contamination.

At present, therefore, data do not support the idea that resistant strains of agalactiæ exist. It is, of course, too early to expect any reliable evidence on the possible development of resistant strains.

Ruakura Herds.—For the first time since the beginning of control measures, No. 1 and No. 2 herds can be reported clear of infection. After treatment of all cows when dry only one formerly-infected cow revealed trouble this season, although new cases have occurred. In No. 1 herd (87 cows) one cow calved with infection and six developed infection during the year. All yielded to treatment. In addition, one cow died from coliform mastitis. No cases of staphylococcal mastitis occurred. In No. 2 dairy (91 cows), infection with agalactiæ did not appear during the season.

Contagious Abortion.—The demand for calfhood vaccination of dairy heifers with strain 19 has shown a steady increase, 231,000 doses of vaccine being sold during 1948.

The results from vaccination have continued to be satisfactory, as is shown in the following table :—

INCIDENCE OF ABORTIONS IN VACCINATED DAIRY COWS, 1943–47

——	——	Abortions.	Per Cent.
First pregnancies	113,549	3,141	2·8
Second pregnancies	46,878	1,156	2·5
Third or later pregnancies	26,910	490	1·8
Total pregnancies	187,247	4,787	2·6

In these herds, during the season immediately preceding that in which the vaccinated heifers calved, 18·8 per cent. of unvaccinated heifers and 6·8 per cent. of unvaccinated older cows aborted. Blood tests indicated that approximately 40 per cent. of the abortions of vaccinated animals were not due to contagious abortion. Thus abortions directly attributable to contagious abortion would be less than 2 per cent.

An experiment has been started at Ruakura to test the effect of infection with contagious abortion on semen production and the possibility of protecting bulls against infection by vaccination with strain 19. No results are yet available.

Trichomoniasis.—Trichomonas investigational work has continued during the season The main aim has been to obtain some measure of the incidence and distribution of this disease and to obtain experience of the tricin test and the blood agglutination test for the presence of the disease in herds.

Though a search was made for trichomonads in twenty-four herds where the breeding history was very suggestive of this disease, the organism was found only in one instance. Three of these herds gave positive reactions to both the tricin test and blood agglutination test, three herds to the blood test, and six herds to the tricin test, a total of twelve herds showing positive reactions. Five herds showed " high normal " readings of the blood test, two of these also giving positive reactions with other tests. Because of the difficulty of diagnosis under such circumstances, the blood test has been carried out in one of the Ruakura herds believed to be free of the disease. Of 47 cows tested, 45 showed " normal " and 2 " high normal " reactions.

Field veterinarians have also sent in many samples of mucus and aborted fœtuses for examination, but in only one case was any flagellate organism found. Identification was not positive. Arrangements have been made for field veterinarians to be supplied with outfits for the collection of mucus blood and semen samples from suspect herds and bulls.

It is not possible on available evidence to give more than an opinion as to the probable incidence of the disease. From data collected so far it would seem that many herds are harbouring the organism but have become sufficiently immune over a period of years to enable them to attain conception rates and final calving percentages which, though far from satisfactory, are not disastrous. These herds, however, are dangerous to the industry as reservoirs of infection.

Sterility Survey.—To obtain a measure of the relative incidence of different types of female sterility, cows culled as empty from the herds in the artificial insemination groups have been slaughtered and the genitalia post-mortem examined. Difficulties at the freezing-works because of rate of killing have made it impossible to handle more than a small number so far, but the provision of a slaughterhouse at Ruakura should increase the general efficiency of this work in future.

Over the past four years 177 such cows have been examined. These have all had three or more inseminations artificially, followed by one or two natural matings, before being culled as empty. The following summarizes the findings:—

Diagnosis.	Number.	Percentage.
(1) Luteal cysts	6	4·6
(2) Cystic ovaries (no luteal tissues) ..	7	5·4
(3) Bursal adhesions	3	2·3
(4) Cystic fallopian tube or salpingitis	4	3·1
(5) Advanced tuberculosis	2	1·5
(6) Pyometra	1	0·7
(7) Recent abortion	2	1·5
(8) Anoestrus	1	0·7
(9) Endometritis	14	10·7
(10) Normal	92	70·7

The outstanding finding was that in 70 per cent. of the cases there was no noticeable abnormality. For this reason they have been classified as "normal." Future work may be able to provide more accurate classification of these. The classification "endometritis" included all degrees of this condition, and it is considered that a high proportion would have returned to normal in time or with suitable treatment. Only those cases classified under the headings (1) to (6) can be considered as likely to be sterile in the true sense of the term. On this basis, approximately 80 per cent. of the cows which have failed to conceive in these herds are apparently not sterile. This figure is practically the same as that found by the Herd Recording Department of the Dairy Board as being the percentage of cows that conceive of those carried over empty from one season to the next.

Johne's Disease.—A field experiment to determine the value of vaccination of calves on infected dairy-farms in giving protection against Johne's disease was started last year. One hundred and thirty-nine calves on seven farms in the Taranaki and Waikato districts have been vaccinated. A number of years must elapse before the results of this experiment will become available.

Ketosis and Grass-staggers.—To determine the role of underfeeding in the production of these diseases, recently-calved cows were grazed on small breaks of fresh, short, early-spring pasture and in another experiment in a later stage of lactation on a hard-grazed small paddock of early summer pasture.

In both experiments a mild ketosis (maximum blood ketones, 25 milligrammes per cent.) and a moderate to marked fall in blood magnesium (several cows below 1·4 milligrammes per cent., minimum 0·5 per cent.) occurred following underfeeding, being most pronounced in the recently-calved cows. In several cases the degree of ketosis and hypomagnesæmia was equal to that seen in naturally-occurring cases of ketosis and grass-staggers in which blood ketones are above 16 milligrammes per cent. and magnesium below 1·4 milligrammes per cent. Symptoms of grass-staggers were not observed, though slight generalized muscular tremors occurred in one cow.

The more pronounced degrees of ketosis and hypomagnesæmia were seen in the underfed cows, which continued to produce above 1 lb. butterfat per day at the expense of their body tissue reserves.

To determine the effect of milk-production at the expense of body tissues without dietary restrictions, recently-calved cows were dosed synthetic thyroprotein in the form of iodinated casein at the rate of 36 grammes per 1,000 lb. live weight. Normally-fed cows showed a marked fall in serum magnesium from an average of 2·4 milligrammes per cent. to 1·7 milligrammes per cent. after only three daily doses, and a slight ketosis

accompanied by increase in milk and butterfat yield and loss in body weight. Underfed cows were also dosed iodinated casein, and their fall in serum magnesium was accelerated, while their milk yield rose and body weight still further declined. One underfed cow's serum magnesium fell from 1·8 milligrammes per cent. to 0·6 milligrammes per cent. after seven daily doses of thyroprotein. It is suggested tentatively that a negative balance in energy metabolism in lactating cows is a contributory factor in the development of ketosis and grass-staggers.

Tall-fescue Poisoning in Cattle.—Peripheral necrosis in cattle grazed on tall-fescue grass (*Festuca arundinacea* Schreb) has been ascribed to contaminating ergot (*Claviceps purpurea*).

Experimental feeding of cattle with hay made from tall-fescue grass which had caused an outbreak of lameness in dairy cows produced peripheral necrosis in one of three cows and transitory lameness in a second cow. The hay contained no ergot sclerotia, and it therefore appears that tall-fescue grass itself contains some substance which will cause peripheral necrosis.

Attempts to produce lesions in rats, rabbits, or cockerels which would act as a guide in attempts to extract the responsible substance have so far proved unsuccessful.

Pig Projects

Economics of Meal-feeding.—Results from an experiment using individually-fed Berkshires indicate that pigs below 70 lb. live weight may be fed up to 1½ lb. of concentrate per day; up to 1 lb. per day, between 70 lb. and 90 lb. live weight; and up to ½ lb. per day for pigs from 90 lb. to 110 lb. live weight. At this rate of feeding no monetary loss would result from the outlay upon meal.

Results from group feeding of Large Whites up to 70 lb. live weight showed that a definite profit of 0·6d. per gallon of milk fed would accrue when supplementing is at the rate of 1½ lb. of concentrate per day, 0·4d. per gallon when 1 lb. of concentrate is fed, and 0·3d. per gallon when ½ lb. is fed. From 71 lb. to 90 lb. live weight both 1 lb. and ½ lb. per day show a margin of 0·1d., but 1½ lb. is definitely not profitable.

Because of milk shortage, group results are not available beyond this point.

Although all pigs received as much milk as they could consume in five feeds per day, the feeding of meal supplements effected a substantial saving in daily milk intake. This saving was as high as 1·5 gallons per day between pigs receiving 1½ lb. meal per day and those receiving milk alone. Increasing meal supplements increased the savings effected. This held for both individually-fed and group-fed pigs.

Daily weight gains were slightly increased by increasing meal supplements in the case of individually-fed pigs and materially increased in the case of group-fed pigs.

The feeding of meal in these quantities enables sows to be farrowed earlier in the spring and the weaners to make rapid early gains and thus reach a weight at which they can cope with the spring milk flush. The feeding of meal to summer and early-autumn litters enables them to reach porker weights before winter and also release milk for feeding spring-born baconers.

