1948
NEW ZEALAND

DEPARTMENT OF AGRICULTURE

ANNUAL REPORT FOR YEAR 1947–48

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, 1948.

The origin and development of the Food and Agriculture Organization and New Zealand's place in relation to the work of that Organization are set out in the Report of the Director-General of Agriculture.

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 Divisional Directors.

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

His Excellency the Governor-General.

ANNUAL REPORT OF THE DIRECTOR-GENERAL

THE FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS: ITS BACKGROUND AND DEVELOPMENT

In view of my close association with the Food and Agriculture Organization of the United Nations since its inception, I feel it is not inappropriate to devote my 1947–48 annual report to a short statement covering the background and development of the Organization.

To understand the objectives of the Food and Agriculture Organization, some appreciation of the special background of circumstances and events which brought it into being is essential. In fact, it is probably necessary to go back a century and a half or more to the beginning of the Industrial Revolution, that epoch-making event in the world's history to which no definite beginning date can be assigned and of which no close can be foreseen. In the eighteenth century cities were small and relatively

few. The masses of the people lived and worked on the land, mostly as subsistence farmers; they produced for themselves all but a fraction of their needs. Trade in foodstuffs within a country was small and between countries negligible. Even had there been a demand, transport facilities would have been hopelessly inadequate.

Toward the end of the nineteenth century came those striking changes in manufacturing industry—improved methods of spinning and weaving and the application of the newly discovered steam power. At the same time transport, by canal development, the invention of the steamer, and the construction of railways, completely altered the whole picture of trade and industry. These changes, which, beginning in Great Britain, soon spread to western Europe and the United States of America, were accompanied by a remarkable population increase, thus giving rise to the gloomy prediction of the English clergyman Malthus that, as population would increase in geometrical progression—that is, would keep doubling itself—while food-supply would increase only in arithmetical progression, chronic poverty and periodic famines were inevitable!

As the Industrial Revolution gained in momentum, cities and towns sprang up in profusion. Population moved from the country to the towns and continued to multiply there, creating many social and economic problems, of which food-supply was only one.

Development of External Trade in Foodstuffs

The phenomenon arose of countries depending on external sources for much of their food-supplies. Because the Industrial Revolution coincided with the expansion of North America and the British dominions, and later with African expansion, these supplies were readily forthcoming, the younger countries taking machinery, equipment, and finished goods in exchange for their food and raw materials. International trade, with all its complexities of currency, exchange, tariffs, and the like, thus gradually came into being.

Technological improvements in the manufacturing industry and the development of mass-production methods enabled output to be increased manyfold. The consequent increase in wealth was reflected in increased demand for a great variety of goods and services previously either completely unknown or the prerogative of the very few.

The Position of Agriculture

What was the reaction of agriculture to all this new development? To what extent did it share in the great changes going on in manufacturing industry? Considerable and even remarkable improvements were made in agricultural technique, especially in cultivation and the breeding of better strains of both live-stock and plants, but it cannot be claimed that food-production underwent anything remotely approaching the changes in, say, spinning and weaving and the iron and steel industries. Increased food-production was as much the result of the bringing into production of new areas as of increased yield per unit of land or of labour.

Agriculture has always been something of a problem child to economists. In elucidating their principles and theories they refer frequently to the "special case" of agriculture. Factors of production often do not move very readily from one type of farming to another or from industry to agriculture in response to marked price changes of particular products. A farmer often cannot readily reduce his production if prices fall. He has to plan years ahead, for instance, in live-stock farming or fruitgrowing. Very often he reacts to price falls by increasing production to spread his costs over a greater output, ignoring the fact that probably millions of other farmers are thinking along the same lines and consequently further flooding an already overloaded market. That happened in the 1930's with wheat, sugar and dairy products, rubber, meat, and

other commodities; the world witnessed the Gilbertian tragedy of farmers in the Western World poor because they had produced too much, and in the rest of the world poor because they could not produce enough.

This is not the place to enter into a discussion on the merits and drawbacks of *laissez-faire*. It is sufficient to point out that, while the spur of free enterprise unquestionably has been a major factor in the great productive developments of the nineteenth and twentieth centuries, the system has carried within itself certain defects which have manifested themselves in two ways :—

First, there has been the phenomenon of food piling up in storehouses and eventually being destroyed, of farmers being paid subsidies not to produce, in a world where millions went in want not only in the backward countries, but in those very countries which were the producers of " surplus " food.

Second, and especially in the newly developed Americas and in the British dominions, where free enterprise inevitably meant freehold land tenure, there has been a tendency to " mine " rather than to farm the land by the use of farming methods which gave little heed to posterity. The term " erosion " is often used instead of " faulty farming," but nevertheless millions of acres of once-fertile lands have been impoverished to varying degrees and their restoration is proving costly and difficult.

International Institute of Agriculture

FAO cannot be claimed as the first organization of its kind. In 1905 there was founded in Rome the International Institute of Agriculture (IIA), the result of a convention between representatives of forty countries. That organization, which by 1930 had representatives from seventy-four countries, may be regarded as the pioneer of official international institutions, but it confined its activities to the international sphere and its essential objects were much narrower in concept and scope than those of FAO. They may be summarized as follows: " To collect, examine, and publish statistical, technical, and economic information about all phases of farming, including such things as trade in agricultural products, prices, wages paid for farm work, the recording of new diseases of crops and stock and, where possible, effective measures for their control; to study problems of agricultural credit and co-operation and publish available information; and, should occasion arise, to submit for the approval of the various Governments measures for the protection of the common interests of farmers and the improvement of their conditions." Thus IIA did not envisage dealing with the huge problems of overproduction in the Western World and the raising of nutritional standards over the greater part of the Eastern World.

IIA was taken over by FAO on 1st August, 1946. The employees of the Institute have been placed on the temporary staff of FAO, and the Institute's comprehensive library of statistical data and technical information will prove a valuable asset.

Development of FAO

Just as it is almost impossible to deal with the food problems of any one State alone, so it is almost as difficult to regard the machinery set up to deal with international food problems without mentioning the background of the new international machinery of which it is a part.

The United Nations came into being on 24th October, 1945, when the first twenty-nine of the fifty-one United Nations had ratified the Charter formulated at the San Francisco conference the previous spring. This new international structure is, in reality, composed of a number of functional or specialized agencies which are international and permanent. The General Assembly of United Nations, on which each of the member

States is represented, elects eighteen members who form the Economic and Social Council, which enters into agreement with specialized agencies operating in the economic, social, cultural, health, and related fields.

FAO was the first of these new functional bodies, coming into existence on 16th October, 1945, thus preceding its "mother" organization, United Nations, by eight days, because international organizations are, by constitution, deemed to be set up when a certain number of States have ratified the decisions of their Government representatives.

In addition to FAO, there are the International Monetary Fund and Reconstruction Bank, which came into existence on 27th December, 1945, as a result of the Bretton Woods Agreement, the International Civil Aviation Organization, the United Nations Educational, Scientific, and Cultural Organization, and a number of temporary organizations set up to deal with situations arising out of the war, such as the International Emergency Children's Fund.

Hot Springs and Quebec Conferences

Problems of food and agriculture, currency and finance, trade and labour, and health and nutrition clearly are all closely interlinked, and the general plan is to co-ordinate the activities of agencies for the fulfilment of President Roosevelt's third freedom—freedom from want. It was with the object of fulfilling this great aspiration that the conference was called by the President at Hot Springs, Virginia, from 18th May to 3rd June, 1943.

The conference stated that two-thirds of mankind suffered from malnutrition, including a proportion of even the advanced countries, and as causes of this state of affairs it advanced the following:—

(1) Insufficient purchasing-power;
(2) Inadequate supplies of satisfactory foodstuffs at reasonable prices; and
(3) Ignorance among the public and administrators about nutritional problems.

An interim Commission was set up, one of its main functions being to formulate a specific plan for a permanent organization in the field of food and agriculture. This Commission, working in Washington, drafted a constitution and produced a number of reports describing the field of work of the proposed Food and Agriculture Organization. After acceptance of the constitution had been signified by at least twenty Governments, the interim Commission was able to call the first conference of the permanent organization. In the two years between the Hot Springs and Quebec conferences the Commission, with the assistance of the Governments of practically all the Allied Nations, did an immense amount of preparatory work, entailing not only the preparation of a constitution, but also preliminary studies of food and agriculture resources in various countries and similar studies in the field of nutrition and consumption requirements.

At the conference held in Quebec in October, 1945, the representatives, after signing FAO's constitution, went on to give the new agency form and substance. They elected as first Director-General Sir John Boyd Orr, an eminent Scotsman known the world over for his research work in animal and human nutrition, and who owns and has operated a large general farm in Scotland. They appointed an Executive Committee of fifteen, which chose Professor André Mayer (France) as Chairman and Mr. Howard R. Tolley (United States of America) as Vice-Chairman. Finally, they adopted rules of procedure, financial regulations, and a budget which provided for 5,000,000 dollars for the first full financial year.

Summary of Objectives

The constitution of FAO is in considerable detail, but its main objectives may be summarized as follows:—

(1) To establish, by surveys, research, and collection of statistical data and other information, the proper dietary needs of the people of the world, and to provide all member nations at all times with a true and complete picture of the food situation in every land.

(2) To endeavour to have the production of food in all countries correlated to the nutritional needs of the world's population to the end that eventually there shall be enough of the right kind of food for every one everywhere.

(3) To promote in all possible ways the scientific development of agricultural production and to disseminate information and provide technical services to the Governments to that end.

(4) To assist in organizing the world's marketing and distribution machinery for the handling of food and other agricultural products on a world basis in such a way as to ensure the delivery of these products to the people who need them in the most equitable manner, in the quickest and most effective way, and at the lowest price economically possible—that is, a price which will ensure the producer of these products a return commensurate with the costs of production, the maintenance of his production unit, and the enjoyment of a proper standard of living for himself, his family, and his workers.

The scope of FAO is much wider than the words of its title indicate, and includes fisheries, because of the food and fertilizing value of fish and other sea products, and forests, because of their importance in providing shelter and fulfilling the multitude of other purposes for which timber is essential.

How FAO operates

The general policy of FAO is laid down in its constitution, but the particular programme of work to be followed in any given year is determined by the annual conference of all member nations. Before 1947 the conference appointed an Executive Committee to which it delegated powers enabling it to carry out the recommendations made in conference. The third session of the conference, held in Geneva in 1947, replaced the Executive Committee by a Council of FAO composed of representatives of eighteen nations.

The set-up of the Organization bears many points of resemblance to that of New Zealand's Department of Agriculture. The permanent head is the Director-General, who has been assisted by a Counsellor and a Special Advisor. Technical work is carried out by five Divisions—Agriculture, Nutrition, Forestry, Fisheries, and Economics and Statistics. A Rural Welfare Division is in process of formation. Each Division is led by a Director, and there are also Directors of Administration and of Information.

Each Division is assisted by a standing committee of world experts, and considerable assistance is given by *ad hoc* committees on special subjects such as fertilizers, waste by infection, and industrial fibres.

To some extent the work of FAO has been dictated by expediency, but the basis of all operations lies in the collection of information from member countries. Only by the accumulation and analysis of detailed information on the production, prospective production, and utilization of foodstuffs and raw materials can FAO make recommendations and disseminate information to member Governments.

Under the constitution it is obligatory on all member countries to make periodic reports (in practice these have been annual) outlining prospects of production, imports and exports of food, raw materials, nutrition programmes, and any other steps being taken to improve rural welfare, together with the difficulties being encountered in achieving these objects.

In addition to these periodic reports, FAO frequently requests technical, statistical, and economic information from member countries in connection with specific projects. Steps have been taken in New Zealand, and presumably in other member countries, to forward to FAO copies of all official statistics and any publications, governmental or otherwise, which deal with agricultural problems.

Information obtained from the periodic and other reports is used as a basis for conference discussions and recommendations. It also serves, with data obtained by the standing advisory and *ad hoc* committees, as the basis for the technical reports which FAO is issuing to assist with particular problems.

One method used by FAO which has met with considerable success has been the sending of missions of technical experts to war-devastated or backward countries to assist with the reconstruction of their agriculture. The first of these was to Greece and operated from May to July, 1946, and since then similar missions have been sent to Poland and to Siam. Small missions of technical experts have also been sent to countries requesting advice and assistance on specific problems—for example, a mission has visited Venezuela to offer advice on oil-bearing plants.

The World Food Crisis

FAO is essentially an organization dealing with long-term food and agricultural policy and was not equipped to deal with the food emergency which arose in 1946. Hence, when early in February of that year the United Nations General Assembly called on FAO for assistance to deal with the food crisis which was looming as a result of the war and successive bad harvests, and which would be greatly accentuated by the expected termination of UNRRA, the Combined Food Board, and the Emergency Economic Committee of Europe, it was not without some hesitation that Sir John Boyd Orr agreed to co-operate as far as was within the power of FAO's still embryonic organization.

A meeting, known as the Special Meeting on Urgent Food Problems, was convened in May, 1946, in Washington. The outcome was the setting-up of the International Emergency Food Council, replacing and enlarging the Combined Food Board (United States of America, Britain, and Canada), to allocate foodstuffs, seeds, and fertilizers on the most equitable basis possible, in an endeavour to bridge the gap (estimated at the time at 10,000,000 metric tons of grain) between the supplies available and those required.

IEFC, as it soon became known, began operations almost immediately. Through the commercial section of its Legation in Washington, New Zealand has had representation on several of the commodity committees. The Council was intended to end its activities in December, 1947, but in view of the prolonged nature of the food crisis it was decided at the third session of the conference in September that IEFC be absorbed by the newly formed Council of FAO, of which the former is now a committee. Its activities are now confined to cereals and to oils and fats, these commodities still being in short supply.

World Food Board Proposals

FAO's first session of conference was held in Quebec in October, 1945. Between then and the second session in Copenhagen in September, 1946, important developments occurred in world food problems apart from those considered at the special meeting in May. It was appreciated from the start that if FAO were to achieve anything worth while it would have to go beyond the important but narrow sphere of issuing factual information and giving technical assistance. Throughout the war and up to this day there has loomed in the minds of farmers and agriculturists in the Western World the word "surplus." Memories still linger of the days when wheat was burned, coffee dumped, and bonuses paid farmers not to produce; when increased production merely served to lower still further an already uneconomic price. Not only is this "fear of plenty" a factor in

retarding production, but even if this fear were eliminated the problem would still remain of ensuring that increased production would reach those in need and at prices satisfactory to both parties.

With this problem in mind Sir John Boyd Orr issued in July, 1946, his World Food Board proposals. In the United States of America 400,000 fewer people were on farms during the Second World War than during the first, but because of technological improvements production was 50 per cent. greater. In New Zealand, wartime production was maintained with considerably fewer people on the land. Thus there was every reason to believe that the world would again witness that state of "poverty midst plenty" when those who had been engaged in farming were free to return to the land. Because of war devastation, political uncertainty in Europe, and the high incidence of bad seasons since the war ended, production has not recovered as rapidly as was hoped.

Nevertheless, despite this temporary setback, in countries where modern agricultural science is applied the main problem is to find continuous markets at remunerative prices. To quote Sir John's report: "A relatively small excess of supply over economic demand is followed by a big drop in prices, as occurred in the late 1920's. On the other hand, a relatively small excess in economic demand over supply is followed by a big increase in prices." The market for foodstuffs depends largely on the purchasing-power of those engaged in industries other than food-production. In brief, a long-term food and agriculture policy must reconcile the interests of consumers and producers and those of agriculture and trade.

For those reasons it was realized that by itself FAO could make only a limited contribution toward freedom from want and the achievement of an expanding world economy. It was proposed from the beginning to work closely with other agencies of the United Nations, particularly the Economic and Social Council, the International Monetary Fund and the International Bank, the World Health Organization, and the International Labour Organization.

International commodity organizations were a feature of the inter-war period. Agreements were concluded for sugar, rubber, tea, and certain minerals. Most of these were quota agreements—"children of the depression"—and were restrictive in character. During and since the war there have been further commodity agreements, such as the Inter-American Coffee Agreement and the Joint Organization of the Governments of the United Kingdom, Australia, South Africa, and New Zealand to dispose of wool surpluses. These organizations suffer from two major defects—the consideration of each commodity in isolation and the lack of financial resources.

Consideration of these factors prompted Sir John Boyd Orr to issue his proposals for the constitution of a World Food Board ultimately representing all countries, and probably appointed by the conference of FAO and including representatives from other interested international organizations. The functions of the World Food Board would be—

(1) To stabilize prices of agricultural commodities on the world markets, including provision of the necessary funds for stabilizing-operations.
(2) To establish a world food reserve adequate for any emergency that might arise through failure of crops in any part of the world.
(3) To provide funds for financing the disposal of surplus agricultural products on special terms to countries where the need for them is most urgent.
(4) To co-operate with organizations concerned with international credits for industrial and agricultural development, and with trade and commodity policy, in order that their common ends might be achieved more quickly and effectively.

It was proposed that the Board maintain very close collaboration with the proposed International Trade Organization.

The Preparatory Commission on World Food Proposals

At the second session of conference of FAO held in Copenhagen in September, 1946, Sir John Boyd Orr submitted his proposals. The forty-seven nations represented there accepted the general objectives, restating them as follows :—

(1) Developing and organizing production, distribution, and utilization of the basic foods to provide diets on a health standard for the peoples of all countries

(2) Stabilizing agricultural prices at levels fair to producers and consumers alike.

To investigate the proposals the conference set up a preparatory Commission of sixteen member countries of FAO under the chairmanship of Viscount Bruce. This Commission began sitting in Washington on 28th October, 1946, and issued its report in January, 1947. The report is a comprehensive document of some ninety pages, including studies of a number of the major commodities which entered into international trade.

Briefly, the Commission recommended the establishment not of a World Food Board, but of a World Food Council of eighteen members generally to negotiate the production and distribution of world supplies of food and raw materials. The Commission was convinced of the necessity of preventing, as far as possible, that disturbing instability of prices which characterized the period between the wars. To achieve that it was considered that the most satisfactory method would be by inter-governmental commodity arrangements and agreements supervised and administered by the World Food Council. It was also proposed that these agreements provide for the creation of famine reserves of basic foodstuffs, held nationally for use internationally, and the establishment of limited price-stabilization reserves or buffer stocks for commodities subject to seasonal and cyclical fluctuations. Among other recommendations was one for the sale of agricultural surpluses at special prices to countries in need but lacking the foreign exchange to buy their full requirements.

The International Trade Organization

Feeling that barriers to trade were a major cause of war, both directly in that they caused antagonism and irritation between nations and indirectly in that by reducing the free flow of trade they diminished the real wealth of the world, members of the United Nations considered, shortly after the establishment of that Organization, that some concrete action should be taken to facilitate the exchange and consumption of goods.

At its first session, held in London in February, 1946, the Economic and Social Council adopted a resolution constituting the Preparatory Committee of the International Conference on Trade and Employment. This Committee met first in London in October, 1946, and again in Geneva the following April. There followed a prolonged session during which a charter was drawn up and detailed tariff negotiations were conducted between various countries. A considerable measure of agreement was reached on tariff reductions and some substantial adjustments were made. After a brief period the Committee met again in Havana in November, 1947, negotiations continuing until March, 1948. As a result of these conferences a charter on trade and employment has been completed for submission to member Governments.

Relation to FAO

The report of the first session of the ITO Preparatory Committee contained a chapter on inter-governmental commodity arrangements in which the general procedure envisaged was (1) the calling of a study group ; (2) the convening of an International Commodity Conference ; and (3) the formation of a governing body to administer the arrangement agreed on.

It was agreed that competent specialized agencies such as FAO should be entitled to submit commodity studies to the Organization or to ask that a study of a primary commodity be made. This was embodied in the final draft charter, which was published in September, 1947.

In the meantime, FAO had conducted its third session of conference, also in Geneva, from 25th August to 11th September. The report of the Preparatory Commission on World Food Proposals formed the basis of much of the discussion, especially by Commission I, dealing with " the world food and agricultural situation." The conference agreed substantially with the Preparatory Commission's report, and Commission I recommended the establishment not of a World Food Board with financial resources and wide powers to fix a general policy incumbent on member States, but a Council within FAO to ensure co-ordination of action between Governments with a view to the implementation of FAO's policy while allowing member countries to retain maximum freedom of action.

There is little doubt that the conference was considerably influenced by the ITO commodity proposals as, though the ITO charter had not yet been published, its contents were known to most FAO delegates, some of whom had been attending ITO meetings before the FAO Conference. Commission I concluded its report with this sentence: " When ITO is established, there will obviously be need for close co-operation between it and FAO; this could be provided for to some extent at least in an inter-agency arrangement."

The FAO conference amended its constitution to permit of the establishment of its new Council. This was done and the Council established on the last day of the conference.

The Council of FAO

The Council of FAO, which superseded the previous Executive Committee, is composed of eighteen member nations elected by ballot for a three-year term, though to begin with one-third will have to be elected for each of the next three years, the duration of the initial period being decided by lot. Each of the eighteen member nations then nominates its representative on the Council. Viscount Bruce was unanimously elected independent Chairman for the first twelve months.

The Council held its first meeting in November, 1947, and its second from 5th to 17th May, 1948. The immediate problems facing the Council are short-range ones of food and material shortages, and one of its first acts was the absorption of the International Emergency Food Council, which now becomes a committee of the Council of FAO, and which is continuing to operate through commodity committees for those commodities still in short supply and under allocation.

At its first session the Council formed a committee known as the Policy Committee on Production and Distribution, which, working with the staff of FAO, will secure all possible information on the individual production plans of member nations. At its second meeting in April, 1948, the Council again reaffirmed the extremely serious nature of the food shortage and urged on all member Governments the necessity for making every effort to increase production. Resolutions passed at the first meeting were concerned with maximum utilization of available foodstuffs, especially dried milk and cereals.

Accomplishments of FAO

To date FAO's accomplishments have been most marked in the technical sphere. It must be realized, of course, that the Organization is essentially one dealing with long-range problems, and no spectacular results are likely to be achieved for many years.

An instance of the type of work which FAO can accomplish is furnished by the International Wheat Agreement, recently signed by thirty-six countries. This agreement, which has still to be ratified by the signatory countries, had its genesis in the days before FAO, but it represents that type of inter-governmental commodity agreement which the Organization can implement for other commodities, working in close collaboration with ITO.

In the technical field much valuable work has been accomplished in the spheres of agriculture, nutrition, forestry, and fisheries, and the dissemination of technical information is a task of sufficient value and importance to justify the relatively small expenditure of 5,000,000 dollars annually.

New Zealand and FAO

Membership of the United Nations and its specialized agencies does not necessarily mean the direct procurement of social or economic advantages: the main objective is co-operation among nations for the common good, and some members should be able to contribute more than others. In the field of food and agriculture New Zealand has much to offer.

In the first instance, we can contribute to the knowledge of the world, and can assist in the provision of technical advice to less-favoured members. Our farm productivity per unit of labour is the highest in the world, and that is not entirely the result of a favourable climate. If the experience and knowledge available in New Zealand could be utilized in the establishment and management of pastures throughout the suitable areas of the world, we should indeed contribute nobly to the production of meat, wool, and dairy products. Our standard of living is high, and from a nutritional viewpoint we rank among the first nations of the world. Therefore, FAO cannot help us greatly in this connection.

At the moment, and for some time to come, we are producing food which is in short supply. Long-term contracts and high price levels safeguard our overseas income and allow of full employment internally. An increasing population, however, demands a real volume increase in overseas exchange as a basis for an over-all expansion in our national economy. Our expansion and our future prosperity, in common with the future prosperity of others, depend on the successful functioning of the United Nations and its agencies. New Zealand is particularly vulnerable in view of our dependence on a narrow range of exports and limited markets, and it may well be that in the days ahead FAO and its activities in the field of distribution may be fundamental to our continued stability and prosperity.

E. J. Fawcett, Director-General.

FIELDS DIVISION

REPORT OF J. W. WOODCOCK, ACTING-DIRECTOR

Climatic Conditions

The weather varied considerably during the 1947–48 season, except during late summer and autumn, when dry weather became fairly general throughout the Dominion.

In Auckland Province a mild and wet winter was followed by a favourable and early spring; January, February, and March were dry and warm. In Wellington Province rainfall was relatively low during the winter and early spring, except for heavy falls in June and October. November was exceptionally dry in all districts, and dry conditions continued throughout the summer except in North Taranaki. By the end of March the Rangitikei, Manawatu, Wairarapa, and southern Hawke's Bay districts were experiencing a major drought, but heavy rains in January and March fortunately saved the remainder of Hawke's Bay and Poverty Bay from excessively dry conditions.

In Canterbury wet periods in April, May, and June delayed the cultivation and sowing of winter crops. The winter was comparatively mild and characterized by good weather without excessive rain, but heavy rain again in October delayed spring sowings. Useful rains fell in the summer in most districts, accompanied by much sunshine and some north-west winds. Altogether, the weather was very suitable for harvesting, but tended to be too dry in summer for best results from pastures and crops. In Otago and Southland the weather in winter and spring were drier than usual, with the result that spring-sown crops were established under favourable conditions and pasture growth during the mild spring was exceptionally good. The season generally was earlier than usual and dry conditions favoured harvesting, though on the lighter lands yields of crops and pasture seeds suffered in consequence.

Pastures

Pasture growth generally was favourable during the early part of the season, but with dry conditions during late summer pastures were affected adversely in most districts.

In Auckland Province growth was well maintained until about mid-January, when the dry weather had a retarding effect over the whole of the province to a greater or less degree. In some districts, including the Waikato, Thames, and the northern King-country, the dry conditions were more severe and pastures became very browned off. Despite increased conservation of hay, considerable pasturage was wasted during the peak periods. The pastures on the Central Plateau, which had deteriorated severely because of shortage of fertilizer during the war years, have recovered considerably.

With the mild winter and good spring experienced in Wellington Province, pasture growth up to November was very good and good crops of both hay and silage were harvested in most districts. The heavy rains of October gave pastures an excellent start into the summer, but the extremely dry conditions in November and December stopped growth, except in the lower Horowhenua and north and central Taranaki districts. Summer growth was very short and the season ended with bare pastures in the Wairarapa, Manawatu, and Wanganui districts, and a fair recovery of greenness, but with no surplus growth, in other districts where good rains fell in late March.

Pasture growth in Canterbury during the late autumn of 1947 was very good and was followed by normal growth in the winter. Growth was again good in spring and early summer, but, especially on light land, grass growth was much retarded by dry conditions from December to March. Consequently, in some districts the feed position at the start of the winter is not good.

In Otago and Southland mild autumn and winter conditions were favourable for pasture-production, and spring growth began early, though in inland areas conditions were too dry for the usual flush of spring growth. In North and Central Otago dry conditions in autumn affected pastures adversely, whereas in Southland good rains just before Christmas caused good growth and favourable conditions generally extended into the autumn.

Supplementary Fodder

In the North Island good crops of hay and silage were saved in the early part of the season, though yields were affected later by dry summer weather. However, those conditions were particularly favourable for good harvesting, the material being cut generally much earlier than usual, with the result that hay is of better quality. A considerable amount of hay and silage was used in districts later affected by drought to keep up the milk-supply, and the reserves which have been built up in other districts may be called on largely to make up deficiencies of hay for winter feeding in parts of Wellington Province. The growth of fodder crops suffered because of dry summer weather.

In the South Island crops of hay were also saved under good conditions and increased areas were cut in Otago and Southland because of the favourable spring.

Fodder crops varied considerably and those in Canterbury and North Otago suffered severely during the dry autumn. Turnip and swede crops in particular were affected by insect damage. In Southland, where favourable conditions enabled cultivation work and sowing to be carried out early, good crops of swedes and turnips are reported.

Crops

Conditions in the main cropping areas of the South Island were again unfavourable for autumn sowing of crops but, apart from one or two districts, spring-sown crops were established under good conditions. As a result, the area of wheat was reduced and a greater area planted in spring-sown crops such as barley and peas.

Details of estimated areas of chief crops and the comparative figures for 1946–47 are as follows:—

	1946–47. Acres.	1947–48. Acres (Estimated).
Wheat	144,006	122,000
Oats (all purposes)	181,468	171,000
Barley (all purposes)	62,845	76,000
Potatoes	19,276	19,300
Onions	1,202	1,380
Peas	51,481	60,000
Maize (for grain)	7,865	7,300

Wheat.—The acreage in wheat again declined. In the South Island on the heavier land yields were excellent, but on the lighter land yields were down and some of the samples were pinched and of low bushel weight. The bulk of the wheat, however, was of very good quality, partly because of the excellent harvesting-conditions. In the North Island wheat crops in some districts suffered severely from the dry weather and from attacks of rust, and generally the yields were well below normal.

Oats.—Except for late-sown crops, yields were good and, apart from Southland, where quality suffered through lodging, the grain was generally in good condition.

Barley.—Because of delay in spring sowing, many barley crops suffered from the effects of dry weather and, though yields were good from early spring-sown crops, the bulk of the crops sown would yield less than usual. However, the lower yield will be compensated by the increased area sown.

Potatoes.—The area planted in potatoes will be much the same as in the previous season, but generally, due to the dry season, yields in the main crop areas will be lower. Early crops in most parts of the North Island, on the other hand, yielded remarkably well and there was difficulty in disposing of some of the crops, especially in view of the larger acreage planted in Hawke's Bay and Poverty Bay.

Onions.—Though the season was favourable to the onion crop in some districts, dry conditions in others reduced the yield. In general, crops were harvested under good conditions and the quality is satisfactory.

Peas.—The acreage sown to peas was again high, but many crops were sown late in November and yields suffered because of the dry weather. Yields varied considerably, but will be generally below normal.

Maize.—The early part of the season suited maize crops particularly well, though damage by cutworm after germination necessitated the resowing of several hundred acres in the Gisborne district, which will cause a reduction in the over-all yield.

Linseed and Linen Flax.—Both these crops suffered appreciably from dry weather and attacks from rust during summer, except in Otago and Southland, where good yields were obtained in the coastal districts.

Crop Advisory Committees

During the year the Barley Advisory Committee, the Onion Marketing Advisory Committee, and the Potato Advisory Committee continued to function and gave material assistance to both 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. A new Committee set up during the year, the Small Seeds Advisory Committee, gives advice on seed-production.

Seed-production

During the period under review import restrictions were extended by the British Government to apply to practically all grass and clover seeds normally bought from New Zealand. These restrictions, with the exception of that affecting cocksfoot, were not introduced until the 1947 harvest was well in hand and, as a result, had no effect on the production of seed during that harvest. In the case of cocksfoot, restrictions on which were introduced during 1946, production diminished by about 40 per cent. In other lines of seeds, production was either maintained at the 1946 level or increased, and the British import embargoes brought about a sudden and very marked fall in prices for all seeds affected. However, inquiries from the Continent of Europe enabled a market at lower prices to be found for most of the 1947 crop, with the result that the predicted surplus of seed, in general, did not eventuate.

Crop seeds are being produced almost entirely for use in New Zealand and supplies are being maintained at a satisfactory level. Peas remain in good demand, and over-all arrangements with the United Kingdom are absorbing the total exportable surplus of all field peas.

Contract Growing of Seeds.—Several hundred acres of various types of seeds are being grown annually under contract to the Department as a means of multiplying to a commercial stage the nucleus lots of selected pasture and crop seeds raised by the Departments of Agriculture and Scientific and Industrial Research. The seed produced

is, in general, distributed to selected farmers in suitable areas with a view to its further multiplication under the Department's certification scheme. The following table sets out the extent of operations during 1947 :—

Seeds produced under Contract during 1947

Variety of Seed.	Quantity of Seed produced.	Purchase Value of Seed produced. £
Perennial rye-grass	3,313 bushels	5,503
Italian rye-grass	2,540 bushels	2,064
Short-rotation rye-grass	3,124 bushels	2,655
Montgomery red clover	2,567 lb.	638
White clover	4,822 lb.	1,005
Cow-grass	700 lb.	114
Lucerne	2,390 lb.	444
Oats	983 bushels	247
Rape	16,703 lb.	432
Peas	533 bushels	400
Lupins	90 bushels	52
Swede	57 lb.	4
Maize	826 bushels	599

Seed Certification.—The volume of seed handled under the Department's certification scheme is very satisfactory. More than two-thirds of the perennial rye-grass, short-rotation rye-grass, brown-top, white clover, Montgomery red clover, rape, turnip, swede, and onion seeds produced in New Zealand is either certified or Government approved. The following table shows the quantities of seeds certified during 1946 and 1947 :—

Seed.	1946.	1947.
Perennial rye-grass	550,675 bushels	1,015,804 bushels
Italian rye-grass	284,288 bushels	178,941 bushels
Short-rotation rye-grass	48,449 bushels	174,443 bushels
Cocksfoot	477,961 lb.	469,317 lb.
Brown-top	773,209 lb.	563,939 lb.
Timothy	25,020 lb.	6,725 lb.
White clover	3,654,326 lb.	3,182,936 lb.
Montgomery red clover	927,834 lb.	519,344 lb.
Cow-grass	141,479 lb.	303,607 lb.
Subterranean clover	4,241 lb.	34,337 lb.
Lucerne	3,050 lb.	2,194 lb.
Seed wheat	39,820 bushels	98,963 bushels
*Seed maize	1,207 bushels	806 bushels
Rape	311,918 lb.	487,222 lb.
*Turnip	5,499 lb.	9,310 lb.
*Swede	424,173 lb.	295,255 lb.
Chou moellier	41,633 lb.	..
Onion seed	10,478 lb.	5,000 lb.
Seed potatoes	7,651 tons	6,799 tons

* This seed is termed " Government approved."

A further marked increase in the production of short-rotation rye-grass seed under certification has taken place, and this, to some extent, may account for the falling-off in the production of certified Italian rye-grass seed. The production of certified cocksfoot seed has been well maintained, despite the appreciable falling-off in the total amount of this seed which has been harvested.

The figure for 1947 production of certified timothy seed is not complete because a very appreciable quantity of seed which was harvested during the 1946–47 season has not yet been machine dressed. Partly because the selected strain of timothy is not well known and partly because of the high price being asked for this seed, the production of certified timothy at the moment seems to have outstripped the demand. However, this is felt to be only a temporary phase in the production of timothy seed in New Zealand.

Adverse seasonal conditions have had some effect on the production of certified Montgomery red clover during the 1946–47 season. On the other hand, the acreage of cow-grass under certification has increased very materially. The production of certified subterranean-clover seed during 1947 is in line with that for the 1944–45 season, the figure for 1946 having been depressed by unfavourable seasonal conditions.

The quantity of certified seed wheat increased materially in 1947, primarily because of an alteration in the scheme of certification which permitted areas sown with lines of seed a further generation removed from selection to be eligible for certification.

Higher yields of certified rape seed account for the increased production shown. The figures of production for Government approved turnip and swede seeds do not reflect the Dominion requirements, as the acreage devoted to these crops is adjusted year by year in accordance with the carry-over of seed from the previous season. A severe frost in November, 1946, when chou moellier crops were in full flower accounted for a complete failure of all seed crops under certification. Other areas of chou moellier were affected similarly, and as a result an extreme shortage of this seed occurred during 1947.

Extension Service

The farm advisory work, which is the main activity of the Fields Division, has been expanded as trained staff has become available. A considerable amount of this work is done by visits to farms, by telephone, and by visits of farmers to the Department's offices. During certification and experimental work a considerable amount of advisory work is also done. Many lectures have been given by Fields Division officers to Young Farmers' Clubs and branches of Federated Farmers. Several field-days were arranged on demonstration farms and on plots laid down with co-operative farmers. A start has been made to revive the farm schools, which were at one time a feature of the extension service during the winter. The Division is co-operating with the National Broadcasting Service in giving midday and evening radio talks to farmers.

Seed-testing Station

As a result of the increased production of grass and clover seeds, the demand for the Department's seed-testing services was greater than in any previous year. Samples received for testing during the calendar year 1947 totalled 47,506, of which 16,352 were officially drawn samples for certification and 31,154 samples were received directly from merchants and farmers. The number of samples received in each of the past five years is as follows:—

1943	23,964
1944	26,960
1945	35,000
1946	44,943
1947	47,506

The numbers of tests carried out during the past two years are as follows:—

Test.	1946.	1947.
Purity	33,732	35,623
Germination	40,000	48,922
Ultra-violet	5,190	6,087
Picric acid	7,258	6,398
Totals	86,180	97,030

Germination Tests.—The unfavourable harvest season of 1947 resulted in much seed, especially rye-grass, having poor germinating capacity and made the germination-testing work during the year especially difficult. The installation of six new cabinet germinators during the year eased the congested conditions in this department.

Strain Tests.—During the year, 6,398 picric-acid tests were carried out. The number of lines entered for certification by this test was 5,706; 71 samples were submitted by merchants for preliminary testing with a view to determining suitability for entry into certification later, and 661 samples were tested for the information of departmental officers and farmers.

Rye-grass samples submitted to the ultra-violet test numbered 6,087. Official samples representing lines entered for certification numbered 3,511, and 355 samples were submitted by merchants for preliminary testing. The balance of 2,221 tests represented tests undertaken for departmental information or for the benefit of individual farmers.

Pre-harvest Examination of Rye-grass Seed.—Substations staffed by six officers of the Seed-testing Laboratory were established at Christchurch and Timaru for the examination of rye-grass seed crop samples from the 1947–48 harvest for incidence of blind-seed disease. A total of 724 samples was examined, compared with 4,057 samples in the previous harvest. The incidence of the disease was much less general and less severe than in the previous three seasons and good germinations are accordingly being recorded for the 1948 crop.

Moisture Tests.—Only 8 samples of wheat were received for the pre-harvest moisture tests. The favourable weather during the harvesting period enabled growers to proceed confidently with harvesting and little need was felt for the moisture-testing service. An increased number of samples of artificially dried Chewings fescue seed was received for moisture analysis during the year.

Instruction and Publicity.—The appointment of a liaison officer resulted in much good work being done in bringing before farmers the advantages of using tested seed. Show exhibits, radio talks, and lectures were the means employed. In addition, a motion picture with sound has been prepared for demonstration of the Station's activities.

Seed-purchasing.—During the calendar year 1947, 523 requisitions were received from other Government Departments and seed valued at about £65,000 was purchased.

Equipment.—Difficulty has been experienced in obtaining delivery of new equipment from overseas, but this is now coming to hand gradually, and as it arrives will afford further relief to the Station from the congestion brought about by shortages of essential apparatus.

Accommodation.—Additional accommodation, amounting to 4,700 square feet in a nearby building, has been taken over and the work of preparing this for occupation by a section of the staff has been started.

Field Experimental Work

Field research activities have continued to expand both in the number of experiments undertaken and in the scope and complexity of the projects studied. The total of field trials has increased during the past year from 578 to 872, and there is every indication that this number will increase still further. The increasing complexity of the research work undertaken has necessitated the employment of increased numbers of scientific staff to cope with the problem of analysis, while on the field side a scheme has been designed to enable officers to specialize in field research and attain the high standard of skill that accurate field-work demands.

While the majority of research activities are still being carried out under the farmers' co-operative experimental scheme, a large and increasing volume of work is being conducted at research areas and demonstration farms. In many cases the work at such areas has been designed to give specific detailed information about certain problems, whereas the field trials conducted in all parts of the Dominion under the co-operative scheme give less specific but more extensive information about the same problems covering all variations of soil and climate.

In such a manner both the specific information and the general application of such information to all farming conditions are secured with the minimum of delay. Types of trial which would interfere unduly with normal farming operations are restricted to experimental and demonstration farms.

The necessity for an accurate but practical and reasonably rapid method of determining the proportions of species in a complex sward has long been recognized and a statistical examination of methods now in use to determine their reliability has recently been started. This work is expected to be of interest to all field research workers.

Description and Progress of Field Experiments

(1) *Pasture Trials*

(*a*) *Mowing Trials.*—Fifteen of these trials are now in progress at the Marton Experimental Area. Seven trials are essentially technique investigations of various types and study such factors as the differences in responses to fertilizers that are shown by the different elements of the sward (in particular, the grasses as compared with the clovers), the effect on the sward of various mowing and grazing techniques, statistical studies of the variability of swards, the relation of pasture-production figures to stock-production data, and comparative studies of different mowing techniques.

Four trials compare various fertilizers. Of these, trial I examines the residual effect of various forms of phosphates and lime, and it is expected that the summary of sixteen years of pasture-production figures from this trial will be published during the coming year. Another fertilizer trial (trial S) will be closed this autumn, production data for the past eight years having demonstrated that serpentine-superphosphate is a more efficient fertilizer per unit of phosphoric acid at Marton than is superphosphate; it is hoped to publish the results from this trial within the next few months, together with other field research data on serpentine-superphosphate. Trial E compares many types of phosphatic fertilizers, and trial A the effect of fertilizer placement on pasture-production.

Three mowing trials (V, C, and H) compare species and strains of pasture plants, and trial D examines methods of preparing land for sowing to grass in terms of the pasture-production from the swards established.

At the Dargaville Demonstration Farm 3 mowing trials are in progress, 2 being fertilizer trials and 1 investigating possible "minor" element deficiencies on one of the leached soil types present on the farm. Three other mowing trials in North Auckland are located on the ironstone soil, a "problem" soil at present mainly not used for farming, but covering extensive areas of country of easy topography. These trials also examine possible "minor" element deficiencies in this soil.

At the Waimate West Demonstration Farm a mowing trial is examining the changes in seasonal grass-production during the year. It is hoped shortly to carry out this fundamental study in many districts throughout New Zealand.

At the Winton Experimental Farm, Southland, a detailed comparison is in progress of reverted superphosphate and serpentine-superphosphate in their effect on pasture-production, stock-carrying capacity, and stock-production. Final figures will not be available from this experiment for some years.

(*b*) *Observational Top-dressing Trials.*—This important series of trials has now been in progress under the co-operative experimental scheme for at least twenty years. During that period thousands of experiments have been conducted throughout the Dominion and have proved to be accurate guides to the fertilizer and lime requirements of pasture under all farming conditions. Through the extension services of the Fields Division the results from the trials have been made available to farmers and used by them to their very great advantage.

Nevertheless, the need for further work of this nature is indicated by the very considerable increase in the number of experiments now open. This need has arisen because of the following :—

(i) The completion of the examination of soil types as they are recognized and classified by the Soil Bureau of the Department of Scientific and Industrial Research, the aim being to classify each soil type according to its fertilizer and lime needs.

(ii) The comparison between different types of fertilizer. Serpentine-superphosphate is one type of phosphatic fertilizer and the majority of trials now include this material, but new forms are constantly being developed and have to be tried in the field. One important series of trials examines more concentrated forms of fertilizer which may be of advantage in hill-country top-dressing, where transport charges are heavy, or possibly for application from aircraft.

(iii) Changes in the fertilizer requirements of soil as a result of erosion or of improved fertility. Erosion is well known, but the improvement in fertility of much country, particularly in the cropping districts, has not been as well recognized. This has been brought about by top-dressing and the use of improved strains of pasture plants. By these means pastures have been maintained for longer periods and have carried greatly increased numbers of stock.

Results from these trials are supplemented by production data from mowing trials and by soil and plant chemical analysis. Officers of the Soil Fertility Research Station, Hamilton, in their studies on the chemical side of this work have greatly enhanced the value of the results secured.

A small but important section of the work deals with a study of "minor" element deficiencies. Overseas work, particularly in Australia, has shown the importance of several elements previously not considered essential to plant growth. Some of these elements may affect stock health and yet not produce a noticeable effect on pasture growth.

A detailed potash-response survey has been started of the soils of Taranaki and of the effect of previous pasture management on the response to potash. A total of 186 observational pasture top-dressing experiments is now open.

(*c*) *Pasture Species and Strains.*—Many of these trials are carried out with the co-operation of the Grasslands Division, Department of Scientific and Industrial Research. The major importance of pasture research in New Zealand is reflected in greatly increased numbers of trials of this type. These trials deal with investigations into pasture species for different soil and climatic conditions, comparison of "strains" of pasture plants, examination of seeds mixtures and seeding rates, problems associated with pasture establishment, the introduction of clovers into hill-country pastures and the improvement of such pastures generally, methods of producing swards less liable to erosion, the healing of eroded areas, and demonstration plots for farmers. Trials are both small scale and paddock scale; in the latter case, stock-grazing records are secured. In Central Otago, investigations into the regrassing of depleted country have continued,

and it is hoped to expand this work in the near future. The total number of trials with pasture species now open is 209, 96 of these being standard plot trials on ploughed land, 15 pasture-establishment trials, 71 investigating the introductions of clovers to and the improvement of hill-country pastures, 22 paddock trials with short-rotation rye-grass, and 5 trials of the regrassing of depleted country in Central Otago.

(2) *Annual Crops*

(*a*) *Wheat.*—The examination of the fertilizer requirements of wheat on different soils and under different farming conditions is progressing satisfactorily and is already giving valuable preliminary results. The wheat variety trials are designed to field test new wheat crosses bred by the Wheat Research Institute and are conducted in co-operation with the Institute. The method-of-sowing trials investigate a new type of sowing equipment. Of a total of 34 trials in the present season, 22 are variety trials, 9 are manurial, and 3 are method-of-sowing experiments.

(*b*) *Oats.*—Eight of the 9 trials now open are variety trials of recent introductions and new crosses bred by the Agronomy Division, Department of Scientific and Industrial Research, Lincoln, the remaining 1 being a method-of-sowing trial. Close co-operation is maintained with the Agronomy Division concerning work with all crops other than wheat.

(*c*) *Barley.*—In the present season, 16 variety trials with malting-barley varieties have been conducted. Other work has included 2 manurial trials and 1 method-of-sowing trial.

(*d*) *Cereal Green Feed.*—Six trials are in progress which compare the productiveness of green material of several barley, oats, and rye-corn varieties. Some new introductions are showing particular merit for different farming requirements.

(*e*) *Brassicas.*—Variety trials with locally produced and imported seed of various turnip and swede varieties total 27 and have confirmed previous results showing that the standard of the crops grown from New Zealand seed produced under Government supervision is at least as high as that from comparable imported seed. Two trials at the Marton Experimental Area examine methods of application and forms of boron which will control mottle-heart disease and not affect germination adversely. Three trials concern production of rape and swede seed, and 11 trials are simple demonstrations of the new club-root-resistant rape, which has been proved by earlier trials to merit its name.

(*f*) *Linen Flax.*—Of 4 trials now open, 2 are manurial trials, 1 is a variety trial, and 1 a method-of-sowing trial.

(*g*) *Linseed.*—Three variety and 1 manurial trial are in progress. This crop is growing in importance and experimental work with it is expected to be increased in future years.

(*h*) *Sugar-beet.*—A further 10 acres of sugar-beet has been sown, on which area it is hoped to continue the trials with machinery designed to lighten the labour demand of this crop. Various types of experiments have been sown in this field.

(*i*) *Lucerne.*—Of the 9 trials now open, 6 compare the selected strain of lucerne now being produced under certification with ordinary commercial types, and 2 are trials of a new "grazing lucerne" which may prove valuable in certain localities. One trial is a manurial experiment which includes various "minor" elements as well as the more common fertilizers and lime.

(*j*) *Lupins.*—The 7 lupin trials compare varieties of "sweet" lupins with other crops, such as rape, for stock-feeding, examining more especially their value as lamb-fattening crops.

(*k*) *Maize.*—Five trials with maize are variety trials incorporating lines of hybrid seed originating in the United States of America. Some of these lines are showing considerable promise in this country. Two trials have manurial comparisons and 1 compares types of seed of the one variety.

(*l*) *Potatoes.*—Of the 42 trials now in progress, 30 are variety trials which are giving valuable information about varietal characteristics, vigour of growth, resistance to disease, yields, and quality of tubers of a large number of varieties. Five manurial trials examine more especially the effect of different times of application of nitrogenous fertilizers, and there is a keeping-quality trial, a field-spacing trial, and a trial with a seed-dressing stated to improve sprouting. Four trials with a substance that retards sprouting indicate that this material may be of great value for preserving table potatoes for considerable periods.

(*m*) *Other Crops.*—These include trials with edible shrubs, with crop mixtures, and with a new variety of rye-corn.

(3) *Miscellaneous Trials*

(*a*) *Pampas-grass.*—Field trials include comparisons of so-called "strains" of pampas-grass, methods of establishing pampas, manurial trials, and the effect of intercultivating and of sowing pasture or crop species between the pampas rows. A comprehensive survey of farmers' pampas-grass plantations should be completed and results published shortly.

(*b*) *Weed Control.*—Trials of this type are chiefly concerned with the new hormone-type weed-killers, which have been shown to be most valuable materials for weed control. Interim results from this work have been published and a summary of the present season's trials will be prepared shortly. The field of research with weed-killing chemicals has hardly been touched as yet, and each year brings new developments which require investigation under New Zealand conditions. The experiments so far completed have shown the limitations as well as the possibilities of these chemicals for weed control, and the hope of the future is to obtain materials that will be suitable under known conditions for certain specific weeds and not to produce a single weed-killer that will solve all weed-control problems.

(*c*) *Cultivation Practices.*—These types of trial include investigations into the effect of burning stubble from cereal crops before ploughing, placement-of-fertilizer trials, studies of the effect of lime on the physical condition of the soil, rates and methods of sowing pasture seeds, and studies of the effect of bordering land in the preparation of such land for border irrigation.

(*d*) *Casting Worms.*—The 79 plantations of casting worms throughout New Zealand are being kept under observation, but definite results from this project will not be available for a further year or two.

(*e*) *Blind-seed Disease of Rye-grass.*—The control of this disease is being studied in collaboration with other interested Departments, and 9 trials have been undertaken by the Fields Division, mainly of the effect of fertilizers and of spraying and dusting with various chemicals. The incidence of the disease during the past season was very low, however, and conclusive results are not expected to be available from the past year's trials.

(*f*) *Insects and Insecticides.*—These trials are mainly studies of the liberations of parasites of St. John's wort and bidi-bidi and trials with insecticides such as D.D.T. against grass-grub, crickets, and other insects. Much of this work is still in the preliminary stages.

Other experiments cover ecology studies of tussock country, comparisons of laboratory, field, and glasshouse germinations of pasture seeds, and trials of some introduced species in various localities such as high-altitude country.