Effect of Housing and Pasture on the Efficiency of Food Conservation.—Though complete data are not yet available it appears that no significant saving in milk per pound of live-weight gain can be effected by allowing fattening pigs access to pasture. Neither the type of housing nor the level of feeding provided influenced the economy of live-weight gain. The types of houses under comparison were the Danish and the open-fronted fattening-house, both of which are much superior to average farm equipment, but about which there is much controversy.

Incidence of Crooked Jaw in Pigs.—At the request of the New Zealand Pig Breeders' Association the incidence of the abnormality known as crooked jaw in Berkshire pigs was investigated in the Northland area, from which breeders had reported considerable trouble.

All studs in the area (12) were affected and 232 pigs from 31 sows and 15 boars were involved. A total of 117 young pigs had normal jaws and 115 showed the crooked condition. Twenty-six of the breeding-sows were normal and 5 were crooked. All boars were normal. The 5 sows with crooked jaws produced 50 pigs, of which 50 per cent. were crooked.

Examination of the pedigrees up to the grandparent stage showed that 33 studs in New Zealand were represented. If the condition is an inherited one, it must be present in some degree in all of those which were situated in Taranaki, Waikato, and Bay of Plenty districts. Though the condition is classed as a defect for stud-book purposes, none of the stock examined was apparently handicapped in grazing, fattening, or reproduction, so that the economic importance of the trouble appears negligible.

The survey brought out one outstanding fact about the effect of inheritance: the incidence of crooked jaw is almost the same in matings where one parent is affected as in matings where neither is affected. This indicates that it would be very difficult to breed out the defect.

Observations on the Milk Yield of Sows.—Five sows were used for milk-yield observations, the general objective being to determine the lactation level and the characteristics of the lactation curve of New Zealand sows in relation to the growth of suckling pigs.

The average milk-production per sow for the eight weeks of suckling was 605 lb. and 86·4 lb. per pig. This level is substantially higher than overseas figures, typical values for which are 367 lb. for sow and 55 lb. per pig. This may be a major factor explaining the high weaning weights in New Zealand relative to those of overseas breeding-sows.

The shape of the lactation curve of the Ruakura sow was such that the peak level of output was reached in the sixth week. This again departs from overseas results where the peak is attained in the third week.

The economy of live-weight gain made by the litter of 3·6 feed units per pound is the same as overseas figures for sows and litters similarly fed.

From further studies of this type it is hoped to obtain correlation between sow-milk yield and piglet growth which will permit more accurate selection of breeding-stock on a basis of milk-yield difference and which will enable studies of sow nutrition in relation to milk yield to be carried out effectively.

Trace Elements

Cobalt: Aerial Top-dressing.—Pasture samples have been collected at intervals from the 1,800-acre area of bush-sick country near Taumarunui aerially top-dressed during August, 1947, with 20 oz. of cobalt sulphate per acre. Analyses show that aerial top-dressing has greatly increased the cobalt content of the pasture and that the top-dressing has so far remained effective for more than a year. Over the easy country a fairly even spread has been obtained, but over the more broken areas there was greater variation in spread. Analyses of samples from outside the prescribed areas have indicated that in some cases loss of cobalt because of wind occurred during top-dressing. For future undertakings it is recommended that where accurate placing is required, as on small or irregularly-shaped farms, top-dressing should be carried out in winds not exceeding five miles per hour.

Toxicity of Cobalt to Sheep.—To investigate the feasibility of distributing cobalt through the fæces by administering heavy drenches of cobalt sulphate to sheep, ewes were given single massive doses of the mineral varying from ½ oz. per sheep to 3 oz. per sheep. Three ounces were in all cases fatal, and one sheep out of five succumbed to a dose of ½ oz. Deaths occurred within a few hours of drenching. It was concluded, therefore, that this method of top-dressing was not likely to be satisfactory.

The sheep which died stored large amounts of cobalt in the liver (400 to 1,100 parts of cobalt per million (p.p.m.) of dried liver, as compared with normal sheep (0·15 p.p.m.)).

Copper and Molybdenum.—Continuation of work on the etiology of peat-scours has added further confirmation to the hypothesis that this disease is caused by a moderate dietary excess of molybdenum superimposed on a moderate deficiency of copper. The molybdenum content of peat-scours pastures varies from 3 to 7 parts per million in summer to up to 16 parts per million in the spring scouring season, compared with a figure for normal pastures of 1 to 3 parts per million throughout the year. Feeding molybdenum to stock on copper-deficient pastures reduces growth rate, causes scouring, and increases a tendency to broken bones. Some anomalies have yet to be investigated.

An examination of pastures from leached coastal sands and podsolized sandy gum-land soils has disclosed a marked copper and molybdenum deficiency in many parts of the North Auckland district and in coastal areas in other parts of New Zealand, notably near Foxton. Further work on this new development in copper-deficient areas is being carried out, especially the study of stock health on those areas.

In the third season of experimental dosing of molybdenum to ewes at Wallaceville, where pasture copper is normal, it has been found that liver copper of new-born lambs is reduced to about 10 parts per million. This is in the region of values at which enzootic ataxia occurs, but no cases developed in the lambs.

Molybdenum is so far the only element which shows any appreciable effect on storage of copper in bovine or sheep's livers; feeding molybdenum reduces the storage more in cattle than in sheep. It has been found in sheep that the effect of extra dietary molybdenum is more to cause reduction of copper already stored in the liver than to prevent further storage when large doses of copper are fed.

Parasitology

Distribution of Hæmonchus contortus (Large Stomach Worm).—Observations on the distribution of *H. contortus* were briefly reported in last year's report. The examinations have now been completed on 407 specimens of lamb stomachs collected from December, 1947, to February, 1948, from five selected freezing-works in various parts of the Dominion.

The following table gives the results of the worm counts, and from it an indication can be obtained of the incidence and intensity of infestations in the districts concerned. The corresponding figures for *Ostertagia* (small stomach worm) are also given.

THE PERCENTAGE OF LAMBS CARRYING INFESTATIONS OF HAEMONCHUS, DECEMBER, 1947, TO FEBRUARY, 1948

District.	Number of Lambs Examined.	Number of Worms.			
		0.	1–100.	101–500.	Over 500.
		Per Cent.	Per Cent.	Per Cent.	Per Cent.
North Auckland ..	31	6	47	33	14
Waikato	116	5	60	30	5
Poverty Bay	93	17	63	11	9
Taranaki	90	6	52	29	13
Southland	77	72	27	1	..

These figures indicate that *Hæmonchus* is fairly widespread throughout the North Island, though few heavy infestations (over 500) were seen. In Southland the parasite was less frequently seen and the worm burdens were much smaller.

PERCENTAGE OF LAMBS CARRYING INFESTATIONS OF OSTERTAGIA. DECEMBER, 1947, TO FEBRUARY, 1948

District.	Number of Lambs Examined.	Number of Worms.			
		0.	1-500.	501-2,000.	Over 2,000.
		Per Cent.	Per Cent.	Per Cent.	Per Cent.
North Auckland ..	31	9	43	39	9
Waikato	116	10	38	43	9
Poverty Bay	93	17	42	30	11
Taranaki	90	15	50	32	3
Southland	77	21	33	30	16

Infestations with *Ostertagia* were also widespread and heavy infestations (over 2,000) were not very common. The range of *Ostertagia* extends further south than that of *Hæmonchus*.

Liver Fluke in Bay of Plenty.—The presence of liver fluke in small areas in the Bay of Plenty has been confirmed. It has occurred on farms near Whakatane on which many miles of watercourses occur. For this reason attempts to control the intermediate host snail (*Myxas ampulla*) would prove very difficult and uneconomic. An excellent response to carbon-tetrachloride drenching has been obtained, and regular drenching once or twice per year should keep the parasite under control.

There is a history suggestive of black disease in this area, but the diagnosis has not yet been confirmed. If black disease is present, vaccination will be advisable.

Regurgitation of Tablets Dosed to Sheep.—As a result of reports from Australia that a proportion of phenothiazine tablets dosed to sheep was regurgitated some time after dosing, an attempt was made to determine whether the same problem existed in New Zealand. Groups of sheep were dosed with two types of tablets. None of the tablets in use in New Zealand was regurgitated, but 14 per cent. of another type of tablet was. The difference is due to the rates at which the tablets disintegrate in the rumen.

Phenothiazine Drenching.—On a property in the Waikato where a heavy hogget mortality (20 per cent.) was experienced during autumn and winter and where all the surviving animals were unthrifty, a drenching experiment was carried out comparing two dose rates of phenothiazine with untreated controls. At the end of August the hoggets were weighed, drenched, and samples of fæces obtained for worm-egg counts. Five weeks later the animals were weighed again and further fæcal samples obtained. The results are summarized in the following table :—

	Group I: 15 Gramme Phenothiazine.	Group II: 30 Gramme Phenothiazine.	Group III: Undrenched.
Mean body weights—			
31st August, 1948	50·8 lb.	50·8 lb.	51·4 lb.
4th October, 1948	61·3 lb.	61·9 lb.	61·0 lb.
Gain	10·5 lb.	11·1 lb.	9·6 lb.
Mean egg counts—			
31st August, 1948	622 e.p.g.	851 e.p.g.	856 e.p.g.
4th October, 1948	262 e.p.g.	462 e.p.g.	843 e.p.g.
Percentage reduction	58 per cent.	46 per cent.	1·8 per cent.

Normally for sheep of this age a 20-gramme dose would be recommended. Fifteen grammes were given, as these hoggets were poorly grown, and 30 grammes to determine whether the use of the larger dose would be justified by greater efficiency. No such greater efficiency was demonstrated.

The above weight differences are not significant. Soon after the completion of the trial with the spring pasture growth both groups showed a rapid improvement in condition.

Immunity in Sheep to Hæmonchus contortus.—The study of immunity to *Hæmonchus* was continued, using lambs reared under worm-free conditions. The effect of small repeated doses of infective larvæ which were begun at the age of two months was observed. At the age of eight months infected and control groups were dosed with phenothiazine and challenged with a large dose of larvæ. The infected and control lambs all developed heavy infestations, but a significant difference both in size and number of worms present in the stomach was observed.

In another trial repeated infections were continued until the age of fifteen months, when the lambs were drenched with phenothiazine and challenged with a large dose of infective larvæ. At the same time a group of three-months-old worm-free lambs were also dosed with the same number of larvæ. On post-mortem examination there were striking differences in the number and length of the worms in the infected and control sheep at fifteen months of age.

A comparison of the worm-free lambs at three months and worm-free sheep at fifteen months, after the challenge dose, showed that a smaller number of normal-sized worms was recovered from the younger animals and a large number of worms, all of which were retarded in development, was recovered from the older animals.

It is considered likely that fifteen-months-old sheep showed an age resistance (in retarded growth of the worms) and that the smaller numbers developing in the three-months-old lambs is because of the operation of some other factor. These results stress the importance of examining more than one criterion of worm resistance in trials of this nature.

The Effect of Tickicidal Sprays on the Cattle-tick, Hæmaphysalis bispinosa.—Preliminary tests of various compounds used as sprays against the adult cattle-tick were conducted in the North Auckland Peninsula. D.D.T., B.H.C., and Derris gave rapid kill, but within three days reinfestation had taken place and adults were engorging. Arsenical preparations were slower acting but gave more lasting protection. Reinfestation occurred within ten to fourteen days.

B.H.C. has the grave disadvantage that it is fat soluble and has a very persistent musty odour. For this reason its use in dairy herds and premises may result in severe tainting of cream.

Bacteriology

Salmonella Infections.—During the year an examination of organs and fæcal material submitted from cases of persistent and often fatal scouring in both cattle and fowls disclosed the presence of *Salmonella typhimurium* infection. This organism of the *Salmonella* group is one which occurs frequently in human infections and has been isolated from mortalities of ducks, pheasants, rabbits, and guinea-pigs.

Salmonella typhimurium has recently been isolated from a case in sheep involving several deaths.

Work on the role of *Salmonella choleræ suis* as a pig pathogen has been continued. Experimental results have shown that the feeding of freshly-isolated cultures or such cultures maintained in the dry state *in vacuo* may provide a reliable method of transmitting the disease to weaner piglets. Preliminary work on the possibility of establishing some degree of immunity by the use of vaccines has been begun, but for the assessment of the protective value of vaccines prolonged experimental work will be necessary.

Biochemistry

Testing of Proposed New International Standard for Vitamin D.—At the request of the Medical Research Council, London, tests have been carried out at Wallaceville Laboratory as one of a series of laboratories collaborating in the assay of the proposed new International Standard for vitamin D. The proposal is to replace the existing International Standard for vitamin D (a solution of irradiated ergosterol) with a crystalline preparation of D_3.

To obtain data on the antirachitic potency of this new preparation, four solutions were issued by the Medical Research Council to participating laboratories. Of these solutions one was a solution of the existing standard, one of pure calciferol, a third contained the proposed new standard material, and a fourth another vitamin D preparation. The solutions were labelled W, X, Y, and Z, and only the issuing committee knows which is which.

All four solutions were tested at four dose levels, in the ratio 1 : 2 : 4 : 8, using 10 rats on each dose of each preparation. A total of 200 rats was used in the assays, the method used being the prophylactic bone ash technique. Results were tabulated, the ratio of potencies of the four preparations calculated, and data sent in to the Medical Research Council. Information on the final assessment of potency of the preparation will be received after deliberation at the International Standards Conference to be held in April of this year.

Digestibility Studies on New Zealand Foodstuffs.—A large amount of additional data has accumulated on the digestibility and nutritive value of New Zealand pastures in the course of intake investigations. These have involved continuous digestibilities throughout the past two seasons on typical high-producing dairy pastures under three different starting rates. When completely analysed these should provide a fairly complete picture of seasonal changes in the nutritive value of dairy pastures and of the effect of major variations in management.

Similarly, a number of trials (seven from 1944 to 1947) have permitted examination of the nutritive value of autumn-saved pasture. The following table summarizes the data obtained :—

Nutritive Value of Autumn-saved Pasture (Percentage Dry-matter Basis)

Type of Feed.	D.O.M.	D. Pr.	S.E.
Autumn-saved pasture	66·5	15·6	60·9
High-quality spring pasture	70·8	17·8	65·8
Average-quality silage	60·4	5·0	49·1
Average-quality hay	51·2	4·3	32·6

It is clear that the autumn flush of pasture, if preserved *in situ*, will retain a high feed value throughout the winter and thus enable it to be used by early-calving cows at a period of pasture shortage. All the data available suggests that autumn-saved pasture is almost as good as high-quality spring pasture.

"Unknown" Water-soluble Fractions in Fodder Plants.—Analyses to confirm the existence and amount of unknown water-soluble fractions in pasture and fodder plants have been extended to include cocksfoot. The amount of this fraction in plants expressed to date has been—

	Per Cent.
Blue lupins (stem, leaf, flower)	17·2
Blue lupins (stem, leaf, pod, seed)	16·4
Rape (stem, leaf)	10·4
Red clover (stem, leaf, flower)	9·6
Paspalum (stem, leaf)	5·2
Cocksfoot (leaf, stem)	2·8

Cocksfoot contained a much smaller percentage of unknown constituents than forage plants examined so far. There appears to be an appreciable amount of organic acids (50 per cent.) in this fraction in rape, and a chromatographic analysis showed the presence of three acids—citric, malic, and one other. Paspalum also contained malic and citric acids.

The work is being continued further to identify these acids and estimate their contribution to the fraction.

Apiculture

Wasp Control.—Field work was carried out on methods of combating the recently-introduced wasp, *Vespa germanica.* It was discovered that the queens of these wasps were attracted to certain plants and hedges in the spring by honey-dew excreted by insects infesting them. The plants act as natural lures, and when sprayed with D.D.T. are converted into poisoned baits which provide a valuable means of destroying the queen wasp in its susceptible phase. Power spraying with D.D.T. of large oak-trees which similarly attracted queen wasps in great numbers also proved an effective means of destroying queens. It was found possible to attract queen wasps by means of a synthetic honey-dew which was unattractive to hive bees. The Horticulture Division collaborated in this work.

Artificial Insemination and Progeny Testing of Queen Bees.—It has long been realized by commercial apiarists that great differences in performance exist between queen bees, and breeding from selected queens for desirable qualities is the accepted practice. The mating of queen bees with drones can take place only in the air, and hence, while the queen could be raised from approved stock, no satisfactory control existed over the type of drone which would mate with her, and breeding was a haphazard affair. Recently a technique was developed in the United States of America for the instrumental insemination of queen bees. The application of this method and progeny testing with a view to improving existing strains of hive bees was begun at Wallaceville. The technique of insemination was mastered and successfully-inseminated queens were kept under observation in the laboratory apiary. Breeders of queen bees who will furnish suitable stock for breeding will collaborate in the project.

Poison Honey.—Work was continued on the extraction of new toxins from toxic honey, using a superior method of extraction. The toxicity of different portions of *Coriaria arborea* and *Coriaria sarmentosa* was further investigated.

Treatment of Nosema apis.—Trials of drugs against *Nosema apis*, methods of controlling growth of grass round beehives, and causes of fermentation in honey were investigated.

Wallaceville has been declared a quarantine-station for imported queen bees, which are passed free from disease there before being despatched to their importers.

Publications

Buddle, M. B. (1948): "Vaccination against Bovine Brucellosis." *Aust. Vet. J.*, *24*, 171.

Buddle, M. B. (1948): "Immunity in Cattle Vaccinated with *Brucella abortus* Strain 19 by the Subcutaneous and Intracaudal Routes during Calfhood." *Aust. Vet. J.*, *24*, 262.

Cunningham, I. J. (1948): "Tall Fescue Grass is Poison for Cattle." *N.Z. J. Agric.*, *77*, 519.

Cunningham, I. J. (1947): "Photosensitivity Diseases in New Zealand v. Photosensitization by St. John's Wort (*hypericum perforatum*)." *N.Z. J. Sci. & Tech.*, *29*A, 207.

Cunningham, I. J., and Hogan, K. G. (1948): "Increases in the Molybdenum Content of Pasture on an Acid Peat Soil from Top-dressing with Ammonium Molybdate." *N.Z. J. Sci. & Tech.* (In press.)

Cunningham, I. J. (1948): "The Control of Copper Deficiency in Lambs in New Zealand." *N.Z. J. Sci. & Tech.* (In press.)

Cunningham, I. J. (1949): "A Note on the Cause of Tall Fescue Lameness in Cattle." *Aust. Vet. J.*, *25*, 27.

Docker, T. M. (1948): "Bovine Trichomoniasis." *Aust. Vet. J.*, *24*, 226.