Summary of Numbers of Experiments laid down, discontinued, and carried on for the Period 1st April, 1947, to 31st March, 1948

Nature of Trial.	As at 1st April, 1947.	Discontinued during Year.	Laid down during Year.	As at 31st March, 1948.
1. Pasture—				
(*a*) Mowing trials	12	1	12	23
(*b*) Observational top-dressing	102	4	64	162
(*c*) Minor element	4	2	2	4
(*d*) Potash survey	..	..	20	20
(*e*) Pasture species and strains	40	2	58	96
(*f*) Pasture establishment (general)	6	..	9	15
(*g*) Surface-sown legumes	53	1	19	71
(*h*) Short-rotation rye-grass	30	8	..	22
(*i*) Depleted land	3	..	2	5
2. Crops—				
(*a*) Wheat, manurial	4	5	10	9
(*b*) Wheat, variety	21	23	24	22
(*c*) Wheat, method of sowing	..	..	3	3
(*d*) Oats	5	5	9	9
(*e*) Barley	12	14	21	19
(*f*) Cereal green feed	..	..	6	6
(*g*) Brassicas	47	49	45	43
(*h*) Linen flax	5	5	4	4
(*i*) Linseed	4	4	4	4
(*j*) Sugar-beet	3	3	3	3
(*k*) Onions	2	2	..	..
(*l*) Lucerne	6	1	4	9
(*m*) Lupins	5	6	8	7
(*n*) Peas	1	1	1	1
(*o*) Maize	12	12	8	8
(*p*) Potatoes	33	33	42	42
(*q*) Other crops	1	..	6	7
3. Miscellaneous—				
(*a*) Pampas-grass	5	2	2	5
(*b*) Weed control	73	64	122	131
(*c*) Cultivation practices	5	..	10	15
(*d*) Casting worms	79	..	..	79
(*e*) Blind-seed disease of rye-grass	..	..	9	9
(*f*) Insects and insecticides	..	..	5	5
(*g*) Others	5	..	9	14
Totals	578	247	541	872

Soil Fertility Research Station, Hamilton

During the year considerable progress has been made in establishing the basic programme of research which was laid down at the inauguration of the Station. Limitations of staff and buildings have continued as serious factors in determining the scope of projects that could be undertaken. These have been most acutely felt in the technical field-work and in facilities for working up and co-ordination of results. Plans for a central building have been completed and the first steps toward preparation of the site have been put in hand.

The acquisition of an area of flat land adjoining the Rukuhia Airport has provided opportunity for field experiments on a lighter and more responsive type of soil (Horotiu sandy loam) than any on the Station site. It is also well suited for trials involving cultivation and growing of crops.

Field Research

During the past year the trials designed to compare techniques of measuring pasture-production have been carried on and have given some interesting data. As part of this series a section was devoted to the " white clover " technique, in which the whole of the plots under comparison was planted with cuttings from one parent plant, thus eliminating variation in the material under trial. The whole area established well and promises to be valuable as providing a technique to be used in certain circumstances. The trial has not yet been running sufficiently long to give any reliable indications of the relative merits of the techniques under comparison.

The preliminary stages of the work on the possibility of using wethers kept at a constant weight to measure pasture-production on a fixed area have now been completed with promising results. A paper summarizing the results of the findings to date is being prepared. With certain modifications and safeguards, the method appears to hold promise of being of value for comparing fertilizer treatments on relatively large areas, but suffers from the drawbacks of the large expenditure of both money and time necessary to conduct trials on a comprehensive basis. During the coming year it is hoped to re-establish this trial, introducing various fertilizer treatments on the newly acquired area at Rukuhia.

Already progress is being made in connection with the development of peat soils. The nitrogen responses reported last year have given disappointing results on further observation. Though the initial effect is very large, it is not prolonged, and with present high costs of nitrogen it cannot be recommended for general use. There may be a sphere of use for artificial nitrogen in carrying on newly established grass until clovers develop sufficiently.

If results from the use of artificial nitrogen have proved disappointing, results from the use of lime, phosphate, and potash have given great encouragement. Some striking clover responses have been obtained, but chiefly where all these materials have been applied in combination ; results from any one of these in the absence of the others may be very disappointing. Work is proceeding to throw light on necessary minimum rates of applications and the frequency with which applications require to be made to maintain a satisfactory rate of pasture growth.

Though the use of artificial nitrogen has proved discouraging, the nitrogen balance of the peat soils is of utmost importance and must be approached through the growing of clovers. Extensive trials are being carried out to determine the precise conditions under which clovers can be made to thrive on raw peat.

Additional trials under way on the peat deal with the placement of fertilizer and also with the use of albino subterranean clover in comparison with the Mount Barker and Tallarook strains.

Irrigation and Soil-moisture Studies

Spray Irrigation Trials.—The irrigation trials referred to in last year's report have been continued. Since the start of the trials in January, 1947, the irrigated plots have received twenty-one irrigations.

Grass-production on the two unirrigated and the four irrigated plots has been measured throughout this period by weighing the grass cut on strips in each plot. The number of sheep-grazing hours on each plot has also been recorded. Throughout the year from January, 1947, to January, 1948, the plots receiving 1 in. of water at each irrigation carried 55 per cent. more stock and gave 42 per cent. more grass cut by the mower than the unirrigated plots. The plots receiving $\frac{1}{2}$ in. at each irrigation carried 36 per cent. more stock and gave 28 per cent. more grass cut by the mower than the unirrigated plots.

Regular botanical analyses of the pasture were made throughout the year. During the dry weather the weed content, mainly pennyroyal, accounted for 85 per cent. to 90 per cent. of the growth on the unirrigated pasture. One of the plots receiving 1 in. of water contained 6 per cent. to 12 per cent. of weeds, and its duplicate had a weed content of only 1 per cent.; the latter plot at this time had 78 per cent. rye-grass and 18 per cent. white clover. The plots receiving $\frac{1}{2}$ in. of water at each irrigation were far more weedy, containing about 40 per cent. weeds in one and 11 per cent. to 20 per cent. in the other. If allowance be made for weeds, the increase of growth from irrigation would be much greater than the figures quoted.

Drain Gauge Trials.—Little or no information was available in New Zealand regarding the proportion of the rainfall which passes away into the subsoil as drainage water below the reach of the plant roots and is lost to the plant.

A portion of undisturbed grassland was separated from the surrounding land by sinking two concrete rings each 3 ft. deep to a depth of 6 ft. in the soil. The surface enclosed is about $\frac{1}{3000}$ of an acre. A perforated steel plate was inserted between the rings, leaving 3 ft. of undisturbed soil above. The soil below the plate was removed and a funnel for collecting drainage water inserted in its place.

By measuring the drainage water it was found that in August 41 per cent. of the rainfall passed away in the drains, in September 30 per cent. and in October 38 per cent. Analyses of the drainage water have shown the amounts of plant-food which are lost in the drainage. A feature of this work is the large amount of magnesium which is being lost from Hamilton clay soil.

Manurial Requirements of Soils

For estimating available phosphate of soils in the field, consideration of accumulated data from 1945 to 1947 led to a trial of Truog's method, and this has proved promising enough to warrant its provisional adoption for advisory work. A modification of the method will be used in the field officers' outfits. The extractant employed is a 0·002N sulphuric-acid solution buffered at pH 3. The sulphate ion does not displace absorbed phosphate, a form which appears unavailable for plant uptake. For potash tests the Purdue rapid test has been provisionally adopted and used for routine advisory work, and provision for its use will be made in field outfits to be issued to advisory officers.

The soil tests for phosphate and potash have been further checked by use in conjunction with tissue-test methods. Indications were in general agreement, but there were exceptions. Soil samples from all observational top-dressing trials have been examined by quick-test methods, and results await comparison with field pointings. Mitscherlich pot experiments were carried out in the past season on 13 soils from various parts of New Zealand.

In the field outfits at present on issue, lime requirement of soils is judged from a joint consideration of pH and exchangeable lime. To put recommendations on a sounder footing, a measure of base-exchange capacity is needed in addition. Efforts have been made to devise a simple test for this capable of use by field officers. The Truog test for lime requirement was examined critically. Soils in no need of liming could be distinguished, but the test proved untrustworthy for assessing the lime requirement of deficient soils.

A large number of pot experiments was carried out, including those into the use of minor elements and the use of compost with and without mineral fertilizers.

Testing of Limestones

Commercial limestones in New Zealand are for the most part much less finely ground than formerly. The necessity for fixing some standard of fineness has prompted a general study of the relative importance of such factors as fineness of grinding, reactivity, and purity. Some 100 commercial limestones have been tested for carbonate

content and fineness of grinding by the service section and for rate of solution in dilute acid by the research section. The rate at which a limestone dissolves in a dilute acid does not necessarily reflect its behaviour in the field, and selected limestones are being studied further by pot experimental methods. Field trials are under consideration. In the field a further factor comes into prominence—that of hardness. The treading action of stock is likely to pulverize a soft limestone but have little effect on a hard stone, and the hard stones may require a finer grinding All stones are being tested for their resistance to crushing, and selected extremes will be compared in mowing trials.

At the present early stage, indications in the pot experiments are that fineness of grinding has a very big influence, overshadowing that of reactivity and also that of size of application. In these experiments the limestone was incorporated in the soil, not applied to the surface. An effect on germination was noted. Some work on the solubility of limestone in a saturated solution of carbon dioxide has been carried out.

Plant Analysis

Investigations of the tissue-test techniques as a means of determining mineral deficiencies in pasture plants and fodder and cereal crops have been continued. The first step in this work has involved the checking and improvement of existing chemical methods, most of which have now been developed to a satisfactory degree. The second stage has involved securing extensive reference data from the more important plant species. The work has now entered the important stage of correlation of results with findings or indications from other techniques of mineral-deficiency investigations.

Visual symptoms have received attention, but have been of limited assistance, especially in the pasture investigations. Efforts, therefore, have been directed more particularly toward relating the tissue-test findings to the results of soil analyses carried out by the soil research sections and the conclusions from field observational top-dressing trials or mowing experiments and conclusions from the peat investigations. It is hoped shortly to add to the over-all picture results of plant-ash analyses.

Using the travelling laboratory, visits have been made to various North Island observational top-dressing trials, in most instances satisfactory agreement being obtained between results of tests and observed responses. However, in detailed plot experiments conducted at the Soil Fertility Research Station, correlation of fertilizer treatment with sap levels or correlation of growth responses to treatments with sap levels has been disappointing. It would appear, therefore, that the tissue-test techniques are of more particular value in revealing acute deficiencies rather than in showing up or evaluating small differences in nutrient availability.

Even between methods of examination of the plant sap considerable variations have been noted. For example, potash and phosphate results by the Purdue and Carolus methods frequently conflict. In general, the Purdue phosphate results are in better agreement with observed responses than the Carolus results, whereas for potash the Carolus technique appears to be preferable.

Despite these shortcomings, however, the method appears to be of value in the following ways: as a confirmatory test to visual methods, especially for crop plants; as a supplementary test to soil or plant-ash analysis; as a quick test for available nitrogen; and as a quick test adaptable for use by field officers.

Weed Control

While the experimental programme of this section has been extended considerably during the year, to a large extent the work has been restricted to investigations into the use of weedicides in the control of perennial weeds of pastures. Much of the work to date has been exploratory, as it has been essential for the Department to check the

claims made overseas about the utility of various recently discovered weed-killing materials. In general, investigations have indicated that claims made for hormone weed-killers in the control of perennial weeds are, as a rule, somewhat overrated. At the same time, it has been evident that the effective use of chemical weed-killing methods depends on a complete knowledge of the plants concerned and of the conditions under which a specific weed-killer may be applied satisfactorily.

In addition to the examination of the more important pasture weeds—blackberry, gorse, and ragwort—a number of special problems have been investigated—for example, the extermination of willows and aquatic weeds obstructing streams, canals, and drainage ditches. There is convincing evidence of the continued spread of willows and *Poa aquatica*, and also abundant evidence to indicate how great will be the cost of clearing existing infestations.

Microbiology Studies

Staff and equipment of the microbiological section have been built up to a satisfactory level during the past year, and in the past six months in particular a considerable volume of work has been accomplished. Much time has had to be spent in finding and evolving techniques suited to local conditions and in making a survey of organisms likely to be encountered.

To date, about 50 soils of different types and treatments have been plated for counts of fungi, bacteria, and actinomyces, numbers varying from 2,000,000 to 15,000,000 per gram of soil. Peat samples have shown high fungal numbers, though of limited flora, this being in conformity with the prevailing high acidity, though relatively large numbers of actinomyces, which are more usually found in conditions nearer neutrality, were present.

Rhizobium studies in relation to peat soils have been continued and a trial laid down on Rukuhia peat of various white and subterranean clovers, inoculated and uninoculated. Nodulation of clovers growing on peat is not uniform and isolations from some of the plants have shown different strains to exist. At present some 50 different isolations are under test to isolate an effective strain.

About 30 different actinomyces have been isolated from Hamilton clay loam and peat. In view of the function of these organisms in the breakdown of nitrogenous materials, these are being typed and will be further studied. Nitrification studies along normal lines have given erratic results and further work is to be done using the soil-perfusion apparatus.

No azatobacter have been isolated, but radiobacter type of organisms are present and several have been isolated.

Microbiological work on peat has also included the plating of soils from different field, plot, and pot trials, and rhizosphere studies of the main grass and clover species growing in peat have been started.

Analytical Services

Three hundred soils from field trials have been tested, and results will soon be ready for correlation with observed field responses. It is expected that information of value to both laboratory and field staff will be gained from the results. Soils from research areas at the Station, field trials, and pot experiments have been analysed by standard methods.

Soils submitted for analysis for advisory purposes numbered 200, and field officers were provided with analysis and comments on the nutrient status of the soils for farmers' information. The use of this service is increasing, and it is hoped that equipment will be available shortly to enable Instructors to make their own tests.

The great bulk of work handled in the analysis of fertilizers has been from the field trials of the Division to establish the quality of fertilizers used. A limited number of official samples under the Fertilizers Act have been analysed. Practical recommendations were prepared on methods of reducing rotting in bags, which promised to be in short supply. Investigations have been started to determine the cause of the difference between serpentine rock from Te Kuiti and North Auckland in reverting superphosphate.

All ground limestones used in field experiments are tested for purity and fineness. Periodical sampling of commercial products is undertaken to keep a check on the quality of stone marketed. All commercial products on sale were specially tested during the year for purity and fineness and sieved for research into reactivity and hardness. Rocks thought to be potential sources of lime were tested for farmers. The samples of burnt lime submitted were, with one exception, of poor grade and quite uneconomical. Moreover, the purchase of low-grade burnt lime for pest control would be most unsatisfactory.

Pasture dry-matter samples numerically outnumbered the total of all other samples. They are undertaken for estimation of dry-matter production on field trials and at the Research Station. In certain trials the dried samples are retained for analysis.

Miscellaneous samples include water from the lysimeter at the Station. This is a service which should be included as a major research were suitable staff available.

Weedicide and organic research has included detailed study of the herbicidal action of power kerosene. Work for other Station research projects has included analysis of samples of weed-killer and the preparation of organic compounds not obtainable commercially.

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

Soil—	
Research	709
Service	614
Limestone	287
Fertilizers	149
Pasture	3,089
Miscellaneous	51
	4,899

Irrigation

Up to September, 1947, the season's rainfall had been sufficient, but from then until the end of March, 1948, dry conditions prevailed, made worse by a long sequence of north-westerly winds. These circumstances created what could be called the usual Canterbury weather for this period of the year, but these conditions had not prevailed during the past four seasons, which had abnormal rainfall for this period. Under these normal conditions during the present season the value and necessity of irrigation if production is to be increased have been strikingly demonstrated on farms where irrigation water has been made use of in South and Mid Canterbury.

The main activity has been centred around the establishing and development of the irrigation research area at Winchmore, in Mid-Canterbury.

Of the three areas, the dairy unit of 150 acres is furthest advanced. Milking was begun in September, the herd finally comprising for the season 27 cows in milk, 24 of which are first-calving heifers. All the stock have been bought where they could most readily be obtained. With herd-testing and the use of good sires, and the purchase of further heifers with a known background, it is intended to build up the herd as quickly

as possible. The area is expected to come into maximum production next season, and should provide information on the possibilities of dairying on light land under irrigation in Canterbury at the earliest possible time. Such information would be invaluable for future settlement and production. The experience of this unit has already indicated that ample feed suitable for the production of butterfat, together with the provision of winter feed, is close to becoming a certainty under irrigation on this particular class of land.

The mixed-farm unit of 350 acres is in the process of development to a plan constructed by the advisory committee. The handicaps to its quick establishment are difficulties associated with fencing-materials, and lack of shearing shed and yards, dip, and implement accommodation. The fencing position is the most acute, as subdivision is essential to irrigation development and without it no headway can be made. At present, 500 ewes are being carried; 110 acres have been border dyked and sown in permanent pasture. The remainder of the area is being systematically cleaned and winter feed and green feed grown.

The development of the research area of 250 acres is handicapped even more seriously than the mixed-farm area. Lack of buildings and fencing-materials are the chief difficulties. A series of experiments has been laid down during the summer and autumn months of this year, and the whole area is under cultivation with the objective of cleaning the land and preparing it for irrigation.

Fertilizers

Rationing.—The rationing of phosphatic fertilizers was continued during the season. For top-dressing, the allocation was increased from 50·4 per cent. to 67·2 per cent. of the quantities used in the average of the two base years ended 31st May, 1941. This has meant an increase of one-third over the quantities allocated the previous year. Increases were also made for the sowing of grass seed on cultivated land in the North Island from 1½ cwt. to 3 cwt. an acre and in the South Island from 1½ cwt. to 2 cwt. an acre.

Importations.—For the fertilizer year July, 1947, to June, 1948, it is estimated that approximately 380,000 tons will have been imported. Supplies from Nauru and Ocean Islands have been more plentiful, and for the full year it is estimated they will approximate almost half of the total imports of raw rock phosphate. Both basic slag (20,000 tons) and North African phosphate (21,000 tons) were imported, as were limited quantities of nitrogenous and potassic fertilizers.

Transport.—The delivery of lime and fertilizer has been retarded sometimes because of the limited number of railway trucks available for the purpose and also because of shortages of labour at the works. To assist the transport of fertilizers, arrangements were made to subsidize road transport up to one hundred miles from works and also to use water transport for deliveries to certain areas when railway trucks were in short supply.

The free railage concession applicable to lime ceased as from 12th October, 1947, and was replaced by the Lime Transport Assistance Scheme, which came into operation on 24th November, 1947. Authority has now been given for the back-dating of lime-transport assistance to the earlier date to overcome any hardships resulting from the lapse of time between the ending of free railage and the beginning of lime-transport assistance.

Nassella Tussock

Eradication measures against nasella tussock are being carried out in badly affected areas under the direction of the two special Boards set up in North Canterbury and Marlborough.

Phormium Tenax

With the payment of the guaranteed price, greater interest has been taken in this industry by millers and others. However, production is well below the requirements of end users of hard fibres, but fibre-production is increasing steadily. Labour is still one of the major problems to be dealt with, and mills are being handicapped by shortage of skilled operators and cutters for green leaf. Another factor arising from shortage of labour is that swamp maintenance is well behind, and this will seriously affect the green-leaf supply unless the drains can be attended to and space filling carried out in the plantations.

The end users of fibre are working from hand to mouth, and had it not been for the import of sisal to help the manufacture of baling-twine and binder twine the position would have been desperate for the harvest requirements. The prospects for the coming season are not good, as a greater quantity of these twines will be required because of the world shortage of wire. Every effort is being made to encourage millers to further production.

Financial Aid to Growers.—Government aid to millers and growers has been made available and up to date one proposition has been dealt with. This is the purchase of about 600 acres of land near Invercargill, and the total amount involved is about £27,000.

End Users' Requirements.—Increasing use of phormium fibres, &c., is being made by fibrous plasterers and upholsterers. In nearly every town, large and small, factories making fibrous-plaster sheets are in evidence, and it is estimated that some 700 tons of fibre, &c., is used annually for this purpose alone.

The position with regard to binder twine and, particularly, baling-twine became serious because of the non-delivery of baling-wire, and every effort was put forward to supply the harvesting-machines with the necessary twines, which was eventually accomplished.

The present machinery installed by end users is capable of absorbing 7,000 tons to 8,000 tons of fibre and tow, and the Department's target is 10,000 tons of fibre, tow, and stripper slips a year.

Production of Fibre.—The total amount of fibre, tow, stripper slips, and unscutched fibre (straw) produced for the year ended 31st January, 1948, was 4,643 tons, made up as follows:—

	Tons.
Fibre	1,540
Tow	312½
Straw (unscutched fibre)	2,581
Stripper slips	209½
	4,643

This is an increase of 1,471 tons over the previous year's production.

Flock House Farm of Instruction

The standard of training at Flock House was considerably widened during the year, and the course of instruction includes lectures, demonstrations, and visits to stud farms and other centres of agricultural interest in the district. The number of applicants has been considerable and there is now a waiting-list of youths desiring to take the course. The average number of boys in training during the year was 28, and it is planned to increase the number to 45 during the coming year.

On the farm, conditions were very dry during summer and pastures suffered, as on all farms in the district. The usual programme of crop-production was maintained.

Sheep.—The station flock consisted of 5,894 ewes, of which 1,400 were two-tooths. The over-all lambing percentage was 95·6. A total of 2,803 lambs had been sold up till the end of March, and 205 bales of wool were produced.

Cattle.—Run cattle were maintained in satisfactory condition during the year; 293 run cows produced 237 calves, a percentage of 81, and 215 cattle were sold during the year.

Dairy Herd.—The production of the dairy herd was well maintained up to the end of November, after which dry conditions caused a decline. From 98 cows a total of 20,754 lb. of butterfat and 48,522 lb. of milk was produced up to the end of March.

Pigs.—Though mortality of young stores was slightly higher, in general pigs progressed satisfactorily. No carcasses were condemned for tuberculosis. A total of 100 fat pigs and 69 store pigs was sold during the year.

Cropping.—The usual programme of growing and harvesting wheat, oats, peas, potatoes, sugar-beet, carrots, swedes, chou moellier, and rape was carried out.

A considerable area of gorse was dealt with by heavy implements during the year.

Young Farmers' Clubs

Further progress has been made in the Young Farmers' Clubs movement during the past year, though not as spectacular as that registered in the period immediately following the war. Since the complete revival which took place in 1945–46 there has been a steady increase in the total number of clubs and a fluctuating rise in the average club membership. By the end of the 1946–47 year, membership had increased to nearly 8,000 and the number of clubs to 278. The rate of progress has since steadied down, the figures to date showing a total membership approaching 9,000 in 306 clubs—an increase of 28 clubs and an estimated increase of about 1,000 members.

Every encouragement has been given to club officials and members to control the affairs of their own units and to assist the progress of the movement by their own efforts. However, the success of the movement is largely in the hands of the departmental officers acting as district Y.F.C. secretaries. District secretaries who are keenly alive to the value of the movement and have an appreciation of local problems and requirements are able to inspire the club and district executives with the necessary sense of responsibility to their clubs and to the movement generally. The control of the movement, through its district committees, councils, and Dominion executive committee, is vested in the members themselves, but the Department has provided so complete an organization that all units must necessarily rely on it to secure co-operation and co-ordination.

Work in the clubs has included lectures, discussions, demonstrations, and field-days, all tending in the direction of agricultural instruction, and the social and recreational side has been developed. Debating has been encouraged, and every effort made to inculcate the spirit of leadership and citizenship.

The numbers of clubs in the four council areas are—

Council.	1946–47.	1947–48.
Auckland	97	108
Wellington	90	97
Canterbury	53	54
Otago-Southland	38	47
Totals	278	306

Co-operative experimental work, an activity in abeyance since the beginning of the war, was reintroduced during the year. The trials are known as Y.F.C. co-operative trials, being co-operative in the sense that the Department provides the materials and directions for laying down the experiments and club members are expected to carry out the work, report on the trials, and see them through to completion.

The Y.F.C. Federation made a move two years ago to sponsor the formation of a "sister" organization for rural young women, to be known as the Country Girls' Association. The executives of the Women's Division of Federated Farmers and the Women's Institute agreed to support the proposed movement, provided its age limit was set at twenty-five, and the Rural Development Division of the Department proffered assistance on similar lines to that provided by the Fields Division to the Y.F.C. movement. Eight branches of the new organization have been established to date, 6 in Canterbury and 2 in the King-country district of the North Island. A central body to control this new organization and co-ordinate its work is expected to be set up shortly and an impetus given to the formation of a number of other branches.

The Y.F.C. Supplement to the *New Zealand Journal of Agriculture* is in its second year of publication and is issued monthly to all Y.F.C. members with their copies of the *New Zealand Journal of Agriculture*.

Show Exhibits

During the year departmental show exhibits were revived after a lapse of five years and exhibits were staged at Hastings, Hamilton, Palmerston North, Christchurch, and Invercargill.

DAIRY DIVISION

REPORT OF H. A. FOY, DIRECTOR

The Season

The past year, no doubt, will be remembered by many people as one of the driest in the history of the Dominion, but dairying was not prejudiced to any great extent, because most of the main dairying districts were less affected than other areas. Nevertheless, though the opening of the season promised a record output, expectations were not fulfilled because of the early advent of dry conditions. Even so, production for the year ended 31st March, 1948, showed an increase of about 8 per cent. on a butterfat basis over production for the preceding year. It is also expected that the season will end at the 31st July with a small increase on last season.

North Auckland had a particularly favourable season climatically. In the Waikato, spring conditions were excellent, but some comparatively long dry periods were experienced during the summer and autumn, some areas being more affected than others. Taranaki was also favoured with excellent spring conditions, but dry weather, particularly in coastal areas, resulted in a sharp decline in production from the summer months onward, though beneficial autumn rains revived production somewhat. The Manawatu and the Wairarapa were less favoured, the weather being particularly dry from the peak months onward.

With the exception of Canterbury, where conditions were somewhat similar to those in the Wairarapa and Manawatu, the South Island experienced a season more or less normal in climate.

Abnormal weather caused an early decrease in production by herds supplying liquid milk to such centres as Wellington, Palmerston North, and Auckland, with the result that supplies had to be augmented at the expense of normal butter and cheese production. In the Manawatu, particularly, emergency supplies had to be drawn from areas much farther afield than is customary in a normal autumn. Some of the milk for Wellington City had to be drawn from the Wairarapa and north of Palmerston North.

Export Values

The total value, for Customs purposes, of all dairy-produce exported during the year ended 31st December, 1947, was £42,535,093, an increase of £12,920,237 over the 1946 valuation of £29,614,856. The products included in this trade are butter, cheese, casein, dried milk, sugar of milk, and condensed milk and cream. Butter accounted for £28,835,878 and cheese £11,621,068, the values for the previous calendar year being £19,841,455 and £8,448,321.