Dunlop, A. A., and Coup, M. R. (1948): "The Nutritive Value of Pampas Grass (*Contaderia selloana*)." *N.Z. J. Sci. & Tech.* (In press.)

Ewer, T. K., and Sinclair, D. P. (1948): "Internal Parasitism in Canterbury Sheep." *N.Z. J. Sci. & Tech.* (In press.)

Filmer, J. F. (1948): "Foot-rot in Sheep can be Eradicated." *N.Z. J. Agric.*, *77*, 465.

Fix, W. J., and Palmer-Jones, T. (1948): "Control of Fermentation in Honey by Indirect Heating and Drying." *N.Z. J. Sci. & Tech.* (In press.)

Hancock, J. J. (1948): "Congenital Photosensitivity in Southdown Sheep." *N.Z. J. Sci. & Tech.* (In press.)

Hancock, J. J. (1948): "Grazing Habits of Dairy Cows." Proceedings Massey Agric. College Dairy Farmers' Conference. *Dairy Farming Annual*, 1948.

James, J. P., and Southcombe, S. A. (1948): "Production Records of Artificially-bred Heifers." *N.Z. J. Agric.*, *77*, 363.

Josland, S. W. (1948): "A Note on the Use of Hydroquinone Enrichment Media for the Isolation of Salmonella." *J. N.Z. Assn. Bact.*, *4*, 5.

Josland, S. W. (1948): "The Identification of Salmonella with Special Reference to Serological Methods." *J. N.Z. Assn. Bact.*, *3*, 51.

Lancaster, R. J. (1948): "A Method of Calculating the Digestibility of Pasture Based on the Nitrogen Content of Fæces Derived from the Pasture." *N.Z. J. Sci. & Tech.* (In press.)

Lancaster, R. J. (1948): "Estimation of Digestibility of Grazed Pasture from Fæces Nitrogen." Letter to *Nature*, *163*, *4139*, *330*.

Lees, F. T. (1949): "Autumn-saved Pasture on the Dairy Farm." *N.Z. J. Agric.*, *78*, 177.

McMeekan, C. P., and Longwill, A. (1948): "Quality of N.Z. Baconer Pigs Praised by English Judges." *N.Z. J. Agric.*, *76*, 425.

McMeekan, C. P.; Walker, D. E. K.; Kneebone; and Marks (1948): "Evaluation of the Chiller Beef Carcase." *N.Z. J. Sci. & Tech.* (In press.)

McMeekan, C. P. (1948): "Ruakura Research Shows how to Rear Well-known Dairy Heifers." *N.Z. J. Agric.*, *77*, 138.

McMeekan, C. P. (1948): "Proven Sires and Artificial Insemination in Herd Improvement." *Dairy Farming Annual*, 1948.

McMeekan, C. P. (1948): "Controlled Grazing for Increased Butterfat Production." *Dairy Farming Annual*, 1948.

Palmer-Jones, T., and Devine, B. W. (1948): "Destruction of Queen Wasps by Spraying." *N.Z. J. Agric.*, *77*, 557.

Palmer-Jones, T., *et al.* (1949): "Developments in Control of Wasps." *N.Z. J. Agric.*, *78*, 229.

Palmer-Jones, T., and White., E. P.: Part VII—"A Recent Outbreak of Honey Poisoning," "Observations on the Toxicity and Toxin of the Tutu (*Coriaria adburea* Lindsay)." *N.Z. J. Sci. & Tech.* (In press.)

Roach, R. W. (1948): "Penicillin for Treatment of Mastitis." *N.Z. J. Agric.*, *77*, 11.

Smith, D. M. (1948): "Aspects of Profitable Pig-fattening." *Dairy Farming Annual*, 1948.

Swan, J. B. (1947): "Celloidin Casts of the Ducts and Vessels of the Sheep's Liver. *N.Z. J. Sci. & Tech.*, *29*, 91.

Walker, D. E. K. (1948): "The Influence of Sex upon Carcase Quality of N.Z. Fat Lambs." *N.Z. J. Sci. & Tech.* (In press.)

Whitten, L. K. (1949): "Blowfly Strike in Sheep." *N.Z. J. Agric.*, *78*, 17.

Whitten, L. K. (1948): "The Anthelmintic Efficiency of Phenothiazine Sulphoxide against *Hæmonchus contortus* and Certain Large Bowel Parasites of Sheep." *Aust. Vet. J.*, *24*, 114.

Whitten, L. K.; Harbour, H. E.; and Allan, W. S.: "Cutaneous Erysipelothrix Infection in Sheep—An Etiological Factor in Post-dipping Lameness." *Aust. Vet. J.*, *24*, 157.

Whittleston, W. G. (1948): "Efficient Mechanical Milking." *Aust. J. Dairy Tech.*, *3*, No. 2.

Whittelston, W. G. (1948): "A Two-criterion Timer." *N.Z. J. Sci. & Tech.* (In press.)

Whittleston, W. G., and Ellis, R. H. (1948): "A Study of Machine Milking Technique." *N.Z. J. Agric.*, *77*, 49.

Whittleston, W. G. (1948): "'Doubling up' the Milking Machine." *N.Z. J. Agric.*, *77*, 165.

Whittleston, W. G. (1949): "How the Cow Releases Her Milk." *N.Z. J. Agric.*, *78*, 273.

Whittleston, W. G. (1948): "Some Observations on the Nature of the Milk Let-down Mechanism." *Proceedings N.Z. An. Prod. Soc.*, 1948.

HORTICULTURE DIVISION

REPORT OF A. M. W. GREIG, DIRECTOR

Climatic Conditions

The weather during the year was generally good for the production of horticultural crops and the extent of any climatic disasters that occurred was restricted.

Orchardists in the Kerikeri district had an excellent season.

In the Auckland district, where there has been a series of wet winters followed by showery springs, these conditions were repeated, and tree losses were caused through sour sap. Widespread hailstorms in November had a noticeable effect on the grade of apples, especially early varieties from Albany and a few other localities.

At Pukekohe it was excessively wet in 1948, 59 in. of rain falling, compared with an average of 47 in. over the past five years.

Fortunately the tornado which swept across Frankton and some suburbs of Hamilton in August did not affect horticultural crops.

On the 14th August, floods covered 30,000 acres of the Poverty Bay flats and destroyed 70 per cent. of the vegetable crops as well as silting up two orchards to a depth of 18 in.

In Hawkes Bay the weather from the spring of 1947 to the middle of 1948 was very good for the production of horticultural crops.

Lack of rain in the early part of 1948 at Ohakune seriously affected the production of vegetables.

A strong wind at Easter, 1948, resulted in 1,500 cases of "windfalls" on the Motueka area.

A hailstorm in November at Mapua which damaged the foliage of pip-fruit trees resulted in lowering of the grade rather than loss of fruit.

Marlborough had the wettest season for twenty years, but this had no adverse effect on crops.

The severe flooding of the Clutha River in October caused a loss of 680 tons of vegetables from 120 acres of market gardens in Otago.

Horticultural Production

(Localities in parentheses are those where one or more members of the Division's staff are stationed.)

Fruitgrowing.—The number of registered orchards in New Zealand at 31st March, 1949, was :—

Taxable (over 120 trees)	2,038
Non-taxable (under 120 trees)	1,855
Total	3,893

(Every orchard the fruit from which is sold or intended for sale is required to be registered under the provisions of the Orchard Registration Regulations 1937.)

Of the 2,038 taxable orchards, over half—1,025 orchards—are between 1 acre and 5 acres in area and 532 from 6 acres to 10 acres in area.

Fruitgrowing will be considered under pip-fruits, stone-fruits, citrus fruits, berry-fruits, and sub-tropical fruits. (For an over-all picture of pip-fruits see Appendix.)

Pip-fruits (Apple, Pear, and Quince): The major districts for apple-production with over 500 acres in apple-trees as at 31st March, 1949, were :—

	Acres.
Nelson (Nelson, Mapua, Motueka)	3,614
Hawkes Bay (Hastings)	1,364
Auckland (Auckland, Hamilton)	1,307
Canterbury (Christchurch, Timaru)	927
Central Otago (Roxburgh, Alexandra)	896

Minor districts with over 100 acres and under 500 acres include :—

	Acres.
Marlborough (Blenheim)	386
Wairarapa (Masterton)	146
Poverty Bay (Gisborne)	95

The major districts for pear-production with over 250 acres in pear trees were :—

	Acres.
Nelson	320
Hawkes Bay	269

Minor districts with over 50 acres and under 250 acres include—

	Acres.
Central Otago	124
Auckland	105
Canterbury	86

Quinces are grown only to a limited extent, Auckland and Hawkes Bay being the only districts with over 50 acres in quince-trees.

The areas in these districts in 1948–49 were :—

	Acres.
Auckland	63
Hawkes Bay	51

The *total acreage* in pip-fruits was :—

	Acres.
Apple	8,999
Pear	1,006
Quince	186
Total	10,191

Apple, pear, and quince tree figures were almost stationary in 1948, except in the Hawkes Bay district, where nearly 3,500 apple-trees were planted in commercial orchards, the most popular variety being Granny Smith.

Reworking of one variety to a more popular variety continues, nearly 700 apple-trees of miscellaneous varieties being reworked to Sturmer, Golden Delicious, Jonathan, and Granny Smith varieties in the Nelson (Mapua, Motueka) district.

The total of pip-fruit trees at 31st March, 1949, was :—

—	In Orchards Over 120 Trees.	In Orchards Under 120 Trees.	Totals.
	Trees.	Trees.	Trees.
Apple	1,060,354	19,513	1,079,867
Pear	116,688	4,076	120,764
Quince	20,793	1,515	22,308

A general survey of orchards in the Auckland district undertaken in 1948 is almost complete. Its object was to obtain a picture of age groups of fruit-trees, cultural practices, and the general health and condition of trees.

The Division is responsible for setting the grading standards and inspection of apples and pears distributed through the Marketing Department for sale to the public or for export overseas. To check the growers' standard of grading, the Division's Inspectors at assembly points select about 5 per cent. of each line for inspection.

Apple and pear assembly depots operate during the fruit season (January to June). The principal depots are at Hastings, Nelson, Mapua, Motueka, and Auckland. The Te Kauwhata depot was closed in 1948, and new facilities were provided at Alexandra.

In 1948, 2,950,410 cases of fruit, comprising 2,621,365 of apples and 329,045 of pears, were passed by the Inspectors. Of the apples, 78 per cent. were graded Fancy and 20 per cent. Commercial, the balance being Minimum. Of the pears, 86 per cent. were Fancy, 12 per cent. Commercial, and the balance Minimum.

One hundred and sixty-six thousand cases of apples and 33,500 of pears were sold to canning and dehydration factories. In addition, 120,000 cases were used for cider and other purposes.

The two principal apple-producing districts in 1948 were :—

	Bushel Cases.
Nelson	1,338,000
Hawkes Bay	993,000

Other centres with a production of more than 100,000 cases were :—

	Bushel Cases.
Auckland and Hamilton	375,000
Canterbury	169,000
Marlborough	131,000
Central Otago	120,000

The major pear-producing centre in New Zealand in 1948 was Hawkes Bay with 249,000 bushel cases.

Other centres with a production of more than 10,000 cases were :—

	Bushel Cases.
Nelson	87,000
Auckland and Hamilton	48,000
Central Otago	24,000
Canterbury	18,000

The production of apples and pears during 1948 in Nelson was the heaviest since these fruits were distributed through the Marketing Department.

Dominion total production was estimated as 3,240,000 bushel cases of apples and 444,000 cases of pears.

Horticultural field officers forecast a reduction of about 800,000 cases of apples and 80,000 cases of pears for the 1949 season, the figures at 31st March being 2,453,000 cases of apples and 361,000 cases of pears.

The Apple and Pear Marketing Board was appointed in December, 1948, and the Division has assisted the Board during its first season's operation.

The appointment of this Board and the basis on which prices will be paid for apples and pears in 1949 and subsequent years give a new stability to this important branch of horticultural production.

Pip-fruit orchards in Hawkes Bay and Nelson have a well-cared-for appearance. Orchardists have been purchasing new power sprayers, tractors, cultivating implements, and grading equipment. These have contributed to increased efficiency, easier working-conditions, and better crops. As a whole, the orchards are now more fully equipped.

The Division provided the basic information for the apple and pear cost-of-production survey of 1947 and is continuing the compilation of apple and pear crop statistics for the principal varieties of apples and pears. It is proposed to continue this work for at least four years to obtain fair average production figures per tree and per acre over a representative period.

In Central Otago many orchardists have been installing fire-pots to protect crops against frost. This may be responsible for the increasing smoke nuisance reported in these districts.

Pip-fruit Diseases: New therapeutants were used in New Zealand orchards in 1948, and although they were certainly superior for certain insect pests, other pests such as red mite and woolly aphis were a problem. For example, D.D.T. sprays gave outstanding control of bronze beetle in Auckland, apple leaf-hopper in Nelson, and codlin-moth generally, but red mite became a major problem to pip-fruit growers in Auckland, Hawkes Bay, and Nelson. Considerable investigation of the optimum period and strengths of these new therapeutants is still necessary.

From September to November, 1947, a serious outbreak of fireblight occurred in the Hawkes Bay and Gisborne districts. In Marlborough this bacterial disease was prevalent in domestic orchards in the spring of 1948, but there was no reported recurrence in Hawkes Bay.

Signs of potash deficiency in apple-trees have become conspicuous in many Nelson orchards. No doubt the application of nitrates in increasing quantities in late years has contributed largely to this deficiency.

Stone-fruits (Peach, Apricot, Nectarine, Plum, and Cherry): The major districts for the production of peaches with more than 250 acres were:—

	Acres.
Hawkes Bay	742
Auckland	616
Central Otago	560
Nelson	299

Other districts with under 250 acres but over 50 acres include—

	Acres.
Canterbury	70
Hamilton	50

The growing of apricots commercially is confined to Central Otago, Canterbury, and Hawkes Bay.

The area of apricot orchards in Central Otago was 644 acres. Particulars for other districts containing more than 50 acres include—

	Acres.
Canterbury	100
Hawkes Bay	50

Nectarines are grown principally in Central Otago, Hawkes Bay, and Auckland. The two districts with areas of more than 50 acres were:—

	Acres.
Central Otago	135
Hawkes Bay	59

About a third of the registered plum-trees are grown in the Auckland district. The major districts were:—

	Acres.
Auckland	465
Hawkes Bay	270
Central Otago	269

Districts with more than 50 acres but less than 250 acres include—

	Acres.
Canterbury	101
Nelson	94

The majority of the cherry-trees are grown in Central Otago and Canterbury, the respective areas being 125 and 50 acres.

The total of stone-fruit trees at 31st March, 1949, was :—

	In Orchards Over 120 Trees.	In Orchards Under 120 Trees.	Total.
	Trees.	Trees.	Trees.
Peach	286,686	10,275	296,961
Nectarine	30,689	3,324	34,013
Apricot	95,828	4,013	99,841
Plum	141,916	13,773	155,689
Cherry	25,599	986	26,585

The total acreage in stone-fruits was :—

	Acres.		Acres.
Peach	2,474	Nectarine	283
Plum	1,297	Cherry	221
Apricot	832		

(1) The over-all increase in peach-trees during the year was 24,000, including 5,600 in Central Otago, 6,500 in Hawkes Bay, 5,100 in Auckland, 1,000 in Marlborough and 1,000 in Canterbury. The most favoured variety was Golden Queen.

(2) There was a marked increase of 14,000 plum-trees over 1948, the principal plantings being 4,700 in Auckland, 3,600 in Hawkes Bay, 2,700 in Central Otago, and 1,500 in Nelson.

(3) The Dominion total of apricot-trees increased by 7,500 trees, 7,200 being planted at Roxburgh and Alexandra and 1,500 in Hawkes Bay. In other districts there were slight decreases.

(4) An increase of 4,000 nectarine-trees was recorded, of which 1,000 were planted in orchards near Alexandra.

(5) There was little change in the cherry plantings.

An area of 75 acres is being developed at Katikati by a producer who intends to grow peaches and plums for canning.

The estimated production in thousands of bushels of other pip-fruits and all stone-fruits for the 1948–49 season at 31st March, 1949, was :—

	(1) Peaches.	(2) Plums.	(3) Apricots.	(4) Nectarines.	(5) Cherries.	Quinces.
Auckland	39	45	1	1	..	9
Gisborne	6	6	..	1	..	1
Hawkes Bay	250	43	2	20	1	9
Manawatu and Wanganui ..	1	1	..	..	..	..
Wairarapa	..	..	..	..	..	..
Nelson	55	8	..	1	1	9
Marlborough	4	1	..	1	1	..
Canterbury and North Otago	7	6	8	2	2	..
Central Otago	87	23	118	18	8	1
Totals	449	133	129	44	13	29

Apart from apricots, which show an increase of 33,000 bushels, mainly because of better seasonal conditions in Central Otago, the 1948–49 production figures are about the same as those for 1947–48.

The fungus disease, silver-leaf, continues to have a serious effect on production of stone-fruit in Auckland, Hawkes Bay, Canterbury, and Otago. This disease causes loss of trees each year.

Bacterial spot of plums now affects the majority of plum-tree orchards in Auckland and Canterbury.

In Hawkes Bay, die-back and browning have caused trouble in newly-planted blocks of peach-trees over the past two years.

Physiological disorder of stone-fruit trees in some orchards in Central Otago is indicated by unthriftiness of foliage and fruit. Both young and old trees may become affected and quite a number eventually die.

Citrus trees include the lemon (divided into Meyer and others), the sweet orange, New Zealand grapefruit, and other varieties of grapefruit. Although citrus trees can be grown in many parts of the North Island and in a few areas in the South Island, the commercial districts are at Kerikeri, in the vicinity of Auckland, Tauranga, and Gisborne.

The major districts with more than 50 acres of lemons were :—

—	Meyer.	Other Lemons.	Total.
	Acres.	Acres.	Acres.
Auckland	30	204	234
Tauranga	29	184	213
Kerikeri	46	62	108

In Gisborne there were 7 acres of Meyer lemons and 27 acres in other lemon-trees.