The quantities represented in those valuations are actual shipments and therefore should not be related to the grading statistics included 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.
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
1939	129,277	−11·20	84,236	−2·06	140,764	−9·22

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.
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
1939	129,277	93·373	82·42	40·02	17·06	0·51

Whey Butter graded for Export

Year ended 31st March,	Tons.	Average Grade Points.	First Grade.
			Per Cent.
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
1939	1,904	88·152	94·59

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.
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
1939	84,236	92·133	17·41	79·64	2·94

Grading Standards.—The standard and uniformity of grading is mainly on sound lines and generally the Graders are carrying out their duties capably and conscientiously. Some variations do exist and are to be expected, because district conditions and characteristics in the quality of butter and cheese influence the judgment of the Graders to some extent. That applies more particularly to the smaller ports, where there is very little produce for comparison. It is more in border-line quality that the standard of some officers varies, but good-quality butter and cheese are recognized and pointed accordingly at all ports.

There is very little room for criticism in the methods used for the plugging and sampling of butter and cheese. This has been stressed to all concerned, and it is appreciated that uniformity is desired. All ports have now been supplied with suitable boxes and trays for cheese samples, and there is no excuse for lack of uniformity in this respect.

Quality.—The quality of butter and cheese has been satisfactory; over-all, butter shows improvement and cheese a slight falling off in the quantity graded in the Finest and premium classes. Mechanical and split openness have been more in evidence than last season, and at different times the body of the cheese generally has been at fault.

The early spring months were very favourable for butter quality, more particularly in the Auckland and Wellington districts, and at both ports butter reached the Finest standard and premium quality earlier than usual. No doubt the mild winter and the favourable weather in the spring were responsible to some extent for this improvement. One noticeable and pleasing feature has been the absence of feed flavours, particularly that of cress, which appeared to be spreading to more districts during the past year or so. Generally, colour troubles have also been less in evidence and the body of the butter firmer in character. Some factories were at least three weeks ahead in forwarding butter classed Finest and premium, and, with the exception of some brands from the north of Auckland, this improvement was general at the two ports mentioned. Though the quality of the north Taranaki butters did not show this early tendency to Finest and premium quality, the butter at New Plymouth has been generally satisfactory and the grading much on a par with previous years. Some brands of butter seen in the South Island were of choice quality, but others were less pleasing.

There is a general endeavour on the part of the majority of directors and managers to maintain and improve quality. Though in some cases there is still a tendency to commercialize the method of manufacture, it is considered that as a result of discussions at conferences and meetings more attention is being paid to the incorporation of salt by managers, and in consequence the butter generally has not been as harsh as in the previous season.

The quality of the whey butter, with the exception of the majority of that received at Auckland, has been on a par with that of last season. In the case of Auckland, some slight improvement has been made in some brands because the cream is now dealt with at factories more central to a larger number of cheese-factories, thereby saving the long transport necessary in the past. However, delay in treating and manufacture into butter is still a factor detrimental to this product, and no doubt best results are obtained where the cream can be treated and made up without being held for long periods.

The quality of cheese, while of a good commercial standard, will not show the percentage of Finest which obtained at some of the ports last year.

The quality of Wellington spring cheese was perhaps better than at some of the other ports, but, with the hot and dry conditions which followed, many factories dropped from Finest to First Grade.

Some of the cheese seen in the early part of the season was disappointing. That applied more particularly to north Taranaki, where the body of the cheese coming forward was doughy and lacked acidity. However, the defect was remedied as the season advanced and some good-quality cheese was produced in both north and south Taranaki.

The cheese in the Waikato has been of more uniform quality this season, some of the factories showing good improvement in this respect. One satisfactory feature has been a tendency to more uniform lines from this district, fewer odd vats of poorer quality being in evidence.

The Superintendent of Grading's one visit at the end of November and December was insufficient for the purpose of commenting on the quality of South Island cheese over the season. He was disappointed with the cheese seen at Lyttelton, the main defect being tough bodies and mechanical openness. The cheese at the Bluff were also on the firm side, but much closer in texture. The cheese examined at Timaru and Dunedin were more pleasing and better-quality spring make in body, but in the main too open for Finest.

Examination of Stored Butter.— Stored butter which had been held at the Wellington grading-stores for about three months was examined and, with the exception of one brand, the butter had held up satisfactorily, the regrading points being in line with the class in which the butter was placed originally. Results of similar examinations at other ports indicated that, in the main, the original grading was on sound lines.

Analytical Work.—This work is of major importance and the need for careful and accurate testing is recognized by all concerned. When necessary, irregularities have been discussed with the officer in charge with a view to all ports being on uniform lines.

An improvement in the proper emulsification of samples for the final test of all samples of butter found to contain water above the legal limit has been noted, and, apart from the fact that some of the smaller ports are not equipped with the electric motor and bit for mixing purposes, the work of testing all butter samples is similar at all ports.

The testing-rooms and appliances generally have always been found in a neat condition, and the responsible officers are to be complimented for maintaining these conditions.

Finish and Packing of Butter and Cheese.—Though in some cases the finish and appearance of both butter and cheese could have been better, the outturn of produce has, in the main, been maintained. Graders generally watch the position closely, and offending factories are penalized in grade until the defect is remedied.

Though the finish of the bulk of the cheese has been satisfactory in the main, some bad cases of cracked rinds, defective crowns and lips, and poor finish were seen at Auckland during the season. Apart from these cases, which were mainly concerned with cheese below First Grade quality, this trouble has not been worse than in previous years, and in some districts the improvement which occurred last season has continued.

In the main, cheese rinds have been clean and free from mould, and, though the dry season has been responsible to some extent, some credit is also due to managers and Instructors for the attention given to this important detail.

Butter, on the whole, has been neatly packed and finished. Some odd cases of loose tapes and badly sealed fibre cartons have occurred, but after some instructions these defects have been remedied.

The impressed brand on the surface of the block of butter is in many cases obliterated when fibre-board cartons are used. This seems to be difficult to avoid when cartons of butter are stacked in the factory cool room in a soft condition. With the greater use of the carton container, some solution is desirable to maintain the neat impression of the Fernleaf brand, which was a feature of the butter packed in the wooden box.

Butter and Cheese Packages.—The fibre-board container now being used extensively is proving satisfactory as a container for butter. Factory staffs are becoming efficient in assembling, sealing, and taping, so that the carton usually presents a neat appearance on arrival at the stores for grading.

Wooden boxes of white-pine and rimu or a mixture of these timbers are still used by a few factories in the North, and the sub-standard white-pine box is used exclusively in the South.

On the whole, cheese-crates have been up to standard, though some ports report that considerable breakages of battens have occurred. *Pinus radiata* is now used extensively for cheese-crates, and when the crate is made solely of good timber of this type there is no cause for complaint. In some cases the timber is immature or very knotty and the crate will not stand up to rough usage.

The beech timber in the South Island makes a very solid cheese-crate, but apparently is being used for other purposes, as a number of factories in the south are now being supplied with *Pinus radiata* timber.

General.—Arrangements were made at the beginning of the season for a trial in connection with the splitting of grade points within a class to be carried out at Auckland. This was done to see what advantage, if any, would accrue to factories if such a system of grading was adopted and also to satisfy the claim made by some managers that their produce was being penalized under the present method of line grading. The results of the trial are not yet available, but it is believed that there have been very few occasions when variations in quality were sufficient to justify such action.

Butter Instruction

Manufacture.—Quality generally has shown a further improvement. Several factories which up to the beginning of the present season have been consistently making low-scoring butter have this year been manufacturing butter comparable with the best. This has been the result of the favourable season, the installation of extra plant, and more efficient farm-dairy instruction.

Again, because of favourable weather throughout the autumn, winter, spring, and early summer, growth has been uniform, and as a result feed flavours, including that of land-cress, have been less in evidence. The opinion that there is not much room for growth of land-cress in a close-pasture sward has apparently again been upheld by experience during the past season. This leads to the conclusion that with an improvement in pasture-management not only will production be increased but the incidence of land-cress flavour will be reduced. From an inspection of farms where cream having land-cress flavour was produced there was evidence of considerable overstocking, with resultant opening of swards, which permitted the growth of cress.

Spotted and streaky colour was evident at times in some brands, but to a much lesser extent than in the previous year. It is considered that this improvement is the result of more careful attention to manufacturing detail, including control of temperatures.

Cream Grading.—A tendency to grade cream to a lenient standard is still evident, and is especially noticeable in areas where competition for supply exists; the checking of grading at these factories requires continued and close attention. Following complaints of easy grading, firm action was necessary at one factory. Since then an improvement has been evident.

Cream quality generally has shown an improvement, partly because of a favourable season with less evidence of feed flavours and partly because of more efficient farm-dairy instruction.

Dairy-factory Staffing.—This has not been without its problems, especially where married quarters have not been provided. For the retention of a good staff, the provision of suitable married quarters is now more than ever necessary. Dairy companies have realized this and are making every endeavour to provide suitable housing, which, with present shortages, is not easy. However, the staff position is improving.

Detergents.—The shortage of suitable detergents has caused a good deal of inconvenience on dairy farms and in factories. Caustic soda is used extensively in cleaning operations, and though some success has been achieved with the use of proprietary mixtures as substitutes the general opinion is that there is nothing to equal caustic soda for certain operations, such as cleaning milking-machines and portions of factory equipment.

Cheese Instruction

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

No serious starter failures were experienced during the season under review. That, it is believed, can be attributed not only to better facilities for keeping single strains active, but principally to the rotational use of these starters plus careful technique on the part of the operator.

While most factories in south Taranaki are using the Jones starter apparatus and with some success, equally good results are being obtained in other districts where different starter outfits are in use.

There appears to be no doubt that single-strain starters assist managers to make a closer cheese in a shorter time than can be done with commercial starters, but it is questionable whether the right characteristics of the Cheddar flavour are imparted to cheese by the use of these cultures.

Manufacturing Methods.—In general, methods of manufacture at the majority of factories are on sound lines, but 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. That applies more particularly to most of the factories in the South Island, where dry stirring is still relied on to get the right degree of firmness.

The importance of the efficient control of such details as pasteurizing, setting, cooking, and hooping temperatures, and cutting, drying, and cheddaring the curd, has been constantly stressed. Pasteurizing temperatures at most factories in the North Island vary from 150 degrees to 160 degrees. The higher temperature is used at most factories in the Waikato, while in Taranaki 150 degrees to 155 degrees appears to be the popular temperature for pasteurizing. In Southland the temperature has been lowered this season at most factories, and it is understood that they are now pasteurizing

at a temperature of about 140 degrees. Though this low temperature may be all right during some parts of the season, it is considered that a higher temperature is desirable, especially in the spring.

Milk Grading.—Milk grading generally is being carried out fairly satisfactorily and the procedure outlined to all cheese-factory managers has put milk grading on a more uniform basis. Though samples are being graded conscientiously and well at most factories, too many managers are too lenient toward border-line cases.

Curing-rooms.—In the course of factory visits special notice has been taken of the conditions of the curing-rooms and the way the cheese were being looked after on the shelves. In most cases the cheese were free from mould and the shelves were cleaner than was the case a few seasons ago. The practice at practically all factories is either to wash the shelves down with some bleaching-powder before putting the cheese on or to dust them over with sulphur or chloride of lime. In factories equipped with temperature- and humidity-control units very little trouble is experienced in keeping the cheese clean and free from mould.

Finish.—The finish and dressing of the cheese have been very creditable indeed and, though there have been one or two isolated cases of poorly dressed cheese, this important part of the work is receiving careful attention by the managers. There is still room for improvement in some instances, but the improvement during the past few years is very pleasing.

Labour in Cheese-factories.—The staffing of factories has again presented a problem in many districts and, though the position was perhaps a little easier in the past season than previously, it has been very acute in the Waikato and the larger factories in Taranaki and the Wairarapa. Many of the companies have now realized that they can no longer expect their staffs to live in make-shift accommodation and have either built or are building houses where married men can live in reasonable comfort.

In view of the fact that the labour position has been so acute at many of the larger factories during the flush months of the season, it is gratifying that, as far as can be judged, neither the quality nor the finish of the product has suffered to any noticeable extent.

Inspection of Dairy-produce in Britain

The necessity for the senior officer of the Dairy Division in London, Mr. F. H. Taylor, to maintain his personal knowledge of the industry in New Zealand, as well as to keep this Dominion in touch more closely with trends and developments overseas, has long been recognized. The intrusion of war necessitated the postponement of such a visit, and it was not until May, 1947, that arrangements for Mr. Taylor to visit this country could be completed. He came via Canada and the United States of America, and returned to London in February, 1948.

Apart from the information which Mr. Taylor was able to furnish after his brief visit to North America, it is felt that much was gained through his visit here. It was possible for him to address a number of meetings of dairy industry representatives, as well as to make many personal contacts. Mr. Taylor's visit would do much, in addition to imparting information about the outturn and marketing of dairy-produce in Britain, to further the appreciation by those directly concerned of the necessity for maintaining and, if possible, improving the standard of quality as well as the suitability of New Zealand's dairy-produce.

During the year under review the New Zealand Government further developed its post-war publicity for butter, cheese, and meat. The publicity emphasized the high quality of the Dominion's dairy and meat products, and trade reaction, which indicates the trend of public opinion, has been most favourable.

During Mr. Taylor's absence, routine work in Britain was carried on by Mr. G. V. Were and Mr. M. H. Wallace. Following are extracts from their reports on work done during the year under review.

Mr. Were reports in part as follows :—

Creamery Butter.—The general standard of quality of our butter, judged by examination of many brands from all over New Zealand, is sound from a present-day commercial viewpoint, with a seller's market. Its uniform quality is appreciated by merchants, and many reliable and experienced people in the provision trade do not hesitate to quote it as the best butter imported into Britain to-day.

While it is gratifying to hear favourable comment on our produce, it is necessary to keep a constant check on condition and quality of our goods. I am of the opinion that the flavour of much of our butter would be made more attractive by the exercise of greater care when neutralizing cream. Some of our butter, though commercially fairly sound, may be described as insipid, flat, neutral, and occasionally alkaline in flavour. The best definition of such butter which comes to my mind is "overprocessed," thereby removing much of the desirable character we expect to find in top grade.

There is no valid reason for our butter to contain less than 1·5 per cent. of salt, but care must be taken to avoid harsh flavours because of its excessive use. It is preferable to have too little rather than too much salt in butter. I am informed that 40 per cent. of our butter is handled by patting-factories and is distributed to retailers in the form of ½ lb. pats. Some of these patting plants show a useful overrun by adding salt to suit the requirements of different districts. Public taste for salt content of butter is by no means uniform in Britain, and I consider this to be a sound reason for not patting butter in New Zealand for this market. In my opinion, the patting of all butter for United Kingdom trade should be carried out in Britain so that the taste for salt in different districts may be catered for.

Whey Butter.—There is a much wider range of quality in this commodity than should exist. Before the war, when whey butter was used exclusively for manufacturing purposes, its quality was of less importance than at present. Recently, when the stock of butter was low, whey butter in its original form was issued to the public for table use. The Ministry was obliged to adopt this measure to honour the ration. Normally whey butter is used in a blend, the ratio being five creamery to one whey, and sold as national butter. The quality of such blended butter depends largely on the quality of whey butter used in the mix.

Therefore it should be recognized how necessary it is to raise the general standard of quality of whey butter.

Cheese.—Under present conditions of bulk stowage in warehouses, where crates are often piled ceiling high, it is not possible to examine and report on as many individual brands as we were accustomed to do when crates were stowed to brand, grade, colour, &c. Many more cheese are examined than our reports indicate, but it is considered inadvisable to report on single cheese unless some outstanding feature is associated with it. Viewing the position from the Ministry's angle, I see no advantage in stowing to marks while the need for rationing continues. The extra expense of stowing to brands would be considerable and the return for such extra expenditure nil.

The average quality of New Zealand cheese has been fairly well maintained. What little flavour our cheese possess is fairly sound, but it may almost be described as a negative quality, chiefly because of immaturity. Bitter flavours have been less prevalent this season than last, but there is a greater tendency to slittiness; this blemish is not serious, but is sufficiently noticeable to merit comment.

At present and for some time past cheese has been distributed for consumption almost immediately on arrival here, and the result has been that New Zealand cheese has not reached its best condition for eating.

Cheshire-type Cheese.—A goodly proportion of special cheese on arrival here resembled Cheddars more closely than Cheshires, but this does not mean that the quality is poor and the cheese unsaleable. On the contrary, though the quality of some has been disappointing, the cheese have had a ready sale and have mostly been the subject of favourable comment from the trade.

With few exceptions, flavours have been reasonably sound, with that comparatively sharp lactic taste which appeals to the palate of so many people in Yorkshire, Lancashire, Cheshire, and north Wales. Bodies of many have been inclined to rub smooth and Cheddar-like, and, in my judgment, this is the chief fault. Texture shows considerable improvement on some of the early trials, and in this respect many bear a close resemblance to home-produced Cheshires.

It is desirable that bigger shipments of this type of cheese should arrive here early in the season and fade out as the season advances. From the end of September to early March home-produced Cheshires are scarce, and this is the period when specials from New Zealand would be most acceptable. Home-produced Cheshires account for from 20 per cent. to 75 per cent. of the cheese distribution in the Cheshire-cheese area from March to September. Large consignments of New Zealand specials arriving here during the English manufacturing season may be regarded with disfavour and upset the balance of supply.

Distribution.—The Ministry of Food releases supplies in accordance with registration permits to the Butter and Cheese Association, Ltd. (B.A.C.A.L.). This organization passes the goods over to number one suppliers, who, in turn, distribute to the wholesale trade and thence to the retailer.

With dairy-produce in short supply, trade and consumer opinion on quality is difficult to assess. I have not heard of any complaint about the general quality of our butter and cheese, but that does not mean that our products have reached the peak of perfection, which should always be our aim.

At present an effort is being made, through the Shipping Inspector of the Marketing Department and the Ministry of Food, to tidy up some of the slack practices which have developed during recent years in the handling and transport of our produce between ship and final destination.

Following are extracts from Mr. Wallace's annual report :—

Butter and Cheese Inspection.—We have endeavoured to see portion of every ship's consignment of New Zealand dairy-produce arriving here. Thus we have forwarded reports dealing with the cargoes of seventy refrigerated ships (including twelve for a second voyage). To accelerate information about quality, for some time we have been air-mailing report sheets dealing with each brand of butter or cheese inspected. This means a saving of time of approximately two months. Inspections were made at the usual ports of discharge—Avonmouth, Cardiff, Glasgow, Liverpool, and London. We also travelled to various other centres for the same purpose, including Gloucester, Hull, Manchester, and Warwick.

Quality of Creamery Butter.—A point worth mention is the uniformity of our product, especially in flavour and make. So marked is this characteristic that on ironing diverse brands it is difficult to discriminate. A trifle more acid flavour in our butter would perhaps be an advantage, though the impression is that greater care has been exercised in the addition of soda to the cream. There were few cases of pronounced soda flavour observed in the butter.

No complaints have been received about the quality, and I believe it has shown improvement. I would emphasize the words of a Bristol merchant : " At all costs keep your quality up. Better let us go without than send a low-grade article."

Fibre Cartons.—The greater proportion of our butter is now arriving in these containers, and under normal transit conditions they are satisfactory. The blending or matching of colour of paper tape with that of the cartons and the proper sealing of the tape would improve the appearance and stability of the boxes. During the year some seventy-one sample cartons and portions of fibre-board, covering all deliveries to New Zealand, were received at this office for testing at the research laboratory at Princes Risborough. It is pleasing to report that the large majority of the samples submitted complied with our present standard of wet bursting-strength. This factor is considered to be of great importance in the carriage of butter at our normal low temperatures, because condensation is often experienced after the discharge of the butter from the overseas vessel.

Laboratory test sheets show that progressive improvement is being effected in the manufacture of fibre-board in strength and moisture resistance. In the case of Swedish fibre boxes a system has been adopted for code marking each shipment to New Zealand. This provides a means for subsequent checking if necessary. It is thought the idea could be extended with advantage to embrace deliveries from all manufacturers.

Cheshire-type Cheese.—There is a diversity of opinion about this make of cheese. Many traders and other interested people take the best English-type Cheshire as their standard and tend to judge the New Zealand product on the basis of its relationship to this standard and not on that of its peculiar merits. It is a matter of speculation whether they ever appear identical, unless both makes are stored for a comparable period and under similar conditions. But with English Cheshire—indeed, all types of cheese—in short supply, the time is ripe to test the market fully.

The London officers devote considerable time to the inspection of dairy-produce from all countries on behalf of the United Kingdom Ministry of Food, apart from the assistance given to the British Ministry. This work provides very useful knowledge for the New Zealand officers on all types and varieties of dairy-produce. The scope of the duties of the Division's London officers also includes a general liaison with the British Standards Institute, British Society of Dairy Technology, International Dairy Federation, and overseas developments in connection with all phases of dairy manufactures and distribution of dairy-produce.

Market Milk

Of the thirty-nine milk-treating houses in the Dominion, thirty-seven were granted registration under the regulations during the year, two being refused registration. The standard of acceptance for registration was purposely low, but neither of these two depots was satisfactory by this low standard, and as their term of continuing working was known to be limited it was decided to withhold registration for the present.

Organization.—The pattern of general operation has crystallized during the past year and, in general, has followed a system whereby the local Dairy Instructors paid routine visits to milk-treating houses checking routine working and such items as milk

quality. The Market Milk Instructor paid visits about every three to four months, and when there gave the plant, operations, and quality control close examination, following this as necessary with practical instruction.

Milk-treating Houses.—Instructional work by the officers of the Division has resulted in a definite improvement in the operation of various depots during the year. Efforts generally have been directed toward improving methods of plant operation and sterilization, and this limitation has been enforced by the fact that many depots are very poorly equipped and in several cases need closing down and rebuilding and re-equipping.

Efforts have also been hampered by the almost total lack of laboratories in the milk-treating houses—in the thirty-nine depots in the Dominion there are only four properly equipped and properly staffed laboratories. Despite this handicap, regular methylene-blue testing has been adopted in several of the depots. Where testing was already being carried out, check testing has been included in the work done by the Market Milk Instructor.

Grading.—Milk produced for town milk consumption is not subject to any system of compulsory grading and, apart from the unsatisfactory chemical quality of quite a lot of milk in the Canterbury and Otago districts, the general hygienic quality of much of the town milk in both Islands reflects the lack of a quality incentive. After instruction and encouragement to several of the milk-treating-house managers, testing of the incoming raw-milk supplies was carried out regularly and carefully. The results enabled the managers to assist the Live-stock Division Inspectors in improving the supply from many farms, while also giving the managers " case histories " of some of the regularly unsatisfactory suppliers.

Technical.—The year brought a general decision to change from cardboard disk bottle-capping to aluminium capping, and practically all new filling-machines on order for this country are being equipped to handle this new type of cap. Assistance has been freely given to the trade in organizing for the change-over.

The tendency to change from the " holder " method of pasteurization to the " high-temperature short-time " method of pasteurization is noticeable, and in view of the lead given by other countries the trend is probably justified. The " holder " method continues in favour where small depots are concerned because of the economy in first cost of batch pasteurizers.

Analytical Tests

pH Testing.—During the year, 5,095 tests were made, compared with 4,841 the previous year, an increase of 254. The testing was done at eight grading-stores and the number of tests for each was: Auckland, 2,525; Wellington, 1,110; New Plymouth, 906; Wanganui, 214; Lyttelton, 188; Gisborne, 84; Napier, 50; Bluff, 18. 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, 2,505; Gisborne, 298; Lyttelton, 387; New Plymouth, 906; Wellington, 1,191; Wanganui, 182; and Napier, 37; making a total of 5,506, compared with 4,659 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 120,558 churnings of butter were tested for moisture, and of these only 0·25 per cent. was found to exceed the legal limit of 16 per cent. Churnings tested during the previous year totalled 113,648, of which 0·28 per cent. was found to be over-moisture. The average moisture content of New Zealand butter graded for export during the past season is estimated to have been 15·710 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 120,115, of which only 0·05 per cent. failed to comply with the regulations. In the previous year 113,365 samples were tested, 0·08 per cent. being found to infringe the regulations.

Dairy Laboratory, Wallaceville

During the past year every effort has been made to carry on the laboratory work so as to provide assistance to the instructional and grading services of the Dairy Division. In view of staff changes it has been found more profitable to restrict the variety of work being done and concentrate on doing larger numbers of certain types of samples. The total number of samples dealt with was 3,740, of which 308 were chemical and 3,432 were bacteriological, the latter figure showing an appreciable increase over that for the previous year. The corresponding figures for the previous year were: total, 3,023—chemical, 306; and bacteriological, 2,717.

Chemical.—The majority of chemical samples were butter and cream to be examined for copper and iron content. Special attention has been given to whey cream and butter, in which metallic contamination is often excessive. The results obtained provide valuable information for Instructors to make use of in dairy factories.

A small number of water samples have been chemically examined and advice given about treatment where that is desirable. Interest in farm water-supplies appears to be increasing, and there is undoubtedly scope for more advisory work of this nature to assist Farm Dairy Instructors and bring them in contact with the Laboratory.

Bacteriological.—As in previous years, the principal bacteriological work has been the examination of butter samples, which are sent regularly from the dairy-produce grading-stores. Small numbers of starters, water, and cream samples have also been tested. The butter results show that some factories regularly clean their equipment well enough to achieve low bacterial counts, but the number which do so is rather small. In many factories the standard of sanitation as revealed by the bacterial counts leaves room for improvement, especially in the case of quite a number of factories which often make butter with very high counts.