The major districts for the production of sweet oranges with areas more than 50 acres are :—

	Acres.
Kerikeri	215
Auckland	55

Districts with between 25 and 50 acres of sweet oranges are :—

	Acres.
Tauranga	31
Gisborne	30

Auckland is the only district with more than 250 acres of New Zealand grapefruit. Particulars are :—

	Acres.
Auckland	345

Other districts with more than 50 acres are :—

	Acres.
Tauranga	115
Kerikeri	76

The total acreage planted in citrus fruits is :—

	Acres.		Acres.
Meyer lemons ..	120	New Zealand grapefruit	555
Other lemons ..	517	Other grapefruit ..	105
Sweet orange ..	336		

A summary of the citrus trees planted in New Zealand at 31st March, 1949, is :—

—	In Orchards Over 120 Trees.	In Orchards Under 120 Trees.	Totals.
	Trees.	Trees.	Trees.
Lemons, Meyer	8,910	1,949	10,859
Lemons, others	40,573	5,964	46,537
Sweet orange	26,620	3,632	30,252
New Zealand grapefruit ..	43,033	6,902	49,935
Other grapefruit	9,482	1,767	11,249

The Meyer-lemon-tree figures show an increase of 1,500 trees over the past year, mainly accounted for by increases of 500 in each of the Auckland and Tauranga districts. There has been an increase of 2,500 New Zealand grapefruit-trees in the Auckland district. Other citrus figures have remained stationary.

Hard-wax scale has spread all over Auckland Province and attacks citrus trees as well as an exceedingly wide range of evergreen trees and plants.

The incidence of soft-wax scale is becoming an increasing problem to citrus orchardists at Kerikeri.

Citrus borer is a great problem in Kerikeri, Auckland, and Tauranga.

In the early spring of 1948 citrus brown-rot was responsible for severe fruit losses in Auckland.

At Kerikeri the application of D.D.T. spray has lessened the damage to fruit caused by dicky rice weevil.

Citrus canker still remains the most serious of all diseases attacking citrus trees. At Otumoetai, Tauranga, two orchards have been found reinfected with citrus canker and two new infections were found outside this locality.

The estimated production of citrus fruits in 1948 in packed bushels is :—

	Meyer Lemons.	Other Lemons.	Sweet Orange.	New Zealand Grapefruit.	Other Grapefruit.
Kerikeri	6,000	10,000	13,000	11,000	1,600
Auckland	1,300	40,000	1,200	70,000	800
Tauranga	1,600	90,000	2,800	44,000	300
Gisborne	400	4,600	3,000	400	200
Hawkes Bay	300	900	200	800	100
Totals	9,600	145,500	20,200	126,200	3,000

Facilities : The Division is associated with the Marketing Department at the various citrus assembly depots. Lemons are received at the citrus depots at Kerikeri, Auckland, and Tauranga, and by a private firm on behalf of the Marketing Department at Gisborne. A new citrus depot was opened at Tauranga during the year to replace one destroyed by fire.

Berry or small fruits consist of strawberries, raspberries, loganberries, gooseberries, boysenberries, currants, and cape gooseberries.

The only major district for strawberry-production at 31st March, 1949, was :—

	Acres.
Auckland and Hamilton	233

Minor districts with over 20 acres but under 100 include—

	Acres.
Canterbury	54
Otago	29

Major districts for raspberry-production with more than 50 acres at 31st March, 1949, are :—

	Acres.
Canterbury	297
Nelson	174
Hawkes Bay	115
Wairarapa	70

There were also 40 acres in raspberries in Otago.

The major district for gooseberry-production with over 50 acres at 31st March, 1949, is :—

	Acres.
Wairarapa	63½

Minor districts with between 10 and 25 acres are :—

	Acres.
Nelson	17
Hawkes Bay	17
Auckland	13
Manawatu	10½

The major districts for currant-production with over 25 acres at 31st March, 1949, are :—

	Acres.
Wairarapa	71
Nelson	33

Minor districts with between 10 and 25 acres are :—

	Acres.
Canterbury	18
Hawkes Bay	13

The Dominion acreages of berry-fruits at 31st March, 1949, are :—

	Acres.		Acres.
Strawberry	364½	Gooseberry	139½
Raspberry	754	Currant	153
Loganberry	13	Boysenberry	25

There was an increase of 84 acres of strawberries in Auckland and 25 acres in Canterbury during 1948.

In Nelson there was a decrease of 22 acres of raspberry, but the areas in Canterbury increased by 40 acres ; otherwise there were no significant changes.

Berry-fruits : The estimated production of these fruits during the 1948–49 season was :—

——	Strawberries.	Raspberries.	Loganberries.	Gooseberries.	Currants.	Boysenberries	Cape Gooseberries.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Auckland	419	8	11	9	..	14	..
Tauranga	7	½	..	7½	1	1	..
Gisborne	1	3	1	2	..	..	..
Hawkes Bay	15	150	3	30	15½	15	..
Manawatu and Wanganui	11	29½	½	17	3	½	1
Wairarapa	2½	100	13	200	116	3	..
Nelson	13	191	..	23	26	5½	35
Marlborough	½	6	..	2	½	..	..
Canterbury	82	334	16	16	25	..	..
Otago	30	108½	2	15	16	1½	..
Totals	581	930½	46½	321½	203	40½	36

Production of all berry-fruits has substantially increased this past season, particularly strawberry-production, which has more than doubled.

Dr. C. H. Cadman, an authority on raspberry diseases, from the Dundee University, in Scotland, when visiting New Zealand in 1947 recognized a disease, known in England as red-core root fungus, infecting strawberry-plants in the Auckland district. A survey of strawberry nurseries in the Hamilton district conducted in 1948 shows that this disease is widespread.

Grass-grub is responsible for considerable damage among strawberry and raspberry beds in South Canterbury.

The Extension and Horticulture Divisions undertook an economic survey of the commericial production of raspberries at Motueka, Tapawera, Canterbury, Otago, Hawkes Bay, Masterton, Palmerston North, and Utiku.

Sub-tropical fruits are grown in Auckland Province. They include Chinese gooseberries, tree tomatoes, passion-fruit, and feijoa.

Sub-tropical Fruits : The estimated production of these fruits during 1948 was :—

—	Chinese Gooseberries.	Tree Tomatoes.	Passion-fruit.	Feijoa.
	Tons.	Tons.	Tons.	Tons.
Kaikohe	8	17	26	1
Auckland	9	131	51	7½
Tauranga	15	94	29	11
Manawatu	..	..	..	..
Totals.. ..	32	242	106	19½

Tree-tomato plantations in the sub-tropical districts show infection from some virus diseases.

Brown-spot and grease-spot on passion-fruit continue to cause heavy losses of fruit in North Auckland.

Vegetables

Under the Commercial Gardens Registration Act, 1943, commercial market-gardeners register their gardens and pay fees on a prescribed scale. The fees collected by the Division, after deduction of costs of collection and administration, are paid to the Dominion Council of Commercial Gardeners to assist in the sound development of commercial market-gardening.

Last year 3,300 growers registered their gardens, covering a total area of 17,630 acres, divided into 16,670 not under glass and 960 under glass. Districts with more than 1,000 acres are :—

	Acres.		Acres.
Auckland	3,889	Palmerston North	1,330
Hawkes Bay	2,093	Timaru	1,263
Christchurch	1,878	Nelson	1,254
Pukekohe	1,731		

Market-gardening.—A Dominion summary of the area used in 1948 for the production of the principal vegetables shows the following acreages in each crop :—

	Acres.		Acres.
French beans	316	Lettuce	1,300
Runner beans	238	Parsnip	358
Beet-root	253	Peas	3,347
Carrot	933	Pumpkin	1,116
Cabbage	2,334	Indoor tomatoes	440
Cauliflower	2,174	Outdoor tomatoes	1,570

The major district for french-bean production is Hawkes Bay, with 140 acres. Other principal acreages of french beans' centres are :—

	Acres.
Auckland	70
Manawatu	33
Pukekohe	25

Runner beans are produced chiefly in Auckland, where 134 acres were cropped. The only other centre with an area of more than 25 acres was Hawkes Bay, with 30 acres.

Districts with areas of more than 25 acres of beet-root are :—

	Acres.
Auckland	52
Hawkes Bay	52
Manawatu	25

The major districts for carrot-production are :—

	Acres.
Ohakune	215
Pukekohe	170

Districts with areas of between 25 and 100 acres are :—

	Acres.		Acres.
Timaru	70	Auckland	28
Christchurch	61	Gisborne	26
Manawatu	51	Masterton	26
New Plymouth	47	Dunedin	25

The major districts for cabbage-production with over 100 acres are :—

	Acres.		Acres.
Auckland	453	Manawatu	146
Pukekohe	265	Masterton	128
Christchurch	265	Timaru	124
Hawkes Bay	179	Ohakune	117
New Plymouth	167	Hamilton	107
Dunedin	154		

For cauliflowers the major production districts with more than 100 acres are :—

	Acres.		Acres.
Auckland	527	Manawatu	138
Christchurch	295	New Plymouth	136
Timaru	150	Dunedin	121
Hawkes Bay	145		

The major districts for lettuce-production with over 100 acres are :—

	Acres.
Auckland	398
Christchurch	170
Hawkes Bay	157

The major districts for parsnip-production with 25 acres or more are :—

	Acres.
Ohakune	86
Hawkes Bay	54
Christchurch	30
Manawatu	28

The major districts for pea-production with 200 acres or more are :—

	Acres.
Hawkes Bay	815
Nelson	672
Pukekohe	490
Auckland	382
Christchurch	200

The major districts for pumpkin-production with 100 acres or more are:—

	Acres.
Auckland	433
Hawkes Bay	300
Gisborne	120

The major districts for the production of indoor tomatoes with 25 acres or more are:—

	Acres.
Auckland	157
Hawkes Bay	57
Christchurch	42
Timaru	35
Wellington	32

The major districts for the production of outdoor tomatoes with 100 acres or more are:—

	Acres.
Hawkes Bay	380
Auckland	360
Christchurch	200
Pukekohe	130

Vegetables are delivered to the various produce markets in the main centres and supplies are also delivered on contract to cannery firms at Auckland, Hastings, and Nelson; 8,786 tons of canned vegetables and 260,500 gallons of tomato-juice and tomato soup were canned in 1948, according to figures published by the Government Statistician.

The very heavy production of tomatoes in Nelson during 1948 has been followed by a reduction of 50 acres in this season's acreage of tomatoes. Because of the facilities offered by the dehydration plant at Motueka, there has been an increased area devoted to pea-growing.

The extension of city housing continues to reduce the area available for commercial vegetable-production in the vicinity of Auckland.

In October, 1948, the Government removed the ceiling prices on the prices of vegetables.

A survey of glasshouses around Christchurch shows that there are 1,020 glasshouses, with an area of 1,511,300 square feet; 60 per cent. of the houses and 90 per cent. of the space are used for tomato-growing.

The Extension and Horticulture Divisions undertook economic surveys on the production of tomatoes at Auckland, Pukekohe, Gisborne, Hawkes Bay, and Nelson, and on the production of onions at Pukekohe, Palmerston North, and Marshland.

The Division is also associated with the Marketing Department in the supplying of dehydration plants at Motueka for apples and at Riccarton and Pukekohe for vegetables. The principal canning and jam-making firms have factories in Auckland, Wairoa, Hastings, Nelson, Dunedin, and Roxburgh.

Vegetable Diseases.—The green-vegetable bug has spread throughout North Auckland and has become a serious pest in vegetable gardens. Its biological control is being attempted by the liberation of parasites.

Experiments were concluded in Hawkes Bay in 1948 on the control of red-legged earth-mite. This pest can be controlled with good cultural practices and by the use of D.D.T. sprays and dusts.

At Pukekohe the potato-tuber moth, diamond-backed moth, white butterfly, and carrot-rust fly are serious problems for vegetable-growers.

Virus diseases, particularly spotted wilt and cucumber mosaic, have been severe on vegetable crops in Christchurch.

Growers of cauliflowers in Otago suffer considerable losses through the incidence of "whiptail." Researchers believe this trouble is caused by deficiency of molybdenum salts in the soil.

Hops

The culture of hops is almost confined to the Waimea County, in Nelson Province. The area under hops in 1948 was 750 acres and the yield 986,835 lb.

The hop industry has shown a distinct improvement on recent years. With better seasonal conditions the yield per acre was higher, and the better prices offering have given an incentive to growers to extend the acreage under hops. Now that younger gardens are coming into production the yield in 1949 should be maintained if there are good growing-conditions.

The main variety of hops grown in Nelson, Golden Cluster, has proved to be very susceptible to root-rot fungi, *Gibberella cyanogena* and *Phytophthora cactoram*, which caused high mortality among the plants, sometimes up to 25 per cent., particularly in old-established gardens. On the recommendation of the Horticultural Superintendent, Nelson, who visited Tasmania in February, 1948, several new varieties of hops introduced from that country are now quarantined at the Department's Horticultural Station, Levin, before being planted out for trial in the Nelson district.

The Division is represented on the Hop Research Committee in charge of these trials.

Tobacco

The commercial tobacco-growing industry, which is restricted to Nelson Province, continues to expand steadily; 4,770,827 lb. of tobacco was harvested in 1948 from 4,361 acres. Compared with 1947, these are increases of 64,000 lb. of tobacco and 446 acres.

The major manufacturing companies at Motueka have installed improved leaf-conditioning facilities.

The Division is represented on the Tobacco Research Committee by the local Horticultural Superintendent.

The favourable weather conditions over the 1948–49 season indicate that a new production record will be established, even though a severe hailstorm on 26th January, 1949, caused severe damage to tobacco crops in Riwaka.

Vine and Wine Production

The estimated area in vineyards in 1948 was 890 acres, producing 2,800 tons of grapes, which were converted into 580,000 gallons of grape wine; 194 winemakers were licensed under the provisions of the Licensing Act, 1948.

During 1948, 95,000 gallons of fruit wine was also manufactured.

The excellent conditions during the 1947–48 season resulted in a yield of approximately 600 tons more grapes than in the previous season. This crop was of high quality, and better-quality wine was manufactured in the season.

About 98,000 gallons of cider made in 1948 was mainly produced in the South Island.

During the past ten years the quantity of wine manufactured annually has increased by about 500,000 gallons. The favourable trading conditions that existed during the period provided a strong stimulus for increased production. In 1947 and 1948, 300,000 gallons were imported into New Zealand. These large imports and the substantial increase in the production of locally-made wines have caused vignerons in New Zealand some concern, particularly as wine consumption is now close to saturation point. Local winemakers realize that more attention will have to be paid to manufacturing a higher-grade wine if they wish to retain their share of the market.

During the past year many vignerons have been seeking advice from the Viticulturist on means of improving the quality of wine being manufactured as well as the use of more efficient methods. In March, 1949, 120 vignerons attended a field-day at the Horticultural Station at Te Kauwhata. The Viticulturist demonstrated cultural practices in the vineyard, such as trellising, pruning, spraying, application of manures, and cultivation with machines. In the wine cellar the vignerons were shown the technique of wine-manufacture as well as up-to-date equipment. It is proposed to make this field-day at Te Kauwhata an annual fixture.

Numerous wine and cider samples are submitted to the Viticulturist by wine-manufacturers for microscopical examination and report.

Table Grapes

There has been little extension in glasshouse vineries over recent years, mainly because of the high cost of building. About 312 tons of grapes were produced in 1948.

It is estimated that 120 tons of outdoor grapes, mainly Albany Surprise, were marketed for dessert purposes.

Nurseries

The owners of nurseries who are raising for sale ornamental shrubs, rose-trees, forest trees, fruit trees and plants, and tomato-plants are required to have their nurseries registered before being permitted to sell plants. During 1948–49, 881 nurseries were registered, including 321 tomato nurseries, compared with 810 in the previous season.

Cool Storage of Fruit

In 1948, 1,027,478 bushel cases of fruit were shipped overseas, made up of 1,005,960 cases of apples and 21,518 cases of pears. This was the first major consignment to the United Kingdom since the beginning of the Second World War.

The overseas shipping companies have brought into commission a number of new ships which have up-to-date equipment for keeping apples and pears in good condition for the United Kingdom market.

Export fruit must be treated with care and not be subjected to transit delays or high temperatures between orchard and shipment.

The 1948 export season was a difficult one, but all fruit was despatched without any serious mishap.

New cool stores with a 500-bushel to 1,000-bushel capacity were built by eight fruit-growers during the year. These stores are a distinct advance and enable growers to cool store fruit immediately it is picked and despatch to market in good condition.

In 1948, 71 fruit cool stores were operating in the Dominion, with a total capacity of 1,232,835 bushel cases. Included in this total are 42 cool stores on orchards—18 in the North Island and 24 in the South Island. On 30th June, 1948, the quantity of fruit held in cool store and stored on orchards was :—

	Cool Storage.	Ordinary Storage.	Total.
	Bushel Cases.	Bushel Cases.	Bushel Cases.
Apples	787,668	60,520	848,188
Pears	104,702	620	105,322
Total	892,370	61,140	953,510

For some years it has been realized that raspberries deteriorate quickly in transport, particularly over long distances. In January, 1949, the Department's Cool Storage Officer sent from Greytown to Auckland precooled raspberries in sealed tins. Although this fruit arrived in good condition, it is clear that further experimental work will need to be done before improved means are evolved for the transport of raspberries.

In January and February, 1949, experimental work was carried out with the transport of stone-fruit by rail, the object being to devise a way of reducing temperatures in railway trucks. Further work on this subject will be done in 1950.

Horticultural Station, Levin

This station was established in 1947 with the following objects:—

(1) To investigate the nomenclature and type varieties of all berry-fruits.
(2) To record the responses of varieties of berry-fruits to different cropping and cultural methods.
(3) To build up berry-fruit stock true to name for distribution to nurserymen for the commercial production of plants.
(4) To inaugurate certificate schemes covering approved varieties of berry-fruits to keep the lines true to name and free from disease.
(5) To investigate cultural methods for vegetables.

In 1946 and 1947 a selection of raspberry-canes was made in commercial gardens throughout the Dominion. From these canes 1,000 stools of twenty-six varieties were planted on the Station in September, 1947. These stools fruited in 1948–49, and from these, suckers of seven varieties of raspberries were selected on their fruiting merits for replanting. When those canes have fruited, only the best suckers will be selected, and the others eliminated.

Eight varieties of currants were imported from England, and two varieties from Russia were planted out in 1947. In addition, cuttings taken from seven varieties of currants growing in a commercial garden at Greytown were planted out in the Station. These plants will be tested, and cuttings will be taken from the more promising plants for propagation.