Bacteriological analyses have been made on a small number of dairy factory water-supplies. In addition to the usual analyses, careful examination has been made for the presence of members of the *Pseudomonas* group of bacteria, some of which are able to cause serious defects in butter, especially *Pseudomonas putrefaciens*, which causes surface taint or "rabbito" defect. Though this particular organism has not been found in any of the waters examined, several samples have contained closely related types which usually grow slowly at low temperatures and are likely to produce undesirable flavours.

New Buttermaking Processes

In the previous financial year orders were placed by the Government for a Senn machine from Switzerland and an Alfa-Laval plant from Sweden with a view to their trial under New Zealand conditions. Both these new processes involve fundamental differences in the manufacture of butter compared with orthodox technique. Because of delays in manufacture, the Senn machine has not yet been delivered, but it is expected that it will arrive during next spring. The Alfa plant arrived during the early spring of 1947 and was installed in the Waharoa factory of the New Zealand Co-operative Dairy Co., Ltd. The trials of these plants are under the control of a Buttermaking Processes Committee, comprised of representatives from various sections of the dairy industry, and the operational control is exercised by technical and scientific officers from the Dairy Division and Dairy Research Institute working under a technical sub-committee. The whole aspect of the trials of these new processes is one of co-operation between the dairy industry and the Government, the Government having

bought the machines and provided for the major portion of the cost of their installation, and the industry, through the New Zealand Dairy Board, having allocated an initial sum of £10,000 toward the cost of the trials.

The Alfa plant began operations late in October, 1947, and since has been working almost continuously. As was expected, a number of difficulties have been encountered in applying the process to local conditions. New Zealand buttermaking practice ensures a very close degree of moisture control, an important factor in the economy of butter-manufacture. The Alfa plant did not enable a fine control, but modifications of the technique of operation have made more satisfactory results possible. A satisfactory method of packing the butter has not yet been found, and this has delayed to some extent the preparation of export shipments of the butter.

Because of the fundamental differences in butter-production, Alfa butter is different in body character from the standard New Zealand product. The texture is very smooth, which may be an advantage, but the body condition is such that the butter has a tendency to become oily at summer temperatures. Whether this characteristic is an advantage in a cold climate when standard New Zealand butter lacks spreadability to some extent has yet to be determined. A shipment for export to Britain is now being assembled, which will make possible an assessment under existing trading conditions of the factors novel to Alfa butter. Quality is continually being assessed locally and also through storage trials. As yet the economic factor has not been measured, but in the meantime, apart from the question of operation of the plant under New Zealand conditions, it is important to obtain a clear picture of Alfa butter compared with standard New Zealand butter in order to determine whether there are advantages in this butter which would justify attempts at modification and adaptation of this process of butter-manufacture to New Zealand factory practice.

An outstanding fact emerging from this season's experience is that the Alfa concentrator in its present form will not deal with high-acid home-separated cream, quick sludging of the bowl having resulted during the early autumn, when a portion of the intake of cream was in this condition. The plant has been proved to deal quite well with factory-separated cream and daily collected farm separator cream during the spring and early summer when acidities are low. The trial of the Alfa process is proving of great interest, especially from the technical aspect, but from results up to the present it would not appear that, for the immediate future at least, there will be sensational developments in existing buttermaking technique.

The Senn plant will be installed at the Tirau Factory of the New Zealand Co-operative Dairy Company, Ltd., and will be operated concurrently with the Alfa plant at Waharoa.

Check on Yields and Overruns

All butter and cheese passing through grading ports is analysed for fat content in addition to other constituents, and this analysis forms the basis of the assessment of butterfat received at dairy factories as compared with the amount credited to suppliers. Though there are apparent short credits at some factories, the position as a whole is not altogether unsatisfactory. There is at present some trend away from short credits, and the question is continually receiving the attention of Dairy Instructors, who are guided by the monthly returns and are consequently in a position to take up the subject with the dairy companies concerned. The whole question is somewhat involved, particularly with regard to sampling of milk for butterfat testing. During the year several detailed milk-sampling investigations have been carried out. The results of these investigations are encouraging and justify further work on the problem. The dairy companies concerned have freely co-operated in this work, and in general the necessity for correct crediting of butterfat is recognized by dairy companies and their officers.

Dairy Supply Control Order

This regulation, which has as its purpose emphasis on the supply of butter in relation to cheese for shipment to Britain, restricts the normal freedom of suppliers to change from supplying cream for buttermaking to supplying milk for cheese-manufacture, and gives greater freedom than is provided in the Dairy-produce Regulations to change supply in the reverse direction. The Order originally came into force in 1940 with an objective of maximum cheese, and in 1942 was altered following the request from the United Kingdom Government to place emphasis on butter instead of cheese. During the year under review a number of applications for exemptions have been received from suppliers, and where the individual circumstances warranted the appeal authority has granted exemptions. The majority of applications have been successful, and there should be few, if any, suppliers who suffer hardship as a result of the Dairy Supply Control Order.

Dairy Industry Developments

The most important development in the dairy industry during the year was the establishment of the Dairy Products Marketing Commission. There had previously been close co-operation between the Dairy Division and the Marketing Department, both Export and Internal Divisions, and already a good measure of liaison has developed between the Commission and the Dairy Division.

Casein continues to be manufactured on the same scale as for the previous year, all the export surplus of both lactic and rennet types being manufactured for shipment to the United Kingdom Board of Trade.

The production of buttermilk powder is receiving increasing attention, with seven plants now in operation and a prospect of seven additional plants for the 1948–49 season.

Attention is also being given to the possibility of the manufacture of further quantities of roller-process whole-milk powder for shipment to the United Kingdom for infant-feeding.

The major constructional developments include a spray-process dried-milk factory by the East Tamaki Co-operative Dairy Co. which is not yet completed, and substantial reconstruction and modernizing of the large dried-milk plants of the New Zealand Co-operative Dairy Co., Ltd., particularly at Waitoa.

Dairy Products, Ltd., have completed a large sugar-of-milk factory at Kapuni, Taranaki. This unit is the second to be established in New Zealand and will process whey from a number of cheese-factories in the South Taranaki district.

Farm Dairy Instruction

In the course of their duties Farm Dairy Instructors made 113,914 visits of inspection, instruction, and advice to farm dairies during the year, representing an average of 1,497 visits an officer. They classified 25·4 per cent. of milking-sheds as good, 53·1 per cent. as fair, and 21·5 per cent. as bad. The classification percentages for milking-machines were 29·9, 48·5, and 21·6. These figures reveal the need for considerable improvement in the condition of both sheds and machines.

The number of new milking-sheds erected during the year was 1,109 and the number substantially reconstructed 990, compared with 1,083 and 901 in 1946–47.

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

Milking-machines

During the period under review 1,425 new and 995 used milking-machines, a total of 2,420, were installed. In the previous year the figures were 1,375, 878, and 2,253.

Check-testing of Milk and Cream Samples

During the year officers checked the factory testing at 688 visits, and during these visits checked 4,104 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.

Certificate-of-record and Government Official Herd-testing

The C.O.R. and O.H.T. systems have been continued under the same rules as a year ago. Entries under C.O.R. have been well maintained, while entries under O.H.T. have shown a further increase. During the year 642 breeders were on the lists, compared with 627 for the previous year. Cows on C.O.R. test number 1,419 and cows on O.H.T. 9,649, compared with 1,484 and 7,900 for 1946, a decrease of 65 for C.O.R. and an increase of 1,749 for O.H.T. A noticeable feature is the increased number of cows per breeder, indicating a very desirable trend from the testing of a few selected individuals in the herd to the testing of the whole herd.

Dairy Factory Managers' Registration Board

New applications for registration dealt with by the Board for the year totalled 41, certificates being granted in 29 cases. At present 680 holders of certificates are on the register, 234 holding creamery managers' certificates, 375 cheese-factory managers' certificates, 6 first-class cheese and second-class butter certificates, 1 first-class butter and second-class cheese certificates, and 64 first-class certificates for both butter and cheese.

Redundant Cheese Plant

Cheese plant which became redundant as a result of the change back to butter in 1942 had a total list value of £64,000 at that time. Items which now remain unsold naturally have a greatly reduced market value. Endeavours have been made by officers of the Dairy Division in conjunction with representatives of the National Dairy Association to clear much equipment, and as a result little now remains in Taranaki and Manawatu, none in the South Island, and all that from Waikato factories has been congregated at the Karapiro Depot. A concentrated effort to dispose of this plant is now being made.

RURAL DEVELOPMENT DIVISION

REPORT OF P. W. SMALLFIELD, DIRECTOR

During the year the organization and efficiency of the Division have been improved, and it is now sufficiently staffed to carry out the main duties for which it was formed. Appointments were made during the year to the positions of Land Utilization Officer, Engineer, and Rural Sociologist, and the only major vacancy still existing is that of Rural Economist.

In its work the Division has received assistance from the Fields, Horticulture, and Live-stock Divisions, and part of the field-work for the land-utilization and cost-of-production investigations carried out during the year was done by field officers of other Divisions. While the Division's own field-work was carried out mainly in the Auckland and Canterbury districts, it was extended toward the end of the year to the Wellington and Otago districts.

Food and Agriculture Organization

The Division has continued to supply statistical, economic, and technical information to the Food and Agriculture Organization of the United Nations. The periodic annual report, the preparation of which is an obligation of member countries, reviewed primary production for the 1946–47 season and the programme for the 1947–48 season, including not only agricultural and pastoral but also forestry and fishery production. The report also covered nutritional standards, international trade, and commodity programmes. The information contained in the periodic reports of member countries formed the basis of most of the working papers at the 1947 annual Conference of FAO, which was held at Geneva.

At the 1947 Conference fairly substantial changes were made to the constitution of FAO. The Executive Committee was replaced by a Council composed of representatives from eighteen member countries to facilitate the aims of the organization in fostering the orderly production and distribution of world supplies of food and raw materials. The Council, which meets at regular intervals, has absorbed the International Emergency Food Council, which now becomes a committee of FAO and will continue to operate as long as the present world food crisis lasts.

It is expected that the Council of FAO will achieve many of the aims of the Organization through the development of inter-governmental commodity agreements providing for a limited degree of price stabilization and the creation of buffer stocks. Worthy of note in this respect has been the recent attempt to establish an international wheat agreement.

Land-utilization

A statistical review of the sheep industry of New Zealand was completed during the year and copies issued to Government Departments, farmers' organizations, and agricultural colleges. A similar review of the dairy industry was begun, as well as land-utilization studies of selected counties; field-work for the survey of Hutt and Makara Counties was completed.

These surveys have presented district changes in live-stock numbers and traced the causes leading to increases or decreases. Though there has been an over-all increase in pasture carrying-capacity during the past two decades, it has not been uniform over the Dominion and has been restricted to areas where pasture top-dressing has been a regular practice. Of the 43,000,000 acres of occupied land in New Zealand, only on about 7,000,000 acres, comprising the flat and undulating land, is the fertility level being raised,

while on the 12,000,000 acres of tussock grassland and 10,000,000 acres of surface-sown land fertility is not improving. Over large areas of hill-country pasture lands the circumstances leading to a general decline in fertility are beyond the immediate control of many of the occupiers. On the surface-sown hill country the more widespread use of fertilizers, fencing, and cattle is necessary to maintain and improve soil fertility and carrying-capacity. On the tussock grasslands, fencing, spelling, and the destruction of rabbits, though immediately necessary, must be accompanied by research aimed at finding methods for the creation of a pasture sward more suitable than the native tussock for continuous pastoral usage. These works will be costly in labour and materials, but the science and practice of grass farming evolved on the plains must be carried to the hills, even at a great apparent cost, if a permanently productive farming industry is to be a future reality.

The surveys which were carried out in the 1945–46 and 1946–47 seasons to collect data on wheat-production practices and yields were continued in 1947–48 and extended to the Ashburton district. The data for the three seasons are now being examined, and are expected to provide information on the influence of prior crop on yield and consequently the yields to be expected on each main wheat soil, depending on place in rotation.

Farm Management and Economics

To provide a background for future rural development studies, the Farm Management and Economics Section has prepared and published in the *New Zealand Journal of Agriculture* a short history of farming progress between 1840 and 1945. Developments in pasture-management which occurred in the 1920–45 period indicate the trends which should be followed to provide increased primary production in the coming years, and the aim should be to reach an annual usage of 1,000,000 tons each of phosphatic fertilizers and lime.

The main field-work of the Farm Management and Economics Section during the year has been in connection with cost-of-production studies of agricultural and horticultural crops. Studies were completed on potatoes, apples, and pears, and work begun on canning tomatoes and onions. In addition, some local cost-of-production surveys were done for town milk-supply and data collected on tractor usage and seasonal distribution of cultivation work on arable farms.

The Section has prepared a large number of departmental reports on the Dominion's primary industries and overseas trade and has carried out the preparatory work for the Royal Commission on the Sheep Industry. The assistant Rural Economist is acting as Economist Secretary to the Commission.

Farm Engineering

The appointment of an Engineer during the year allowed the start of the organization of the Farm Engineering Section, which, with the increase in farm mechanization, should prove of great assistance to farmers. Four additional Farm Machinery Officers are being appointed, one for each of the Department's four administrative districts, and these officers, working through the local Instructors in Agriculture, will provide farmers with information on machinery and engineering problems.

The Farm Forestry Officer of the Engineering Section has contributed a number of articles to the *New Zealand Journal of Agriculture* on farm shelter and plantations, and is now making a regional study of the Dominion so that further articles may deal with particular district requirements and the problems of hill-country tree-planting to control erosion.

Statistical Section

The Statistical Section has handled a greatly increased volume of work during the year. In addition to the routine work of compiling statistics and tabulating data collected by the field staff, the Section has furnished information on a wide range of subjects in response to requests from other Divisions of the Department, other Government Departments, foreign Legations, and private individuals both in the Dominion and overseas.

The tabulation and analysing of data collected in the potato and apple and pear cost surveys was a major undertaking, and the results have been transmitted to the Stabilization Commission for consideration in determining prices for these products. Some of the information collected in the potato survey has been summarized for publication in the *New Zealand Journal of Agriculture*. The preparation of tables, maps, and graphs for the "Statistical Review of the Sheep Industry" was also a large undertaking.

The regular compilation of butter, cheese, and butterfat production statistics has been carried on as usual, but to these has been added those for dried and condensed milk, &c. The compilation of stock slaughterings has also been continued.

Rural Sociology

The Rural Sociology Section was strengthened by the appointment of a Rural Sociologist and three graduates in home science.

The survey of the rural areas of Marlborough and Nelson which was completed in 1946–47 was published during the year in the *New Zealand Journal of Agriculture*. The survey studied the relation between the development of primary and other industry, the origin, progress, and location of towns, and the services they provide for the interdependent countryside.

Two additional research projects have been undertaken: one relates to housing design in Vincent County, and the other to water-supplies for farm homes in South Canterbury.

The formation of Country Girls' Clubs, sponsored by the Federation of Young Farmers' Clubs, has been helped by the Section. Seven clubs have been formed in the South Island and two in the North.

The work of the district officers has covered the preparation of articles for the women's section of the *New Zealand Journal of Agriculture*, lectures to country women's organizations, and field-day and farm-school gatherings. Thirty-four articles were published in the *Journal*, covering housing, room design, cooking, needlework, furniture, and minor topics.

The demand for lectures is expected to increase, and it is intended that all future farm schools and field-days arranged for farmers by the Fields Division will provide lecture and discussion periods for country women. During the coming winter departmental show exhibits will incorporate a section for country women.

The organization of the Division and the Rural Sociology Section is now sufficiently advanced for long term work in rural social research to be planned to cover rural and urban population trends and migration, standards of living, and culture. The initial work on population trends is now being mapped out, and a socio-metric scale is being devised to enable the standard of living of a farm family to be appraised with a minimum of effort. Development of this scale and the testing of its validity and reliability will be a long process, but when completed will provide a valuable tool for sociological research.

LIVE-STOCK DIVISION

REPORT OF W. C. BARRY, DIRECTOR

Climatic Conditions

In most districts the autumn and winter seasons were mild and live-stock fared fairly well. In Auckland Province dairy herds came through the winter in good condition, resulting in record dairy production in the North Auckland district in the early spring.

An excellent lambing percentage was experienced by the sheep-farmers, and though a good season was expected the average weight of the lambs killed will probably be found to be lower than that of the previous year. Many works began killing operations a few weeks earlier this year with a view to avoiding congestion later. Though the very dry season in some areas retarded the fattening of lambs, it also reduced losses from parasitic disease.

The past summer will be recorded as one of the driest and warmest seasons for many years, and drought caused stockowners concern in many districts. The feed position on many farms became critical and supplementary feeding had to be provided. In several districts herds dried off early and some town-supply authorities found difficulty in maintaining a supply of milk for the population. The dry season also affected root crops adversely, and fattening crops such as rape were a failure. The prospect for the coming winter is not good. There will be no surplus of hay, and pastures are bare at present.

Health of Live-stock

HORSES

The health of horses has remained good during the year, no serious disease having been recorded.

There is little demand for horses, apart from hacks and general dairy-farm types, and little interest has been shown in the breeding of draught horses. At agricultural shows the entries in the hack and pony classes have been maintained, and pony clubs are being formed in many parts of the country.

CATTLE

Diseases scheduled under the Stock Act

Tuberculosis.—Cattle condemned under the Stock Act for tuberculosis during the year numbered 6,120, 5,164 being condemned on clinical symptoms and 956 as reactors to the tuberculin test. In each case compensation was paid in accordance with the provisions of the Stock Act. The tuberculin test was applied to 17,026 cattle, of which 956 reacted, giving a percentage of 5·6.

The total number of cattle, exclusive of calves, examined at abattoirs and meat-export slaughterhouses was 687,382, an increase of 84,627 on last year's figures. Of these, 42,205, or 6·1 per cent., were found to be affected with tuberculosis in varying degree, a large percentage being only slightly affected. This indicates a decrease of 0·9 per cent. infection among cattle slaughtered in these premises.

The testing of dairy herds providing milk for town supply is now required by law, but this work has been practically in abeyance during the year because of discussions about the basis of compensation to be paid to the dairy-farmers for reactor animals.

A total of 3,466 dairy cattle were subjected to the test in herds registered for town supply and 127 reactors were found. In addition, 10,280 cattle were tested at the owner's request and 2,735 head of stock were tested at Government farms under the control of several Departments.

Actinomycosis (and Actinobacillosis).—During the year 637 animals were condemned for this disease, while a large number of animals were successfully treated with iodides. The injection treatment with sodium iodide is most suitable when run cattle are found to be affected with this disease, regular dosing being impracticable.

Malignant Growth.—The number of stock condemned was 218, a decrease of 12 on the figure recorded the previous year. Compensation was paid in accordance with the Stock Act.

Johne's Disease.—A total of 207 animals were condemned for this disease under the Stock Act, the majority being in the Taranaki district. As has been found in other countries, the control of this disease is very difficult. Inquiries have been made with a view to trying out vaccination of young calves on farms where the incidence would warrant such a procedure.

Anthrax.—No cases of this disease occurred during the year. Because of protective vaccination, the stock on previously infected farms have remained healthy.

Blackleg.—The numbers of calves vaccinated against this disease in the affected areas were: Taranaki, 24,000, and Auckland, 36,646; making a total of 60,646. Compared with the previous year, the number of calves vaccinated increased by 4,511 in Taranaki and by 5,615 in Auckland. There were 280 outbreaks in the Auckland district, compared with 334 the previous year. This involved the vaccination of 6,491 calves on 280 farms. In addition, 30,155 calves were vaccinated on 954 farms as a preventive measure.

Non-scheduled Diseases

Mastitis.—Many aspects of the mastitis problem are being investigated by the Animal Research Division. Field officers of the Live-stock Division are co-operating with the research officers on the work being carried out with penicillin. The prospects of good results being obtained with penicillin in the treatment of affected animals should prove satisfactory to the dairy-farmer, but there should be no relaxation of effort in regard to dairy hygiene in the shed in an attempt to reduce the incidence of the disease in dairy herds by preventive methods.

Contagious Abortion.—The vaccination of dairy heifer calves against this disease is an accepted practice, and the programme of vaccination work in the intensive dairying districts is now heavy. In the Wellington district field officers vaccinated about 20,000 calves last year. The work was also very heavy in many parts of the Auckland district, the assistance given by club veterinarians being very valuable. The irregular supply of vaccine from Australia has caused many delays and has upset the arrangement of vaccination itineraries by many officers. Vaccination against the disease is also being carried out in many parts of the South Island.

Temporary Sterility.—Each season field officers are called on to advise farmers about breeding troubles in the dairy herds. Delayed conception in cows, with return of heat periods, is the most common form of complaint. The intensive seasonal nature of dairy-farm production makes such a problem of vital importance to the subsequent season. Otherwise it is felt that the majority of affected animals recover without any special treatment, the enforced delay in breeding being all that is required. Each instance requires to be investigated so that, if male infertility is the cause, it can be rectified as soon as possible.

Grass-staggers.—The incidence of this disease in dairy herds was low last spring. A better standard of dairy-cow husbandry, with more attention to the regular and balanced feeding of cows at and after calving, may have assisted very considerably. An adequate reserve of winter fodder ensures a standby, so that the farmer may meet spring conditions as they arise, whether these conditions be flush pasture growth or the reverse.

Milk-fever.—Milk-fever disease of dairy cows is now commonly recognized and responds readily to treatment. The incidence was low last spring, adequate fodder-supplies being a factor in balancing the spring-feed conditions. For similar reasons, the disease known as acetonæmia in dairy cows was also less evident.

Mortality caused by Poisoning.—Throughout the year numerous instances of stock dying after the ingestion of arsenic have been brought under notice. In many cases the field diagnosis has been confirmed at the laboratory. The careless handling of arsenical preparations on farms is still in evidence. Plant poisoning of stock has not been as prevalent as in former years.

Parasitic Disease of Young Cattle.—Partly because of a favourable season and partly because of the more intensive use of the drug phenothiazine, losses of young stock from worms have been well controlled. There is still need to improve the autumn and winter feeding of young dairy heifer calves if constitution in dairy herds is to be maintained.

SHEEP

A good winter was experienced in 1947, ewe flocks wintering particularly well. An excellent lambing percentage was common in all districts, lambing taking place in most favourable weather. During the early spring both ewes and lambs did well, but dry conditions later persisted to the extent that the lambs could not be finished off to the same degree as in other years. That applied in several districts, particularly on the east coast of the North Island and in many parts of Canterbury. The dry weather also retarded the growth of root crops, rape, and other catch crops normally used by farmers who specialize in the fattening of weaned lambs. Many lambs in store condition were sent to the saleyards because of scarcity of pasture and other feed. Though lamb numbers were high, the average weight of lambs sent forward for slaughter will probably be below that recorded last year.

The incidence of disease in young lambs was probably lower than that of other years, no serious mortalities being recorded at marking or tailing time. Losses caused by pulpy-kidney disease have been normal in all districts.

Shearing was carried out in most districts under ideal conditions, the fleece being even and well grown. Dipping was interfered with somewhat by the water-supply problem, which caused delay in some instances.

Following the use of some of the new dipping fluids, a type of lameness affecting a percentage of the dipped animals has been recorded. The nature of the lameness has been investigated and elucidated, and steps are being taken to effect changes so as to prevent a recurrence of similar trouble.

Control of parasites has been good, dipping solutions being highly satisfactory in this respect. Though some infested lines of sheep have been found at sales, inquiry showed that the animals had not been dipped.

Lymphadenitis.—This disease of sheep is of considerable importance in meat inspection, and its incidence in sheep from certain South Island districts requires careful observation. However, the percentage of carcasses found affected at abattoirs and meat-export works in Canterbury has decreased further. Infection was found in 4·98 per cent. of mutton carcasses in Canterbury in 1946–47, whereas in 1947–48 the figure was reduced to 3·64 per cent.

Pregnancy Toxaemia.—This disease of the breeding-ewes is commonly referred to as sleepy sickness. The weather was mild and pasture reasonably good for ewe flocks last spring, so losses from this disease were low in all districts, particularly in Canterbury, Otago, and Southland. For similar reasons, the disease known as bearing trouble in ewes was also quite rare—in fact, a very good lambing season was experienced.

Parasitic Gastro-enteritis.—There was less evidence of serious worm trouble in hoggets last year. Where the feed-supply to young stock is maintained at an even and reasonable level throughout the critical autumn and winter months, the danger of losses from worm trouble is lessened markedly. These conditions prevailed last year, and though a few flocks showed some scouring it was well controlled by the use of phenothiazine. This worm medicine is becoming better known to all stockowners and is being more widely used, with very gratifying results.

Contagious Ecthyma.—This virus disease is now well controlled by the vaccination of lambs. The vaccine is preventive, owners being advised to vaccinate should the infection appear to be prevalent on particular farms.

Facial Eczema.—Though a warm, dry summer was experienced in many parts of the North Island and suitable preventive precautions were advised, farmers were rather fortunate that a general outbreak of this disease did not take place. Small numbers of outbreaks were recorded in the Waikato and other districts, and there was evidence of liver disease in lambs and sheep sent forward for slaughter from many districts. The danger period passed without serious loss, and though rain was needed badly earlier in the season, its later arrival will provide some growth for the coming winter.

Lameness after Dipping.—Reports from several districts have referred to a type of lameness in sheep after dipping. The lameness was evident a few days after dipping, sheep being distinctly lame on one or more legs. The lesions were confined mainly to the lower part of the limbs, about the fetlocks, and extending down to the hooves. The complaint has been the subject of a special investigation and it is expected that remedial measures will be taken to prevent any recurrence of similar trouble.

Modern dip preparations have proved to be very effective in the treatment of sheep for lice and ticks.

The inspection of sheep at sales is still carried out by field officers. Though some infested sheep have been seen, dipping requirements appear generally to have been complied with.