In February, 1947, four varieties of virus-free strawberries were imported from England and planted out at Levin for runner-production in September, 1947. About 10,000 runners were distributed for testing among commercial growers throughout the country. Although the results of these tests have not been summarized, it is clear that these strawberry varieties are readily subject to virus diseases under New Zealand conditions.

In the 1948–49 season a survey of commercial gardens for the best currant, gooseberry, loganberry, and Chinese gooseberry plants was made on similar lines to the raspberry survey of 1946–47.

Hop sets and hop cuttings imported from Tasmania have been quarantined at the Station pending transfer to Nelson.

Horticultural Station, Te Kauwhata

The 1948 crop was very satisfactory; the grapes harvested were manufactured into good-quality wine.

With improved cultural practices the grapes are ripening earlier, thus reducing the chances of the crop being affected by fungous diseases.

The cultural and wine-manufacturing equipment is up to date. An additional 5 acres were planted with 2,000 one-year rooted vines.

Plant Quarantine

During the past two decades a considerable number of new insect, fungous, virus, and bacterial diseases have been recorded in New Zealand. The large majority of these have been introduced from overseas, and the diseases recorded have arrived as stowaways with the host plants with which they have been associated. Well-known examples are the white butterfly, the red-legged earth-mite, the European wasp, and citrus canker. During the Second World War, in the Pacific area plant quarantines broke down in many places, and the advent of regular air transport has increased the likelihood of new unwelcome arrivals in New Zealand. The Division administers the plant quarantine regulations through an inspection service at the principal ports and carries out fumigation to a limited extent. The Division is securing more adequate premises in which vacuum fumigators are to be installed. At the same time the existing Acts and regulations thereunder will be reviewed to provide a more efficient plant quarantine service without undue interference with international trade in plants and plant products.

Beekeeping

Beekeeping in New Zealand is expanding steadily as new country is opened up for ordinary farming purposes and as essential beekeeping equipment becomes available.

A pleasing feature of this trend is the installation of modern plant where possible and the practice of up-to-date methods of apiary-management.

Following is a summary of apiary registrations at 31st March, 1949, showing the number of beekeepers in groups according to the number of hives kept :—

Group.	1 to 5 Hives.	6–20 Hives.	21–50 Hives.	51 Hives and Over.
Beekeepers	4,017	1,502	422	546
Apiaries	4,112	1,727	763	4,767
Hives established ..	9,406	16,000	14,004	134,976

This table shows that full-time and semi-commercial beekeepers are of major importance in the industry in terms of hive holdings and production.

Statistics show a falling off by 803 in the number of domestic beekeepers with 1 to 5 hives each from June, 1947, to 31st March, 1949. On the other hand, there has been an increase of 62 commercial beekeepers each operating over 50 hives and an over-all increase of 19,878 in the number of hives kept during the same period.

Production of Honey.—The estimated production of honey and commercial beeswax for the 1948–49 season ended 30th April, 1949, is 4,190 tons and 113,700 lb. respectively. This estimate of production was less than the previous year by some 560 tons of honey and 5,050 lb. of beeswax because of low rainfall, strong drying winds, and/or comparatively low temperatures at critical periods in important honey-producing areas. Districts most affected by adverse weather conditions were Auckland, Hawkes Bay, Canterbury, and parts of Otago.

Production of honey in domestic apiaries included in the foregoing figures for 1948–49 season is estimated at 400 tons.

Assistance and Protection of Beekeeping. The number of divisional apiary districts in New Zealand was increased from eight to eleven during the year by readjustment of district boundaries in important beekeeping areas to enable the Division to give the maximum assistance to beekeepers. Field officers of the Division made 2,999 visits to beekeepers and apiaries for instruction and disease-control and also gave a total of 104 lectures covering a wide range of beekeeping subjects at organized meetings of producers.

A comprehensive survey of foul-brood in New Zealand apiaries carried out during the year by officers of the Division showed that 1·7 per cent. only of the hives inspected were diseased and that 10 per cent. of the apiaries inspected contained some disease. Every endeavour is being made to reduce foul-brood to a minimum.

Ex-servicemen Beekeepers.—Thirty-six beekeepers under rehabilitation to the end of March, 1949, have been given instruction and guidance in modern apiary practices by Apiary Instructors of the Division.

Wasps in New Zealand.—Four seasons have passed since wasps (*Vespa germanica*) were first noticed in New Zealand in the Waikato district. These wasps appear to thrive in New Zealand and have become a decided nuisance to farmers, orchardists, housewives, beekeepers, and to manufacturers of sweet foodstuffs.

These wasps are a menace, and every effort is being made to keep them down to a minimum. During the year ended 31st March, 1949, 50,000 pamphlets covering the life-history and habits of these wasps and control measures in operation have been distributed, in addition to posters placed in schools, post-offices, and other public places. Arrangements for the payment of a bounty on all queen wasps caught and destroyed before the nesting period at the end of December, 1948, brought in a total of 118,251 queen wasps, for which £1,478 2s. 9d. was paid by the Department. This work was followed by a free distribution of D.D.T. chemical powder for the destruction of wasp nests, and part-time workers were engaged to destroy any nests reported on unoccupied lands. Up to the end of February, 1949, a total of 379 nests was reported and dealt with. It is considered impracticable to exterminate these pests because they nest in inaccessible places and are spread over the country by the movement of goods in which hibernating queens may be resting. In this way wasps have spread from the Waikato to the Auckland district, the King-country, Taranaki, and Hawkes Bay, where a few nests have been found this year. A concentrated effort by research officers of the Department to find suitable methods of dealing with wasps on the wing wherever they appear is proceeding, in addition to intensive field-work for the destruction of nests.

Overseas Visits

The Horticultural Superintendent, Nelson, visited Tasmania to investigate hop culture there compared with New Zealand, and the Orchard Instructor, Auckland, visited Raoul Island to determine possibilities of citrus development on the Kermadec Islands.

Retirement of Director

Mr. W. K. Dallas, after ten years as Director of the Division and forty years' continuous service with the Department, retired at 30th November, 1948.

SUMMARY OF 1947–48 SEASON APPLE AND PEAR CROP: DISTRICT PRODUCTION AND DISTRIBUTION THROUGH MARKETING DEPARTMENT AND OTHER CHANNELS (IN BUSHELS) AS AT 30TH NOVEMBER, 1948

District.	Marketing Department Receipts.				Private Sales.		Sold to Canning-factories.		Sold for Pulping, Cider, &c.		Total.		Grand Total.
	Export.		Local Markets.										
	Apples.	Pears.	Apples.	Pears.	Apples.	Pears.	Apples.	Pears.	Apples.	Pears.	Apples.	Pears.	
Kaikohe	..	..	1,107	95	1,993	1,405	..	..	..	..	3,100	1,500	4,600
Auckland	25,196	..	222,718	25,644½	50,000	12,500	14,000	2,500	25,000	..	336,914	40,644½	377,558½
Hamilton	..	..	13,070	1,102	22,255	6,458	500	..	2,900	200	38,725	7,760	46,485
Tauranga	..	..	1,943	1,232	5,897	658	..	..	250	..	8,000	1,890	9,890
Gisborne	..	..	42,687	4,735	3,500	750	..	..	..	..	46,187	5,485	51,672
Hastings	363,850	21,518	475,360	165,699	108,312	35,655	16,000	26,363	29,851	..	993,373	249,235	1,242,608
Masterton	..	..	22,302	3,347	2,465	87	2,500	..	4,200	60	31,467	3,494	34,961
Palmerston North	..	..	632	..	3,790	388	..	..	..	..	4,422	388	4,810
Wanganui	..	..	1,942	..	9,249	1,426	..	..	308	..	11,499	1,426	12,925
Blenheim	68,979	..	51,297	1,586	7,987	507	3,227	..	..	..	131,490	2,093	133,583
Nelson	152,686	..	152,135	15,592	11,352	2,142	23,928	1,535	14,330	..	354,431	19,269	373,700
Mapua	229,796	..	272,411	25,317	5,152	542	57,969	1,717	12,541	..	577,869	27,576	605,445
Motueka	165,453	..	177,837	38,932	3,062	150	43,990	1,293	15,413	..	405,755	40,375	446,130
Christchurch	..	..	82,973½	8,416½	61,084½	8,607½	..	..	9,716	..	153,774	17,024	170,798
Timaru	..	..	6,034	634	7,306	1,141	..	..	2,250	..	15,590	1,775	17,365
Dunedin	..	..	271	..	6,523	90	..	..	120	..	6,914	90	7,004
Roxburgh	..	..	51,066	4,777	20,150	3,536	3,228	..	3,292	..	77,736	8,313	86,049
Alexandra	..	..	14,424½	6,668	28,005½	9,432	250	..	..	..	42,680	16,100	58,780
Total	1,005,960	21,518	1,590,210	303,777	357,993	85,474½	165,592	33,408	120,171	260	3,239,926	444,437½	3,684,363½

TOTALS AND PERCENTAGES OF FRUIT GRADES

——	Fancy.	Per Cent.	Commercial.	Per Cent.	Minimum.	Per Cent.
Apples	2,058,756	78·55	538,631	20·54	23,978	0·91
Pears	284,901	86·6	38,444	11·67	5,700	1·73

Approximate Cost of Paper.—Preparation, not given; printing (923 copies), £305

By Authority: R. E. OWEN, Government Printer, Wellington.—1949.

Price 2s.]