Blackleg in Sheep.—This disease of sheep appears to be increasing in several districts. Many owners now find it profitable to vaccinate entire flocks. Though the disease may be confirmed at the laboratory, the infection may be confined to an isolated animal or to very small numbers. On the other hand, where serious loss has been experienced it is advisable to vaccinate the entire flock to prevent a recurrence of such loss.

Cutaneous Myiasis (Sheep Blow-fly).—Though not as common as in the previous year, the sheep blow-fly caused trouble in parts of North Canterbury. The dry season assisted in lessening the extent of the trouble in other districts.

PIGS

The number of pigs slaughtered for the season 1947–48 at premises under inspection was 624,623, an increase of 44,985 over last year's figures.

Inspection of the carcasses at time of slaughter revealed that 82,775 carcasses were found to be affected in varying degree with tuberculosis, the percentage being 13·25. This is a decrease of 0·31 per cent. compared with last year's figures.

Diseases of Pigs

Tuberculosis.—This disease is one of the chief causes of condemnation of pig-meat on inspection. The pig is very susceptible to any trace of infection which may be present in the milk products commonly used in the fattening of pigs in the intensive dairying districts.

Suipestifer Infection.—In the numerous specimens forwarded by the field staff for laboratory examination, the reports show that infection with the suipestifer organism is a common finding. This infection is responsible for quite large mortalities on certain properties.

Other Diseases.—No cases of mange in pigs have been recorded during the year. Neither has kidney-worm infestation been seen, and it is hoped that this parasite will not become established on pig-farms.

A type of lameness in pigs, described as foot-rot, is being investigated in the field and at the laboratory. Because the disease retards fattening of pigs, it is of considerable economic importance.

Swine Husbandry

Pig-meat Production.—For the first time for six years, pig-production figures show some evidence of recovery. Though the increased weight of pig-meat produced in the year ended 30th September, 1947, from fewer pigs might be ascribed largely to the better dairying-conditions experienced in that year as compared with the previous one, the tendency for the figures to increase has been carried through the season and the slaughterings to 31st March, on both numbers and tonnage basis, are higher than for the preceding twelve months. The increase is more than 40,000 by numbers and 3,000 tons of meat, or 6·6 per cent. by numbers and 8·1 per cent. by weight. This increase is the first real sign of recovery in the pig industry since the uncertain days of 1941-42.

A summary of the position as at 30th September for the past six years is as follows:—

Year.	Breeding-sows (as at 31st. January).	Total Pigs slaughtered.	Pigs per Sow.	Slaughtered as—			Total Weight of Pig-meat (as Carcasses).
				Porkers, 40–120 lb.	Baconers, 121–200 lb.	Choppers, over 200 lb.	
1942	91,338	925,982	10·1	494,126	397,717	34,139	47,987
1943	81,882	772,744	9·4	321,049	418,943	32,752	44,320
1944	77,300	740,913	9·6	254,126	464,558	22,229	43,251
1945	77,200	681,280	8·8	170,852	489,220	21,208	42,378
1946	72,000	664,275	9·0	256,821	385,782	21,672	38,437
1947	67,938	645,728	9·5	198,631	423,368	23,729	39,491

Breeding-sow numbers had dropped to 67,938 at 31st January, 1947, the lowest figure since 1931. The figure at January, 1948, is not yet available, but it is hoped that it will show some recovery. That breeding-stock has fallen to too low an ebb is clearly shown by the increasing number of heavy pigs being slaughtered. In the year ended September, 1946, 36 per cent. of all baconers slaughtered were over 160 lb., and this figure increased to 39 per cent. during the ensuing twelve months.

These heavyweight pigs tend to be overfat, and for the good name of New Zealand baconers on both the local and United Kingdom markets it is essential to aim at the slaughter of an increased number of pigs at more moderate weights.

Grading.—Because of prevailing conditions in the trade it has not been possible to secure strict adherence to the baconer grading standards, and the methods in practice are somewhat lenient. Of the baconers slaughtered, 83 per cent. were graded P1, 13 per cent. P2, and 4 per cent. second quality. Porkers were graded 94 per cent. prime and 6 per cent. second quality.

Feed-supply.—It is not possible to import grain at an economic figure for pig-feeding, and supplies of meat-meal available after requirements of other stock are met are insufficient for the needs of the pig industry to supplement home-grown crops for winter feeding and the whey supply in cheese-producing districts. The shortage of feed has contributed in part to the decline of the pig industry in recent years, and the position will have to be more satisfactory before any considerable improvement can be expected.

Pedigree Sow Recording.—The number of sows nominated for recording shows a slight improvement on recent years, but is still regrettably low at 144 for the year ended 31st March, 1948.

Carcass-quality Evaluation Scheme.—By agreement with the National Pig Industry Council and district councils, an effort was made during the year to revive the work carried out under this scheme, which is aimed at discovering strains which are performing particularly well under ordinary farm conditions. All those concerned with the operation of the scheme were circularized at the beginning of the season. The response, unfortunately, has not been all that was expected. Of 245 pigs marked, 209 have been identified in the works and reported on.

National Advisory Service.—Good work continues to be done by the District Pig Councils in securing the improvement of conditions for pigs on farms. Supervisors' annual reports indicate that, despite shortage of materials, piggery improvements are progressing steadily and between £45,000 and £50,000 has been spent in this direction by farmers on the supervisors' advice during the past year.

However, critical analysis of the results accruing from the use of various types of housing has not been attempted, mainly because the National and District Pig Councils have felt that all energies should be devoted to improving conditions under which pigs are kept on as many farms as possible. The suggestion is now being put before all Councils that a modification of this policy, involving the carrying-out of some survey investigational work coupled with the advisory service, is desirable.

Crop-subsidy Scheme.—In company with other subsidies, this scheme was discontinued in favour of a direct price increase of ½d. per pound on all pig-meats. The amount paid in subsidy in the last year of operation of the scheme was £129,134, bringing the total paid for the three years of operation of the scheme to £340,464.

Pig-meat Prices.—Subsequent to the increase in lieu of crop subsidy, a further increase of ½d. per pound was granted as from 5th January, 1948, from which date the schedule price for prime porkers and baconers in the North Island has been 9½d. per pound.

Meat Inspection and Slaughter of Stock

At all abattoirs and meat-export slaughterhouses a satisfactory standard of meat inspection has been maintained throughout the year. Many extensions and improvements at several of the meat-works are being carried out. When completed, the buildings will facilitate the slaughter of increased numbers of stock under less congested and more hygienic conditions. Better accommodation was required at several centres for both animals and men, and so far as material is available an attempt is being made to overtake the building arrears accumulated during the war years.

At several works the labour problem is still difficult and the managements find trouble in maintaining a high standard of dressing of the carcasses.

The grading of carcasses intended for local consumption has been carried out with general satisfaction to the trade and the consumer.

The total numbers of stock slaughtered at registered premises (rural slaughterhouses included) were: sheep, 4,474,743; lambs, 12,745,282; cattle, 746,480; calves, 1,102,790; swine, 634,858.

The following table shows the numbers of stock slaughtered during the past two years at freezing-works only:—

Class of Stock.	Year ended 31st March, 1948.	Year ended 31st March, 1947.	Increase or Decrease.
Cattle	516,660	438,095	78,565 (increase).
Calves	1,065,037	999,526	65,511 „
Sheep	3,383,099	3,659,296	276,197 (decrease).
Lambs	12,595,950	11,620,861	975,089 (increase).
Swine	520,250	481,545	38,705 „

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

Stock.	1944–45.	1945–46.	1946–47.	1947–48.
Sheep	1,894,985	2,594,571	2,348,620	2,232,301
Of which ewes were ..	1,349,074	1,967,187	1,729,109	1,703,989
Lambs	7,119,633	8,735,367	8,246,064	9,243,204

The following table shows the number of stock slaughtered under direct inspection during the year ended 31st March, 1948, at abattoirs and meat-export slaughterhouses:—

Class of Stock.	Abattoirs.	Meat-export Slaughterhouses.	Total Slaughterings under Inspection.
Cattle	170,722	516,660	687,382
Calves	36,876	1,065,037	1,101,913
Sheep	854,218	3,383,099	4,237,317
Lambs	129,300	12,595,950	12,725,250
Swine	104,373	520,250	624,623

Slaughterings at rural slaughterhouses during the year were as follows: cattle, 59,098; calves, 877; sheep, 237,426; lambs, 20,032; swine, 10,235.

Of the animals shown in the table as slaughtered at meat-export slaughterhouses, the following have gone into consumption within the Dominion: cattle, 52,813; calves, 33,023; sheep, 350,546; lambs, 189,846; swine, 222,759.

Compensation paid for Stock and Meat condemned

Compensation amounting to £19,714 1s. 3d. was payable during the year for animals condemned in the field under the provisions of the Stock Act, and £19,455 6s. 6d. for carcasses or parts of carcasses condemned for disease on slaughter for human consumption at abattoirs, meat-export slaughterhouses, &c., under the provisions of the Meat Act.

Importation of Stock

The following stock were imported during the year: cattle, 16; sheep, 343; pigs, 26; horses, 64 (including movements of thoroughbreds between New Zealand and Australia). Of those animals, the following were placed in quarantine for the periods required: cattle, 16; pigs, 26; sheep, 64.

Exportation of Stock

During the year under review the following animals were exported: cattle, 145; sheep, 1,419; pigs, 92; horses, 263. The movement of thoroughbred horses to Australia accounted for 250 of the animals.

Dairy Inspection

The past season has been very trying for the town-milk producer. The hot, dry summer and scarcity of feed resulted in a reduced yield of milk from many herds, so that supply authorities had to go farther afield to acquire milk during the summer. During the very warm months producers found difficulty in cooling milk, and this type of weather was also a severe test of the keeping-quality of the milk.

The temperature of the water normally used for cooling milk rose markedly during the warm weather and the provision of refrigeration is not easy on many farms. Many producers have provided efficient cooling plants to cope with all conditions.

In general, the standard of town-milk production on the farm has been good, the premises and milking plants being maintained in a satisfactory condition. Where complaints have been investigated, it has been found that a number of factors have been involved, some of them difficult to rectify during the warm summer months. If the cooling or the system of collection was at fault, every endeavour was made to rectify it. The handling of a perishable product like milk during warm weather requires a co-ordination of effort at all stages with expeditious delivery to the consumer. Delay or breakdown at any one stage might have very serious results. The handling of stale milk during such a period is extremely risky.

Many improvements to existing premises have been carried out during the year and a number of new sheds have been erected. The hot-water supply to dairies has not always been satisfactory, as many depend on electric current for heating.

New cooling systems and refrigeration plants are on the market, and in large sheds some of these would prove most valuable in cooling milk and thus ensuring the keeping-quality of the product even during hot summer weather.

Poultry

Eggs have remained in short supply during the year, particularly in the main centres, and limited poultry-food supplies have not permitted any programme of increased production. Though it is impossible to quote accurate figures, the Department is not of the opinion that poultry flocks have been reduced substantially during the past year, with the possible exception of Canterbury flocks. Some commercial producers have broken up their flocks and sold their buildings, but new flocks have been established and others increased in size. On the other hand, there are indications that egg-production in general has been adversely affected by the food shortage, mainly as the result of the forced changes in rations fed because of irregularity with which food-supplies have come forward. Unfortunately, supplies of food, more particularly of wheat, have not warranted any programme for increased flocks and increased

production. There is little doubt about poultry-producers responding to a call for increased production once it is possible to provide the additional food required to increase present flocks and establish new ones.

Poultry-producers also experienced considerable difficulties during the incubation and brooding season as the result of power cuts. The majority of commercial producers depend on electric power for operating their incubators and brooders. Very few have stand-by plants, as the cost of such equipment represents heavy capital expenditure. Power Boards co-operated to the full in the majority of districts in an endeavour to assist poultry-producers as far as circumstances permitted.

Standard Mashes.—The standard-mash scheme, put into operation some eighteen months ago as a means of distributing equitably available supplies of meals suitable for poultry, has run more smoothly during the past year. Some 68,000 tons of mash were manufactured and distributed in 1947 and few poultry-producers were able to claim with justification that they were without mash at any time. The scheme has assisted materially during a most difficult period and the food-supply position has not improved sufficiently to warrant its discontinuance. It is still only too obvious that the poultry industry cannot return to normal and embark on a much-needed expansion plan until greater supplies of wheat, barley, and other valuable poultry-foods are available.

Improvement of Stock.—The New Zealand Poultry Flock Improvement Plan, started in 1945, is receiving continued support from poultry-producers. There are definite indications that poultry-producers who have supported the plan by having their breeding-flocks accredited are now able to see improvement in the quality of their stock. The comments of such producers are doing much to overcome any initial criticism and are assisting materially to establish the plan on a sound basis. The progress made to date is indicated by the fact that in 1945, 28 flocks were accredited; in 1946, 72 flocks; and in 1947, 101 flocks. The 1947 accredited flocks contained some 26,000 breeding-hens; those birds could account for 156,000 pullets from accredited breeders at the conservative estimate of six pullets to each breeding-hen during the normal breeding season. From the applications to date for accreditation in 1948 there is every indication that the figure of 101 flocks in 1947 will be passed by a substantial margin.

Poultry-diseases.—Though outbreaks of disease have been experienced in poultry flocks throughout the Dominion during the past year, there is no evidence to suggest that losses have been greater than in previous years. Despite severe difficulties with food-supplies and the quality of food available, there appears to be no reason to suspect that these difficulties have adversely affected the health of poultry flocks as a whole. Increased numbers of poultry-producers have availed themselves of the free service of blood-testing breeding-stock as a precaution against the incidence of pullorum disease in chicks. More than 140,000 birds were blood-tested in 1947. A full-time veterinary officer has been appointed to assist with disease control and to study disease problems of poultry. This will strengthen considerably the services now given by the Animal Research Station, Wallaceville, and the Poultry Instructors.

The Poultry Demonstration Plant, Upper Hutt.—The management programme of the plant has been dominated to a marked degree by the limited food available. It was not possible to expand the flock and so stock the housing available in the plant. The rearing of pullets was restricted to some 700 birds, whereas under normal conditions more than double this number will be required annually for replacements. No attempt was made to develop the table-bird section of the plant.

Progress was made in the preparation of housing intended for the establishment of breeders' laying trials, which are to be closely linked with the Poultry Flock Improvement Plan. The intention was to open these trials in March, 1948, but the outlook for supplies

of wheat for poultry was so uncertain at the end of 1947 that it was decided to postpone these trials for at least a year. This decision was made reluctantly, as the poultry industry has shown considerable interest in the establishment of laying trials.

A start has been made with testing several strains of White Leghorns and Black Orpingtons as a first step in the proposed programme of pedigree breeding and progeny testing. Some 300 pullets were trap-nested for forty-eight weeks, the highest individual production being 279 eggs in forty-eight weeks by a Black Orpington pullet.

A number of poultry-producers and other interested persons visited the plant during the year, and a field-day was held in February, when more than sixty poultry-producers from the Wellington district, Blenheim, and Nelson inspected the plant and attended demonstrations associated with poultry-disease control.

Wool

The Market for Wool.—When the final returns are available later in the year, it is certain that several records will have been broken during the 1947–48 wool season. It is too early to forecast the likely total wool-production, but there can be little doubt that the total value of wool sold at auction will be a record.

Experiments and Investigations.—Experiments on the use of D.D.T. as a sheep-dipping material have now been suspended because of the greater efficiency and cheapness of "Gammexane" for this purpose. Ample supplies of proprietary dips containing this material are now on the market. The Department has collaborated in the investigation of outbreaks of lameness in sheep after dipping with certain brands of "Gammexane" dips. It is certain that this weakness of the dip will soon be remedied by the makers, but there is no doubt that for efficiency in killing parasites and lasting power in the fleece "Gammexane" represents a great advance on any dipping-material previously used.

Work is still being done on the control of moths in wool-stores with "Gammexane" smoke generators. It has been found that, though their use will not entirely eliminate the moths, one or two applications during the breeding season will keep them down to a tolerable level.

Marking Preparations.—Manufacturers of wool-branding fluids, raddles, &c., are still submitting quite a number of new formulæ which they are seeking official approval to manufacture and sell. These substances are submitted to practical tests for scourability and during the past season only 26 of the 46 samples submitted were found to be satisfactory. Deleterious non-scourable wool-marking preparations are still causing trouble in the woollen-mills, and a time-lag will be inevitable before all stocks of wool containing the old non-approved brands have been used up. Wide publicity has been given to the fact that it is now an offence to use anything other than an approved wool-marking preparation, and farmers have been advised always to look for a label on the container showing that the material has been approved.

The Wool-clip.—The clip for 1947–48, in the main, has been less attractive than that of the previous year. That can be put down to the abnormally dry season in both Islands, extending from the autumn and into spring. The wool has reflected these conditions by being in most cases light in condition, dusty, and rather shorter in staple than usual.

South Island: The Canterbury clip seems to have suffered least of all from the dry season. Half-bred wool was well grown and light in condition with good colour, and the Merino wools were most attractive and commanded very good prices. Crossbreds were light in condition, but not quite as attractive as the finer wools. North Canterbury and Marlborough wools showed some burr, and west coast crossbreds were extremely light in condition, stained, and burry.

The Timaru sales have been very good. Merinos have opened up very attractively, though some of the wool was inclined to be dusty. Crossbreds were sound and free from seed, but dusty.

Dunedin had a fairly good season and the clip opened up well at most sales. The only noticeable feature about the Merino wool was that it was heavy in condition. Crossbreds, on the other hand, were light in condition and mainly a little tender.

Invercargill wools have been extremely poor this season because of a hard winter and dry spring, with the result that the wool was poorly grown, light in condition, cotty, mushy, and discoloured.

North Island: Wool brought in for the early sales at Auckland showed a distinct improvement on that of the previous year. The shorn hogget wool was well grown and quite attractive. The main clip was light in condition, but showed good style, no doubt because of unbroken good weather allowing earlier shearing. A pleasing factor was the undoubted effort by growers to prepare their clips for market in a better fashion than hitherto. At later sales the standard of wool deteriorated, however, and discoloration, cotts, and stained wools have been noticeable.

Napier wools have shown the effects of the very dry spring and summer, and after the December sale, which showed the wool to be well grown, bright, and reasonably sound, faults began to creep in, seed and burr being the rule rather than the exception, and dusty wool also becoming bad. Gisborne wools showed the same faults caused by similar weather.

The clip in Wanganui has not improved much on that of last year. The wool still has a lot of seed, and water stain, discoloration, and cotts were also present. There has been a marked improvement in the skirting and classing of Wanganui wools, but preparation of Taranaki wools is poor.

The Wellington clip, for the most part, has been well grown, of good colour, light in condition, but a little tender in the latter part of the season. Nelson and Blenheim wools sold at Wellington have been shabby and poor for the most part.

Season.	Number of Bales sold.	Net Weight.	Gross Value.	Average per Bale.	Average per Pound.
		lb.	£	£ s. d.	d.
1942–43	950,607	327,321,380	19,916,828	20 19 0	14·60
1943–44	930,694	316,152,540	19,424,253	20 17 5	14·74
1944–45	1,038,019	357,606,520	22,013,258	21 4 1	14·77
1945–46	1,022,124	349,365,289	21,552,153	21 1 9	14·80
1946–47	934,730	308,347,839	23,136,014	24 15 0	18·00

Rabbit Nuisance

The past year was marked by the passing of a comprehensive amendment to the Rabbit Nuisance Act, 1928. This amending legislation improves the financial position of Rabbit Boards and establishes a Rabbit Destruction Council. The functions of the Council cover a wide range of activities, and in the future it will play an important part in fostering the constitution of additional rabbit districts and generally devising ways of combating the rabbit menace. The amending Act also provides for the imposition of a levy on rabbit-skins produced and sold in New Zealand. Levy money so collected will be applied to defraying the expenses of the Council and to payment of grants to Boards. When this levy becomes operative, that previously applied by the Rabbit-skins Committee, Dunedin, will cease.

The seriousness of the rabbit pest throughout the Dominion shows little change. In districts under Rabbit Board administration the pest is controlled and in many cases reduced to a minimum. Boards in Hawke's Bay are making great efforts in the fight against the menace, which is particularly bad in that area. A shortage of skilled rabbiters and housing is limiting the efforts of a number of Boards.

In a number of districts outside Board control the pest has increased. No permanent improvement can be expected in areas where extermination work is spasmodic and where the commercial value of the rabbit tends to discourage killing operations during the spring and summer, when skin values are low. It is hoped that through the agency of the Rabbit Destruction Council there will be an early substantial increase in the number of Rabbit boards.

Rabbit Boards now number 108, covering an area of about 18,000,000 acres. During the year subsidies paid to Boards on rates collected amounted to £91,713.

Noxious Weeds

Efforts of land-occupiers in dealing with noxious weeds were, in the main, confined to the better-class land. A shortage of chlorate weedicides was experienced last year because of the reluctance of shipping companies to handle this material after an explosion on a ship discharging sodium chlorate at Melbourne. This shortage precluded more effective work being undertaken in certain districts.

The report of the special Noxious Weeds Committee was considered and adopted at the most recent conference of the New Zealand Counties Association. The recommendations made by the Committee have now been placed before the Government.

Forty counties have now taken over the administration of the Act, and, in general, good work is being accomplished. Finance has been made available by the Department to enable weeds to be dealt with on unoccupied Crown and Maori lands and lands of indigent farmers.

ANIMAL RESEARCH DIVISION

REPORT OF J. F. FILMER, DIRECTOR

Diagnostic Services

With the rapid increase in the number of veterinarians in New Zealand, the Diagnostic Section at Wallaceville seems destined to play an increasingly important part. During November, 1947, all veterinarians of the Live-stock Division spent a week at Wallaceville conferring with the laboratory staff. The final-year New Zealand veterinary students, now graduated, also spent a period of extra-mural training there. It is expected that similar visits will be made annually, and they should do much to improve the liaison between field veterinarians and laboratory workers.

The following are the classes and numbers of specimens examined during the year :—

Cattle	4,563
Sheep	599
Pigs	202
Horses	109
Dogs	48
Poultry	1,302
Bees	162
Other animals	76
Miscellaneous	202
Total	7,263

The following vaccines were prepared and issued free :—

Blackleg vaccine—	
Cattle doses	70,000
Sheep doses	79,200
"Scabby mouth" vaccine : doses	329,000

The function of the Diagnostic Section does not end with the laboratory examination of specimens. An endeavour is made to follow up the results of recommended treatments, and where laboratory diagnosis is not possible preliminary field investigations are conducted, thus providing the ideal link between the field veterinarians and the specialist research workers.

Research Work

Sheep-breeding Projects

Progeny-testing : Romneys.—There has been no improvement in the disappointing results reported last year. During the past four years 44 rams have been tested with the following results :—

(*a*) By evaluation methods available to a breeder no one ram was located that could be considered to have left progeny sufficiently superior to those of any other ram to justify his return to the stud.

(*b*) Application of statistical techniques to the progeny data revealed no significant differences in the fleece weight of progeny between rams when the fleece weight was measured on the lamb fleece. Significantly heavier fleeces were bred in one year when judged at the two-tooth stage.

(*c*) Statistically significant differences in count of wool of progeny existed between rams judged at the lamb stage in two years.

(*d*) Statistically significant differences existed between rams in the character of the wool of their progeny in one year judged both as lambs and two-tooths.

(*e*) Progeny groups showed significant differences in carcass conformation each year.
(*f*) Considerable practical difficulties existed in applying progeny-testing even in its simplest form; these were associated with the number of paddocks required for paddock mating and lambing in sire groups; low fertility levels under individual paddock mating conditions; difficulties of allowing for twins in small sire groups; inefficiency of lamb-fleece weight as an index of subsequent fleece weight; disadvantage of keeping wether lambs past the lamb stage; practical difficulties in testing of ram lambs; increasing age of sires if their worth is to be judged on two-tooth characters; labour required in recording necessary data and in analysis of these.

Inheritance of Count.—In this experiment extremes of "count" in both ewes and rams were used in selective matings over two seasons' breeding operations. In neither year did selection of rams for strong or fine wool produce any significant effect on the count of their progeny; comparisons for ewe groups are awaiting analysis of count data for the hogget fleece.

Inheritance of Carcass Conformation.—Sufficient data on the Southdown-Romney cross are now available to suggest that in fat-lamb breeding a small difference exists in favour of the short-legged ewe, but that this difference is too small to be of any commercial significance. The problem of inheritance in the straight Romney is more confused owing to the greater variation that exists and the problem of ram individuality. Selected groups of good- and poor-carcass ewes were bred this last season to a pair of closely related intermediate-type rams with similar performance records under progeny test for carcass quality. The dams have already been slaughtered and carcasses measured, and their offspring are to be killed at a standard weight of 90 lb.

Influence of Ram on Carcass Quality of Fat Lambs.—A repetition of last year's work was carried out to obtain a measure of seasonal influence on the progeny of each of the eight fat-lamb ram breeds under study, the same sires being used as in the previous season. The sires have been replaced for the current season to overcome any individuality problem. No critical analysis will be attempted or conclusions drawn until all results are to hand, but it is obvious that the Southdown cross is pre-eminently suited for the present fat-lamb export trade in regard to quality.

Nutrition of the Breeding-ewe.—As a background to experimental studies on ewe nutrition, an examination of live-weight changes of breeding-ewes from a month before tupping until two months after the completion of lambing has been carried out, using approximately 1,700 ewes. The work aims at determining whether live-weight changes during the two to four weeks before tupping affect the fertility level and whether subsequent changes are related to ewe losses during pregnancy, lamb mortality, and milk-production in the ewe. A considerable amount of data has been secured and is now in the process of being analysed.

Sterility in Two-tooth Breeding-ewes.—Of the 100 two-tooth and 26 four-tooth (with records of barrenness) under observation, 27 per cent. of each group proved empty. Of these empty ewes, only 2 (8 per cent.) of the two-tooths were never seen on heat, while 42 per cent. came on heat only once. Among the four-tooths, comparable figures were lower.

Fifty per cent. of each group lambed to first mating. For ovulation observations, 28 operations were performed on ewes shortly after their second, and, in some cases, also after their third, heat period. Only in 1 case had ovulation failed to occur, so that the results indicate that failure to ovulate is not an important cause of sterility, at least in animals that come into season more than once.

An attempt to increase the fertility level of two-tooth ewes by the injection of a hormone (gonadotrophin) at two different levels before heat was not successful.

Records of mating and lambing are being kept for a flock of 200 two-tooth ewes with the object of relating any occurrences of twinning, barrenness, and neo-natal deaths to mating data. Causes of lamb mortality will be determined, if possible. In addition, it is proposed to kill some 50 of the above ewes six or seven days after their first service. Observations are being made on the condition of the ovaries, and if possible the ovum (or ova) will be recovered and examined to see whether fertilization and cleavage appear normal. The reproductive tract of each animal killed will be preserved so that if any abnormalities of fertilization or implantation are noted an examination can be made for anatomical or histological abnormalities in the organs of the ewes concerned.

Fecundity in Ewes.—As part of the general programme for the investigation of fertility in sheep it has seemed desirable to establish how the fecundity of the ewe may be affected by selective breeding. To this end a long-term selective breeding experiment has been commenced. Three flocks of approximately 100 ewes each, with the same age distribution, have been selected:—

(1) High-fertility Flock: Selected on basis of previous performance (or dam's performance in the case of maiden ewes).
(2) Random Flock: Selected with no attention paid to previous lambing history of ewes or their ancestors.
(3) Low-fertility Flock: Selected on similar basis to high-fertility flock, but in the reverse direction.

In the high-fertility flock all subsequent selection will be for a high incidence of twinning; in the low-fertility flock it will be for a low incidence of twinning. Within the random flock selection will be directed neither for nor against twinning, except in so far as this may occur by chance.

Mammary Gland Development in Ewes.—An investigation has been commenced on the normal growth of the mammary gland, the relationship of this to the gonads in each sex, and the nature of the growth produced by œstrogen treatment. Ewes were killed at monthly intervals during the last three months of pregnancy, and two male and two female fœtuses, as well as udders of ewes in their first pregnancy, were obtained at each stage. Normal male and female lambs were killed at monthly intervals from birth to four months. A further series were de-sexed and/or implanted with stilboestrol tablets before they were five days old. These were ultimately killed to provide two examples of each treatment at the ages of two months and four weeks. Mammary glands and reproductive organs were collected in every case. From the weight and gross appearance of the organs it is apparent that stilboestrol treatment had a noticeable effect, but detailed histological data are not yet available.

Deaths in New-born Lambs.—Preliminary investigations have been continued. Properties were visited in Hawke's Bay, Gisborne, Waikato, and the King-country. Recorded losses on the properties investigated ranged from 5 per cent. to 15 per cent. In some cases there was evidence that a proportion of the lambs were premature, but the problem was shown to be essentially one of still-birth and death within twenty-four hours of birth rather than of abortion. Over one hundred dead lambs, representing all districts visited, were examined. The lambs ranged in weight from 4 lb. to 16 lb.; approximately half had breathed, some of these having only partly aerated lungs.

Infertility associated with Subterranean Clover.—Reports from Australia on infertility of ewes grazing almost pure swards of subterranean clover prompted an examination of such pastures in New Zealand. No reports of low lambing percentages have been received, and provided a reasonable percentage of grass is maintained in subterranean-clover pastures no trouble need be anticipated. However, samples of subterranean clover from different districts are being assayed to determine if this plant could become dangerous under New Zealand conditions.

Ketosis in Pregnant Ewes: "Sleepy Sickness".—Two further trials of the dicalcic phosphate, potassium iodide, linseed meal salt-lick were made, one under field conditions at Shannon and the other under experimental conditions at Wallaceville. The farm at Shannon was the one on which encouraging results with the lick were first obtained in 1945. Again on this farm the lick proved effective in controlling ketosis in one group of 100 ewes, whereas in a similar group not fed lick a number of cases of ketosis occurred. At Wallaceville it was necessary to impose extreme conditions of feed restriction comparable to those resulting from falls of snow or silting over in pastures. Starvation for three to five days a fortnight before lambing did not cause fatal ketosis; most of the ewes so treated lambed prematurely and recovered. Starvation commenced three to four weeks before lambing caused fatal ketosis in the majority of multi-pregnant ewes. Feeding of lick under these severe conditions did not significantly reduce the incidence of ketosis.

Sheep Nutrition Projects

Comparison of Crops for Hogget Nutrition.—Observations have been continued at Manutuke on the comparative value of various crops for autumn feeding of hoggets. Thousand-headed kale and turnips have proved to be outstanding for the Poverty Bay district, as they can be grown in the driest years and provide a great bulk of very valuable fattening feed. In addition, kale is available during the whole of the period when facial eczema is likely to occur. The following table gives the comparative production for three seasons of the crops tried:—

PRODUCTION, IN LAMB-GRAZING DAYS

Crop.	1946.	1947.	1948.
Japanese millet	1,628	..	..
Rape	1,065	1,069	..
Turnips	1,435	2,490	2,129
Lupins	280	..	..
Chou moellier	859	..	..
Kale	2,274	2,641	2,097

In each year it has been possible to fatten lambs on turnips and kale during late summer and early autumn when pastures were very bare. In 1947, kale also provided useful winter feed during July after being spelled from the 21st May. Lucerne has been grazed extensively at Manutuke this year and has proved very valuable for providing grazing for large numbers of sheep during the autumn—for example, 1 acre which had been cut for hay on the 8th March provided grazing for 80 lambs from the 2nd to the 13th April, during which time they gained 2 lb.

Comparison of Various Pastures for Ewes and Lambs.—Trials with special pasture mixtures have been continued at Manutuke in 1-acre paddocks. The following broad conclusions can be drawn:

H1 Rye-grass and White Clover.—Provides good feed during winter and spring, but must be grazed leniently during summer to allow seeding. Under these conditions clover growth is very vigorous in summer and autumn, especially after the first year. Recovery of H1 rye-grass in autumn is slow, but it re-establishes very well from reseeding.

H1 Rye-grass, Cocksfoot, White Clover, Montgomery and Broad-leaf Red Clovers.—Under sheep-grazing the cocksfoot and red clovers are dominated by H1 rye-grass and white clover.

Long-rotation Rye-grass and White Clover.—Sown first in April, 1947, long-rotation rye-grass and white clover gave excellent winter and spring grazing, dried out rather badly in summer, but reseeded well in autumn.

Pedigree Perennial Rye-grass and White Clover.—Not quite so vigorous as H1 rye-grass in spring and clover growth not so good in summer. Recovers more quickly in autumn.

Cocksfoot and White Clover.—After the first summer this becomes almost a pure sward of white clover.

Italian Rye-grass, Montgomery and Broad-leaf Red Clover.—The Italian rye-grass provides excellent grazing in winter and spring, but does not survive a Poverty Bay summer. The red clovers thereafter become dominant and provide excellent grazing in summer and autumn.

Six ewes were lambed in each of the paddocks and the lambs did well in all of them, the average daily weight increase varying from 0·45 lb. to 0·54 lb. between the 25th August and the 8th December. On the latter date all except 6 out of 48 lambs were sent to the works. Six lambs were grazed in each of the acre paddocks from the 2nd February to the 13th April. During this period the red clovers proved outstanding, the lambs grazing them making a daily weight gain of 0·4 lb. In second- and third-year pastures in which white clover was vigorous growth varied from 0·24 lb. to 0·31 lb. per day, while in first-year short- and long-rotation rye-grass pastures and second-year perennial rye-grass pastures in which white clover was rather poor growth varied from 0·09 lb. to 0·18 lb. per day.

Rickets and Unthriftiness of Lambs wintered on Green Oats.—Previous field experience has shown that, in the South Island particularly, sheep grazed on green oats during winter become rachitic and fail to grow properly. Administration of calciferol improves growth-rate and prevents rickets. Further evidence from the field suggested that there might be a positive rickets-producing factor in green-feed oats. Experiments have been commenced to study this and, if confirmed, to determine the nature of the factor. The work is being carried out on rats. Considerable preliminary work has been carried out to establish technique, and a study is proceeding on dried oats known to cause rickets in sheep; comparison is made with dried grass. Experiments have been carried out to test the calcification produced in rats by diets containing 53 per cent. of the dried oats (*a*) unextracted, (*b*) extracted with petroleum ether, and 53 per cent. of the dried grass (*a*) unextracted, (*b*) extracted with petroleum ether, all the diets being adjusted to the absolute phosphorus content and to the Ca/P ratio of the standard rachitogenic diet. It is found that on all of these diets normal (complete) calcification is produced, in spite of the adverse ratio which in the standard diet produces severe rickets. A marked distinction is found in the weight increases of the groups on oats and on grass: on both unextracted and (to a slightly less extent) on extracted grass diets the weight increases of the rats over the period of experiment are excellent, on unextracted oats the weight increase is very poor, and on extracted oats only slightly less poor. It appears that there may be some factor present in green oats which has a depressant effect on growth of rats, and that this factor is not completely removed by extraction with petroleum ether. The factor seems also to be present in the petroleum-ether extract.

Experiments are also being made to determine whether supplements of vitamin A or vitamin D fed to rats on a 53-per-cent. (unextracted) oats diet will give normal growth increases. Preliminary assays of these petroleum-ether extracts have shown (1) that some vitamin D is present in the grass extract (probably approximately 2 I.U. per 100 g. grass) and (2) that some vitamin D is present in the oats extract, but that the extract also contains some factor inhibiting growth and thus vitiating the measurement

of the vitamin D present. Work is also proceeding on extracts made with chloroform, which removes more from oats and grass than does petroleum ether. Assays of chloroform extracts are being made, and experiments paralleling those with petroleum-ether-extracted oats are being carried out with chloroform-extracted oats.

Sheep Diseases Projects

Facial Eczema.—No cases of facial eczema occurred on the Department's Research Farm at Manutuke, and very few cases were reported from east coast districts. Quite severe outbreaks occurred in the Waikato during February, March, and April. Warnings were widely broadcast after the warm rains which fell in March and April, and farmers were advised to confine their sheep to small areas at the rate of not less than 100 to the acre and to feed hay. Many farmers followed this advice, with excellent results. At Ruakura, sheep were shut up on five occasions during February, March, and April for a total period of about five weeks, during which they were fed hay and silage. No facial eczema developed and sheep maintained their condition well. In a small test flock which were not confined, 80 per cent. of the sheep developed severe facial eczema.

Post-dipping Lameness in Sheep.—An investigation of the cause of a severe type of lameness observed in sheep dipped in some fluids containing "Gammexane" or rotenone preparations has been made in association with a veterinary officer of the firm manufacturing the dip concerned. As a rule the lameness occurs mainly in lambs or two-tooth sheep dipped in a fluid which has stood for some days after the first mix. On rare occasions, however, it has been observed in sheep dipped on the second day. There have been no cases reported where standard arsenical or phenolic preparations have been used, though the addition of a full-strength arsenic dip to a wash which had already produced lameness had no effect in reducing the incidence.

The lameness has now been shown to be a bacterial infection which gains access through skin abrasions. If these exist on any part of the body, infection of the skin occurs, but if the abrasion is close to the hoof the infective processes extend to involve the soft structures within the hoof and give rise to extremely severe lameness. Examination of the foot reveals very little abnormality, except slight swelling and pain with a considerable amount of heat. The lameness persists for two to three weeks, after which there is complete recovery, but there may be considerable loss of condition during the time that the sheep are lame. The organism responsible has been shown to be *Erysipelothrix rhusiopathiæ*, the organism which causes arthritis in lambs. Preliminary investigations indicate that the addition of an antiseptic to the dip will prevent the trouble, but "Gammexane" dips which already have an antiseptic in their make-up appear satisfactory.

Blackleg in Sheep following Vaccination.—A mortality in sheep from gas-gangrene infection following vaccination with blackleg vaccine was investigated in October, 1947. Of 950 sheep vaccinated on the same day, 88 died from blackleg (*Cl. chauvoei* infection) originating at the inoculation site behind the elbow.

The vaccine was shown to be uncontaminated and was therefore not the source of infection, which was believed to originate from contamination of vaccine or needle and syringe by dust from the wool-shed floor and pens in which the sheep were held during vaccination. This possibility was suggested by the fact that the vaccine was transferred to an open container when filling the syringe and that wool-shed dust was later found to contain 39,000 blackleg spores per gramme. Ten milligrams of the dust, the smallest dose tried, killed a sheep from blackleg within forty-eight hours. Investigation of this mortality suggested that it was unlikely that latent blackleg spores had been activated by damage caused from inoculation of the vaccine. In other work on lethal doses of blackleg culture it was found that sheep are much more susceptible than guinea-pigs.

Sheep regularly succumbed to 0·01 ml. of blackleg culture, whereas guinea-pigs survived the inoculation of 0·05 ml. of the same culture. Challenge experiments showed that satisfactory immunity was conferred by blackleg vaccine.

Foot-rot.—As reported last year, an attempt was made to eradicate foot-rot from the Experimental Station at Manutuke. Since then 800 lambs have been brought on to the Station, and in some lines there were as many as 6 per cent. of bad cases of foot-rot. All feet were carefully examined, and affected sheep were treated in isolation before they were turned into the main paddocks. No cases of foot-rot have occurred in these since January, 1947, and there are to-day some 650 sheep of all ages completely free from foot-rot. In February, 1948, an attempt was made to eradicate foot-rot from Ruakura. Here the difficulties are much greater on account of the large number of sheep, the much greater area, and the large number of small flocks involved in the various experiments. If eradication proves successful at Ruakura, it should be possible on any farm in New Zealand.

Dairy Cattle Breeding Projects

Artificial Insemination at Ruakura: Training of Technicians.—During the winter mating an attempt was made to train six technicians. Although they could be considered rather better than the average class of man-power likely to be available for insemination work, the fact that only three of them reached a consistently satisfactory level of performance emphasizes the difficulty likely to be experienced in training any considerable number of satisfactory technicians.

Dose-rate Levels: Uterine Technique.—Comparisons of three dose-rate levels were made during the early part of the season. From 500 to 600 cows per group were inseminated with dose rates of 25 million, 50 million, and over 50 million sperms per dose. Analysis of the results in terms of the relation of dose rate, storage time, effect of bulls, and effect of technicians suggests the following conclusions:—

(1) Doses of 25 million sperms were as effective as larger doses.
(2) Storage time did not affect conception rate any more with this dose rate than with higher doses.
(3) Results varied with bulls, but even with the weakest in fertility results with 25 million sperms were no worse than with higher doses.
(4) Experienced technicians obtained better results with the low dose rate than did less-experienced operators.

The all-over conception rate was slightly under 50 per cent. for the spring-grade experimental group. This is somewhat lower than the previous year and suggests a rather lower level of quality of the semen used. As before, results varied widely in different herds. With a proved technician the fourth week showed an average conception rate of 43 per cent., though in three herds 67 per cent. of 55 cows inseminated held. A less-experienced technician showed rather poor results in the early part of the season, conceptions ranging from 37 per cent. to 40 per cent., but towards the end of the season he got 65 per cent. of conceptions.

Cervical Technique.—Opportunity was taken during the season to test the possibility of obtaining reasonable conception rates with the cervical technique modified by using very small quantities of concentrated semen. It was argued that the low efficiency of the cervical technique with small doses of sperm might in part be due to a portion of the injected material flowing out of the cervix immediately after insemination, so that the effective dose rate became too low. To test this 50 cows were inseminated with 0·15 c.c. of semen containing 50 million sperms. Results were very poor, only 14 cows holding. For routine work the cervical technique appears to be quite unsuitable.

Distant Group.—The group organized in the Manawatu by the Herd Recording Department of the New Zealand Dairy Board experienced considerable trouble and results were poor. It appears that definite transport and storage problems existed,

since, while the over-all results in Waikato with the same material were much better than in Manawatu, both groups showed a marked fall in efficiency with material used on the second day. Thus on the first day a conception rate of 62 per cent. was obtained in the Waikato, against 44 per cent. in the Manawatu; on the second day the rate in Waikato fell to 41 per cent. and in Manawatu to 24 per cent. No definite cause has been found for this marked drop, but work is in progress to solve the problem.

Pedigree Group.—It is very pleasing to record the increased support given to the experiment by pedigree breeders. No special effort was made to organize a larger group, breeders merely being informed that up to 400 cows could be handled. Sixty-six breeders made available 582 cows for one or more inseminations. Conception rate was rather poor, the average figure being 45 per cent. This low figure is believed to be due partly to a tendency for breeders to offer shy-breeding cows for this work, partly to the tendency to start mating such animals early in the season before sufficient time has elapsed to permit normal resolution of the uterus after calving, partly to the general fall in quality of the semen used during the season, and partly to selection allowed in choice of bull.

Organization.—The spring work makes possible a comparison of the amount of work that can be carried out by highly trained and experienced technicians under two different types of organization—a concentrated group of grade cattle and a scattered group of pedigree cows. The data in the following table apply to the first three to six weeks of the season:—

—	Concentrated Group (Grades).	Scattered Group (Pedigrees).
Inseminations	735	460
Time (days)	21	40
Mean daily inseminations	35	11·5
Daily range	18–59	2–24
Daily mileage	65	142
Miles per single insemination	1·8	12·37

In the grade group the inseminator covered 1,372 inseminations in nine weeks; in the pedigree group 736 inseminations in twelve weeks. Both operators are well above average in capacity; it is estimated that in groups comparable with the grade, the size should not exceed 500 to 600 cows for average operators. In a pedigree group 300 to 400 cows would be ample from the viewpoint of the average operator.

In spite of disappointing conception rates, 623 cows, including 139 pedigree cows, are in calf to one bull, who has a final survey of 402 lb. fat based on the production of 39 daughters, with a daughter-dam comparison for 13 pairs: dams 386 lb., daughters 410 lb., of fat.

Bull Sterility.—The bull sterility service for dairy-farmers was continued during the year, with the modification that examinations were made only on samples supplied by Stock Inspectors and field veterinarians. One hundred and eleven bulls were examined, with the following results:—

	Fertility Level.
Good	23
Moderate	30
Poor	13
Unsatisfactory	21
Bad	15
Sterile	9

Working with seven pairs of identical twin bulls, uniformity data on reproductive behaviour have been extended, and previous indications as to the superiority of identical twin bulls for fertility investigations have been borne out by the results.

Previous work on the sexual strength of bulls fed on hard rations indoors, when compared with their co-twin fed on grass outside, indicated some superiority in the grass-fed animals, but the issue was confused by the complicating effect of exercise obtained by the grass-fed animals. During the year the effect of exercise upon sexual strength has been examined under carefully controlled conditions where an exercise difference alone existed. The data obtained show no beneficial effect of exercise.

Production of Artificially bred Heifers by Merit Sires.—In the 1946–47 season the first crop of artificially bred heifers on both Ruakura and outside farms came into production. Production averages of these heifers on each farm have been at extremely good levels and promise to raise the herd average by a worth-while amount:—

Herd.	Number of Heifers.	Production of Butterfat (Actual).	Mature Equivalent.	Production, Mature Cows same Farms.
		lb.	lb.	lb.
A	13	283	353	361
B	14	305	375	346
C	6	325	395	339
D	12	255	325	279
E	9	286	356	339
F	3	274	344	279
G	7	285	355	289
H	39	280	350	..
S	103	284	354	324

Three bulls were used, and the tabulated results show that the production records of their artificially bred heifers under a wide range of farm conditions agreed reasonably closely with their sire survey results. Farmers have always questioned the sire survey system, on the grounds that the performance of a bull in one herd may not be any guide to his performance in another herd. The point is obviously basic to the whole principle of herd improvement through the use of proven sires.

		Official Survey.		Artificially Bred Daughters.	
Greencroft	Dams ..	(41)	346	(10)	340
Hopes Prince ..	Daughters ..	(41)	374	(10)	363
	All daughters	..	..	(35)	374
Kuku	Dams ..	(13)	367	(19)	356
Butterking ..	Daughters ..	(13)	373	(19)	352
	All daughters	..	..	(40)	353
Awatea Phil ..	Dams ..	(8)	389	(9)	316
	Daughters ..	(8)	387	(9)	370
	All daughters	..	..	(29)	342

During the current season a further crop of daughters by better average-quality bulls have come into production. Results will be reported next year.

Surplus-grade heifer stock bred at Ruakura by proven sires and sons of proven sires are being placed on selected farms to provide a complete picture of breeding results and to obtain data on the performance of comparable cattle in other districts. As

part of these extension activities the Northern Wairoa experimental herd will be gradually replaced by Ruakura-bred animals. Twenty-five calves were made available for this purpose this season.

Ruakura Grade Project.—In this project the objective is to build up a herd of grade cows of average size (50 cows) from a relatively low standard to a 400 lb. butterfat average by the use of proven sires and artificial insemination. Twenty-one daughters of proven sires came into milk during the current season, and a further 30 will calve next season.

Ruakura Pedigree Project.—Here the objective is to see if the proven-sire system of breeding is capable of maintaining or even improving a herd average of 400 lb. The almost universal history of all high-producing herds is one of gradual rise to such a standard followed by an equally definite fall to lower levels. In view of the importance of bull-breeding to the industry, and due to the fact that artificial insemination is a more practical proposition with pedigree than with grade cattle, this work is related closely to the whole question of national herd improvement. In particular, since as a method it does not facilitate line or family breeding and therefore tends to cut across established pedigree breeding traditions and methods, its scientific investigation is of paramount importance.

To establish this herd and commence the work, 12 cows and 13 heifers of a 400-lb. standard were purchased last winter and are now in production. Along with 9 Ruakura-bred pedigrees of a similar standard, the herd size is now 34. It will be built up as quickly as possible by breeding to a 50-cow level.

Dairy Cow Nutrition

Study of Fœtal Development in the Cow.—During the past year 24 pregnant cows were slaughtered and the uteri recovered for detailed laboratory examination and dissection. Killings were carried out at twenty-eight-day intervals from conception and a fairly complete range over the whole pregnant period was covered.

The study will yield not only information of fundamental interest on growth and development of cattle, but will have a direct practical application in permitting accurate corrections to be made to cattle live weights so that live-weight changes can be studied independently of pregnancy effects. Rapid increase in weight during the latter stages of pregnancy obscures changes in true body weight.

Calf-rearing.—Experiments have been initiated to provide information on the comparative efficiency of three methods of milk feeding, especially in relation to the prevention of scours during the first three weeks. In all groups colostrum was fed for the first three days, and thereafter whole milk was fed until the calf reached 70 lb. live weight, with a gradual change to skim-milk by the time it reached 100 lb. live weight. In the first group milk was fed in daily quantities based on 12 per cent. body weight, with a maximum of 2 gallons. The second group received the same quantity of milk diluted with 25 per cent. water. The third group was fed undiluted milk on an 18-per-cent. body-weight scale, with a maximum of 2½ gallons. There was no difference in the incidence of scours in groups fed at different milk levels. The addition of water appeared to reduce the incidence of scours; the group fed at the higher level grew very rapidly up to five weeks, but not thereafter.

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 calving and poor nutrition thereafter), and low-high (poor nutrition to first calving and good nutrition thereafter). The results are reported in three stages—calf, yearling, and cow.

Calf Stage: The weights of the two groups of calves for the past four seasons are set out in the following table:—

BODY WEIGHTS AT 31ST MARCH

Season.	Well Reared, Rotationally Grazed.		Poorly Reared, Set-stocked.		Difference.
	Number.	Weight.	Number.	Weight.	
		lb.		lb.	lb.
1944–47	74	378	80	283	95
1947–48	10	410	12	325	85
Identical twins ..	10	410	10	338	72

The results again emphasize the value of rotating the calves ahead of the cows and thus ensuring that they always receive good, clean pasture.

Yearling Stage: The progress during the yearling stage is shown in the following table:—

	Well Reared.			Poorly Reared.			Differences.		
	1945–47.	1947–48.		1945–47.	1947–48.		1945–47.	1947–48.	
		Non-twins.	Twins.		Non-twins.	Twins.		Non-twins.	Twins.
April	389	437	408	288	312	347	101	125	61
June	443	494	465	310	316	359	133	178	106
September	519	539	520	372	413	439	147	126	81
December	651	688	640	539	547	547	112	141	93
March	703	717	682	561	558	549	142	159	133
Numbers	46	8	8	47	8	8	..	..	..

The differences in the two systems are illustrated by the consumption of hay, silage, and autumn-saved pasture (A.S.P.) by yearlings, as shown hereunder:—

Group.	Year.	Consumption per Head.		
		Hay.	Silage.	A.S.P.
		Cwt.	Cwt.	Hours.
Well grown	1945–46	2	20	112
	1946–47	6	11	237
	1947–48	10	28	66
Poorly grown	1945–46	3	..	..
	1946–47	3	..	..
	1947–48	3½	..	..

There have been some interesting differences in the reproductive behaviour of the two types of yearlings for the three years of the experiment. The well-grown heifers show heat periods at an earlier age than the poorly-grown heifers, but require rather more services per conception. Over the three years 8 well-grown and 2 poorly-grown heifers failed to get in calf.

Cow Stage, 1946–47: This is the first season for which production results are available for the four groups referred to in the introduction to this project. These are summarized in the following table:—

Nutrition.		Butterfat.	Days in Milk.
Prior to Calving.	After Calving.		
		lb.	
High even ..	High even ..	294	281
Uneven	Uneven ..	255	283
High even ..	Uneven ..	280	281
Uneven	High even ..	285	300

As results will be influenced from year to year by seasonal conditions, it will not be possible to draw firm conclusions for a number of years.

Live-weight Changes.—At three years of age the cows which had been on a high even plane of nutrition throughout were 107 lb. heavier than those on an uneven plane throughout. The high-low and low-high groups occupied intermediate positions in that order, thus emphasizing the lasting effect of good nutrition during the first two years.

Winter Nutrition Project.—In this work the objective has been to measure the precise relationship between the level of nutrition during the dry period of the pregnant cow and her production during the subsequent lactation. Two evenly matched groups of cows were fed at different levels during the winter. The high-plane group was grazed on autumn-saved pasture and received an ample supply of hay and silage, while the low-plane group was grazed on relatively bare pastures and received a limited hay ration. Two years' results now available are summarized in the following table:—

	High Plane.		Low Plane.	
Season	1945–46	1946–47	1945–46	1946–47
Number of cows	13	18	13	18
Hay fed daily	7·0 lb.	7·6 lb.	5·5 lb.	3·2 lb.
Silage fed daily	37 lb.	*0	0	0
Gain or loss prior to calving	+30 lb.	+66 lb.	−83 lb.	−64 lb.
Loss at calving	116 lb.	111 lb.	106 lb.	95 lb.
Weight of calf	59 lb.	57 lb.	50 lb.	53 lb.
Total milk	6,346 lb.	6,936 lb.	6,104 lb.	5,888 lb.
Total fat	330 lb.	374 lb.	304 lb.	312 lb.
Fat per cent.	5·2	5·4	5·0	5·3
Days in milk	243	289	243	285

* Silage was not available owing to drought in the previous season, but an extra quantity of autumn-saved pasture was fed.

Identical Twins: Collection.—Forty-five sets of heifers and 6 sets of bulls were collected at Ruakura during the season, bringing the total number collected to 170 sets.

Uniformity Trials: Milk-production.—Nine sets of twins calved sufficiently close together to provide data on the uniformity of twins in respect to milk and butterfat production. The records, reduced, where necessary, to a standard lactation length of 255 days, are given in the following table, and show how closely identical twins resemble each other in milk-production :—

Twin No.	Milk Yield.	Butterfat Yield.	Test.	Casein Yield.	Casein.
	lb.	lb.	Per Cent.	lb.	Per Cent.
T. 1	5,042	266	5·3	141	2·8
T. 2	5,275	278	5·3	144	2·7
T. 3	4,032	240	6·0	105	2·6
T. 4	4,157	248	6·0	110	2·6
T. 11	3,833	222	5·8	99	2·6
T. 12	3,621	216	6·0	93	2·6
T. 13	3,943	212	5·4	98	2·5
T. 14	4,085	211	5·2	98	2·4
T. 17	5,781	323	5·6	154	2·7
T. 18	5,623	315	5·6	149	2·6
T. 23	200	11	..	6·5	..
T. 24	127	5	..	3·6	..
T. 27	4,120	216	5·3	109	2·6
T. 28	4,100	221	5·4	109	2·7
T. 29	5,205	242	4·7	129	2·5
T. 30	5,695	245	4·3	135	2·4
T. 31	349	17	..	9·0	..
T. 32	363	17	..	9·0	..
Variance ratio * ..	45	109	31	101	21

* T. 23 and T. 24 and T. 31 and T. 32 have been omitted from these calculations, as their inclusion would overemphasize the relative usefulness of twins.

The figures for variance ratio give an indication of the superiority of identical twins for research work—for example, in an experiment involving butterfat yields the results from one pair of identical twins would be approximately as valuable as those from two groups of 109 cows each.

Grazing Behaviour.—As the grazing behaviour of dairy cattle is a factor of considerable importance in dairy-cow production in New Zealand, the usefulness of twins for grazing-behaviour studies has been measured. Twins were found to be much more alike than non-twins in respect of grazing-time, loafing-time, lying-time, the distances walked, number of defæcations and micturations, and number of drinks. During the present season studies have also been made of the relation of weather, production level, stage of lactation, season, and nutritional level to grazing behaviour.

Growth.—Growth trials involving 42 sets of twins reared under the same conditions show that identical twins grow much more uniformly than other calves and that for growth during the first year of life they may be considered approximately twenty-five times more useful than other calves.

Quantitative Relationship of Pasture and Pasture plus Concentrates to Butterfat-production.—In this project identical twins are being used to compare the butterfat-producing quantities of two levels of pasture and to assess the effect of feeding concentrates to the cows fed at the higher level. Small areas are enclosed in wire-netting frames during the grazing periods, and at the end of these the pasture in the frames is clipped to the level of the grazed pasture and from the weight of clippings the amount eaten is estimated. The composition and digestibility of the clippings are also estimated. Efforts are being made to calculate intake by the use of indigestible markers, such as

chrome green and monastral blue. This method appears promising and will be much less laborious than the clipping technique. A method has been evolved in which the digestibility of organic matter is calculated from the nitrogen content of the fæces. This appears very promising and is convenient and time-saving.

Study of Milking Methods

Development of Recording Devices.—Apparatus developed last year for the semi-automatic weighing and sampling of milk from every milking of a cow has been under test during the whole season. The method has proved very satisfactory, eliminating many personal errors normally associated with such work and reducing considerably the labour required. The apparatus is being installed in all Ruakura sheds.

As a further aid to research work in this field an apparatus developed for automatic timing of the milking process promises to be extremely valuable and effective, eliminating personal errors associated with older means.

An apparatus for measuring intra-mammary pressure has been constructed and submitted to laboratory tests. Work with this intrument in the shed will be commenced shortly.

Milking-machine Equipment.—The "weighted relief valve" designed to give accurate vacuum control and shown under test to be highly efficient has been streamlined for commercial production. Sample models produced appear to be very satisfactory. The importance of making available a reliable valve to farmers is further emphasized by results of field surveys of large samples of milking-machines carried out during the year in Northland and Canterbury. Thirty per cent. of the valves in Northland and 50 per cent. of those in Canterbury were working incorrectly. With from 50 per cent. to 60 per cent. of vacuum gauges also incorrect, it will be obvious that the field position is far from satisfactory at present.

A new installation design for mounting the milking-machine vacuum pump has been developed. The method gives several advantages over that normally used and has proved very satisfactory in use. Full details have been published for the benefit of farmers. Work on the design of an electrically controlled pulsator unit to replace present mechanical types has reached an advanced stage.

Milk "Let-down" Studies.—A uniformity trial with identical twins to determine their relative suitability for this type of work has been completed. It is clear that these animals will be particularly valuable for fundamental studies of milking behaviour and they will be used, as far as possible, in all future milking-method work.

With a view to finding a suitable technique for assaying milk let-down activity, the method of Turner and Cooper has been tried on rabbits. This method was found to give results with variability within the usual range of biological assay techniques. The chief drawbacks are the necessity for keeping a large colony of rabbits and the reliance placed on eye judgment in determining results which may be to some degree obscured by the temperamental reaction of the rabbit.

Cattle Disease Projects

Mastitis: Penicillin Treatment.—Further investigations have confirmed the opinion that penicillin is a very valuable agent in the treatment of mastitis, as indicated by the following results. These all refer to cases which were diagnosed bacteriologically as being

due to streptococci. Results against mastitis caused by other organisms are poor, but fortunately such cases are relatively rare. In all cases three injections were given at twenty-four-hour intervals :—

Treatment.	Number of Quarters.	Bacterial Cure.	Clinical Cure.	No Effect.
		CLINICAL CASES		
		Per Cent.	Per Cent.	Per Cent.
25,000 units (solution) ..	144	52	22	26
33,000 units (solution) ..	58	57	7	36
Mastics (10,000 - 50,000 units)	136	75	11	14
		SUB-CLINICAL CASES		
Lactating cows—		Per Cent.	Per Cent.	Per Cent.
25,000 units	50	90	..	10
33,000 units	31	84	..	16
Dry cows—				
25,000 units	79	90	..	10
33,000 units	25	80	..	20

Clinical cure means that udder and milk returned to normal but bacteria were still present. Bacterial cure means clinical cure plus removal of bacteria.

In view of the importance of developing methods of using penicillin as a means of field control of mastitis, two methods of herd treatment were compared. In one group of 5 herds of 450 cows all clinical cases occurring during the 1946–47 season were treated with penicillin and the incidence of clinical cases recorded during the following season.

In another group of 7 herds of 400 cows all clinical cases in the 1946–47 season were treated and, in addition, all latent cases and any existing clinical cases, located by examination toward the end of the season, were treated when the cows were dry. Again occurrence of new cases the following season was recorded.

	Treatment during Season.		Treatment during Season and Dry Period.	
	1946–47.	1947–48.	1946–47.	1947–48.
Cows	459	445	386	392
Clinical quarters	101	140	139	74
Percentage clinical quarters	5·5	7·8	9·0	4·7

It is clear that treatment of clinical cases during one season did not reduce the incidence of cases the following year. On the other hand, dry-period treatment in association with treatment during the year produced a marked reduction in the incidence of clinical cases the following season.

A limited amount of data was obtained on the effect of a second course of treatment of cows not responding to the first course or showing only a clinical cure. Approximately half of the cases giving no effect responded after the second course, while most of those showing only a clinical response became bacterial cures. In a few cases which did not respond initially, prolonged treatment was tried, and in most of these some improvement was noted. No reduction in milk yield of normal cows resulted from penicillin therapy, though a proportion of "light" quarters has been noted in clinical cases that have responded to treatment.

Observations have shown that the best results are obtained only when penicillin is used in the early stages. This makes it important to have penicillin available in a form which can be used safely by the farmer himself. Two preparations have been tried. Results are quoted for a patent preparation in which penicillin is incorporated in a solid stick of soluble wax which is inserted into the teat. Another promising preparation is one in which the penicillin is incorporated in a paste enclosed in a small collapsible metal tube with a nozzle which can be inserted into the teat, thus enabling the paste to be squeezed into the udder. Although detailed figures are not available for this latter preparation, it has been tested by a number of veterinary surgeons with excellent results. It is hoped that one or both of these preparations will be available in adequate quantities for the coming season.

Control Measures.—Two seasons' results are now available on the testing of control measures based on segregation, disinfection, and treatment at Ruakura. At No. 1 dairy 44 cases of mastitis occurred in 137 cows during the current season, as compared with 24 cases in 93 cows the previous year. The picture this season has been complicated by the addition to the herd of 24 purchased pedigree cows, 2 of which calved with infection and 2 of which developed mastitis later. At No. 2 dairy 4 cases occurred in 93 cows, of which 48 were first calvers. The previous year 9 cases occurred in 79 cows, of which 47 were first calvers.

No. 1 herd thus continues to suffer a fairly high incidence, while No. 2 herd shows a reasonably low figure.

Contagious Abortion.—Vaccination continues to give excellent results. The following records for cows vaccinated as calves include all calvings up to the end of the 1946 season: 67,974 first calvings, 2·9 per cent. abortions; 23,420 second calvings, 2·4 per cent. abortions; 10,064 third calvings, 2·2 per cent. abortions. In these herds during the season immediately preceding that in which first-vaccinated heifers calved, 19 per cent. unvaccinated two-year-olds and 7 per cent. unvaccinated older cows aborted. In an examination of bloods from vaccinated cows which aborted, 42 per cent. gave negative results. It would therefore appear that vaccination has reduced contagious abortion to less than 2 per cent.

In a trial in which the injection of 1 c.c. of vaccine into the tail was compared with the injection of 5 c.c. subcutaneously, the results obtained from the tail inoculations were not quite as good as those from the subcutaneous method, which will therefore continue to be used.

Trichomoniasis.—Sterility and early abortion in dairy cows due to the protozoan parasite trichomonads has been known to exist in New Zealand for a number of years. During the past few years there have been an increasing number of outbreaks showing the characteristic symptons of trichomoniasis, but it has not been possible to discover the organism. Recently, however, improved technique has enabled definite diagnosis of the disease in a number of dairy herds and also in two beef herds. Control measures depend on destruction of infected bulls and periods of two to three months of sexual rest for cows. This should be relatively easy in dairy herds, but may prove very difficult in beef herds in hill country, where cattle are not under close control.

Johne's Disease.—Preliminary investigations have been commenced with a view to the possible use of a vaccine for the control of Johne's disease.

Thistle Poisoning.—By means of feeding experiments carried out in Hawke's Bay, the toxicity of variegated thistle (*Silybum marianum*) to cattle was confirmed. Material containing 13·1 per cent. to 14·4 per cent. of potassium nitrate on the moisture-free basis was toxic, while that containing 1·4 per cent. to 4·1 per cent. was harmless.

The high- and low-nitrate samples were collected at the same time from two different farms only a few miles apart, and thus it can be concluded that climatic conditions are not a factor affecting the level of potassium nitrate in this particular plant.

It was significant that the experimental animals did not relish the thistles, but had to be starved on to them.

Pig Projects

Progeny-testing.—The aim of this work is to develop and test a breeding scheme involving progeny-testing with the object of improving characters commercially valuable in pig-production. Minimum performance standards for boars and sows have been established. The co-operation of the Cheltenham Dairy Co.'s pig-farm is being used to extend the scheme beyond the limits possible at Ruakura and to test the possible use of such a set-up as a means of application of the scheme to the industry.

Effect of Housing and Pasture-utilization on Efficiency of Food-conversion.—The change in pig-housing trends over the last ten years and consequent change in pasture utilization and management methods have suggested the necessity for acquiring some factual evidence on these aspects of pig husbandry. The experiment aims at finding out whether either limited or free access to pasture is better than no access to pasture, whether it is advisable to limit milk consumption to any specified level to encourage grass intake in the interests of economy and efficiency, and what effect, if any, types of housing may have upon efficiency of gain with and without grass.

The 50 Berkshire pigs involved in the trial are balanced for litters and sex effects, and are being individually fed at five different levels of intake, as under New Zealand conditions skim-milk, or some similar bulky dairy by-product, is the main source of food for pigs and the amount fed will obviously affect the pig's appetite for grass. The design of the experiment is such that it will allow an evaluation of the efficiency of food-conversion at the various levels of feeding.

Inheritance of Defects.—The performance of boars and sows in the Large White and Berkshire studs have been examined in regard to the inheritance of *Atresia ani*, scrotal hernia, and defective feet. Test matings and the culling of parents of affected progeny are the suggested lines of attack in eliminating these defects, which are more apparent in the inbred Large White herd than in the Berkshires.

Necrotic Enteritis.—The frequent finding of bacteria of the *Salmonella* genus has led to a special study of this group of organisms at Wallaceville. Specific sera are now available to make possible the identification of any *Salmonella* of animal sources. Outbreaks of the disease due to members of the group have been encountered in pigs (*S. choleræ suis*), fowls (*S. pullorum*), ducks (*S. typhi-murium*), and guinea-pigs (*S. typhimurium*). *S. choleræ suis* has been isolated from more than fifty widely separated outbreaks in swine. The role of this organism in producing disease in swine is now under investigation. By feeding living cultures it has frequently, but not invariably, been possible to produce either acute or chronic forms of the disease. An attempt is being made to find an unfailing method of transmission so that the possibility of protection by vaccines may be tested under controlled conditions.

Trace Elements

Iodized Licks.—Preliminary experiments have been carried out to test the efficacy of incorporated calcium stearate as a means of reducing iodine losses from iodized licks. Results were not sufficiently conclusive to justify the adoption of calcium stearate as a protective agent. It is proposed to continue investigations into methods of stabilizing iodized licks.

Aerial Top-dressing.—During August, 1947, an experimental aerial top-dressing with cobalt sulphate in the form of a saturated solution was successfully carried out in co-operation with the Public Works Department. For this purpose 1,800 acres of mainly hilly, bush-sick country near Taumarunui was selected. Top-dressing was at the rate of 20 oz. cobalt sulphate per acre, as previous experiments have indicated that on flat country such a rate gave protection against bush sickness for a number of years. Subsequent analyses of pasture samples have shown a satisfactory increase in cobalt content. Pasture cobalt will be checked at intervals to determine the length of time over which the top-dressing remains effective on the country selected for the experiment.

The cost of aerial application worked out at 7d. per acre, which compares favourably with an estimated 1s. per acre for top-dressing by hand. Aerial distribution is considered to offer a satisfactory solution to the cobalt top-dressing problems of hill-country farmers.

Copper and Molybdenum.—Experiments with calves on copper-deficient land have shown that, whereas normal growth and health are maintained by provision of copper as a drench, molybdenum drenching reduces growth rate, causes scouring, and results in a high percentage of bone fractures.

By plot experiments, suitable levels of molybdenum top-dressing have been determined to raise pasture molybdenum to levels found on some farms where peat scours is prevalent. Top-dressing has now been extended to paddock scale, and the effect on health of stock grazing molybdenum-enriched pasture will be determined and compared with natural cases of peat scours.

Attempts to control or reduce the copper storage in the sheep's liver by molybdenum feeding have not been as effective as with cattle. Trials with a number of other elements on sheep have also produced negative results.

Radio-active Tracers.—Over the past year work has been confined to preparation of facilities and collection and building of apparatus. Chemical and electrical laboratories have been set up in a detached building, and considerable progress has been made in equipping them and in instituting precautions for the protection of workers.

Equipment has been difficult to obtain, but sufficient has now been accumulated to commence investigations with radio-active cobalt, which it is hoped will lead to a better understanding of the functions of that element in ruminant metabolism.

Parasitology

Sheep-dipping Experiments.—An attempt was made last season to eradicate ticks and lice from the sheep on the Ruakura farm using a single treatment with a standard "Gammexane" preparation in a power spray unit. When the sheep were examined before treatment, ticks were present in moderate numbers, especially on the unshorn lambs. Biting lice were also present in considerable numbers on the ewes. Soon after one mob of lambs had been dipped a heavy shower of rain fell, and as the kill was unsatisfactory in this group the whole flock was redipped. The entire flock has been maintained completely isolated from all neighbouring flocks either by double fences, roads, or ditches. The flock was examined carefully at shearing-time, nine months after dipping, and no ticks were detected, but a light to moderate louse infestation was detected on a small proportion of the ewes.

A further attempt at eradication was made this season and samples of dip wash were taken at intervals during the operation. The samples are being examined by the manufacturers to determine the rate of exhaustion of the insecticide in the power spray unit for comparison with that observed in orthodox dipping-baths.

The Anthelmintic Activity of Phenothiazine Sulphoxide.—Following the demonstration of the presence of the sulphoxide as an oxidation product of phenothiazine in the gut of ruminants, a series of tests was made with this compound against certain worm parasites of sheep. The material was tested against the large stomach worm (*Hæmonchus contortus*), against which it showed an efficiency similar to that of phenothiazine itself. It also showed some action against the large bowel parasites *Chabertia ovina* and *Oesphagostomum venulosum*. This result is interesting, as the sulphoxide is the first derivative of phenothiazine, of which a large number have been tested by other workers, to show any appreciable anthelmintic activity against sheep parasites. The sulphoxide, however, possesses no advantage over phenothiazine itself and would be more expensive to produce.

Geographical Distribution of Hæmonchus Contortus.—A series of specimens of lamb stomachs were obtained from selected meat-works to obtain more information on the geographical distribution of *Hæmonchus contortus* in the Dominion. The examinations are not yet complete, but in all cases either negative or light infestations only were encountered. Heavy infestations were not seen in this sample, which was collected between December and March, when one would have expected populations of *Hæmonchus* to be at or near their maxima.

Immunity and Resistance to Nematode Infestation in Sheep and Rabbits.—Unsuccessful attempts were made to stimulate an active immunity to *Hæmonchus* in sheep by the subcutaneous injection of ex-sheathed larvæ. Attempts were also made to transfer a passive immunity to lambs by the injection of large doses of serum from immune sheep. When challenged by a test infection, the lambs showed no evidence of immunity.

Attempts were also made, by repeated dosing with infective larvæ, to induce an acquired immunity in groups of lambs grazing on pasture and in groups maintained in pens under "worm-free" conditions. After treatment with phenothiazine the lambs were given a test infection. On slaughter, differences in the size of the worms and the numbers harboured by infected and control groups were not significant.

Observations have been made on the effect of age of the host on the course of an infection with *T. retortæformis* resulting from a single large dose of infective larvæ. Groups of rabbits aged three, six, and twelve months were infected and the resulting infestation assessed by fæcal egg counts. Substantial infestations became established in all animals, but the number of eggs passed varied inversely with the age of the host. After the egg output of the rabbits in the age-resistance trial had subsided to a low figure, all animals were reinfected with a single dose of larvæ. A previously uninfected control group of rabbits three months old was also infected. The previously infected rabbits showed very small increases in egg count, while the controls showed the characteristic very much higher egg-count curve.

Technical Articles submitted for Publication during the Year ended 31st March, 1948

Machine Milking—

Whittleston, W. G. (1948): "Good and Bad Habits in the Milking Shed." *N.Z. J. Agri.*, *76*, 369.

Whittleston, W. G., and Allen, A. J. (1948): "Mounting the Milking Machine Vacuum Pump." *N.Z. J. Agri.*, *76*, 246.

——— (1948): "Milking Machine Technique." *N.Z. J. Agri.* (In press.)

Whittleston, W. G. (1948): "Efficient Machine Milking." *Aust. J. Dairy Tech.* (In press.)

Whittleston, W. G., and Verrall, S. (1947): "The Influence of certain Machine Adjustments on the Rate of Milking." *N.Z. J. Sci. & Tech.*, *28*, 407.

Whittleston, W. G. (1947): "The Essential Factors involved in Machine Milking." *Proc. N.Z. Dy. Sci. Assn.*, *1947*.

Whittleston, W. G., and Verrall, S. (1947): "The Measurement of Milk Volume." *N.Z. J. Sci. & Tech.* (In press.)

Animal Nutrition—

McMeekan, C. P. (1497): "New Zealand Pasture—Its Value for Milk and Meat Production." *Aust. Vet. J.*, *23*, 105.

Wallace, L. R. (1947): "Influence of the Plane of Nutrition on the Reproductive Efficiency of Animals." *Proc. N.Z. Soc. An. Prod.*, *1947*, 114.

Ewer, T. K., and Bartrum, P. (1948): "Rickets in Sheep." *Aust. Vet. J.*, *24*, 73.

Animal Nutrition—continued

McNaught, K. J. (1947): "Spectrophotometric Determination of Cobalt in Pastures and Animal Tissues." *N.Z. J. Sci. & Tech.* (In press.)

Simpson, J. E. V. (1947): "Crops for fattening Lambs on Gisborne Flats." *N.Z. J. Agri. 75*, 352.

Technique—

Whittleston, W. G., and Ziman, J. M. (1947): "A General-purpose Recording Instrument." *N.Z. J. Sci. & Tech.* (In press.)

Apiculture—

Fix, W. J., and Palmer-Jones, T. (1947): "Control of Fermentation in Honey by Indirect Heating and Drying." *N.Z. J. Agri., 76*, 611.

Palmer-Jones, T. (1947): "Use of Pollen Supplements in New Zealand." *N.Z. J. Agri., 75*, 147.

Palmer-Jones, T., *et al.* (1947): "A Recent Outbreak of Honey Poisoning." *N.Z. J. Sci. & Tech.* (In press.)

Aerial Top-dressing—

Andrews, E. D., and Prichard, A. M. (1947): "Top-dressing Cobalt-deficient Land from the Air." *N.Z. J. Agri., 75*, 501.

Parasitology.—

Whitten, L. K. (1947): "Parasitism in Relation to Pasture Farming." *Proc. N.Z. Soc. An. Prod., 1947*, 129.

Whitten, L. K.; Filmer, D. B.; and Clare, N. T. (1947): "A Photosensitized Keratitis in Young Cattle following the Use of Phenothiazine as an Anthelmintic." *Aust. Vet. J., 23*, 336.

Bacteriology—

Josland, S. W. (1947): "Salmonellosis of Swine in New Zealand." *Aust. Vet. J., 23*, 292.

Nielson, R. L. (1947): "Bacillus Mesentericus: An Assay Organism of Penicillin." *N.Z. J. Sci. & Tech.* (In press.)

Photosensitization—

Cunningham, I. J. (1947): "Photosensitization by St. John's Wort." *N.Z. J. Sci. & Tech.* (In press.)

Apiculture

An experiment was commenced in Canterbury with the object of increasing the seed yield of red clover by more effective pollination. Red-clover flowers are not very attractive to hive bees, and the method used in the experiment consisted in "directing" the bees on to the flowers by feeding infusions of the corollas. Thirty hives were used in a field trial in 1948, and evidence was obtained that direction of bees took place. The project will be continued for several seasons so that the economic worth of the method can be tested. The work is being carried out in collaboration with the Horticulture Division and the Fields Division.

Field-work was continued in connection with toxic honey, with particular reference to the effect of climate on its porduction. Detailed work on the toxicity of different portions of tree tutu (*Coriaria arborea*) and methods of extraction of tutin from the plant was undertaken in collaboration with the Horticulture Division and Ruakura Animal Research Station.

Further work was done on the problem of fermentation in honey, and a survey commenced of the type of honey starter used in New Zealand. Trials of drugs against *Nosema apis* were continued.

HORTICULTURAL DIVISION

REPORT OF W. K. DALLAS, DIRECTOR

Climatic Conditions

Though drought conditions were experienced in many parts of the Dominion during the past year, on the whole they were beneficial to the horticultural industry.

After a drought up to the end of March, 1947, the rainfall in the Auckland Province was general and heavy, but from October onward drought conditions again prevailed. A succession of three wet winters and three dry summers has had the effect in some areas of depreciating the condition of the fruit-trees, with a consequent increase of physiological troubles.

In the Hawke's Bay fruitgrowing district the lack of moisture in the subsoil is having a retarding effect on the normal good growth of the trees, and this season's heavy crops are placing a heavy strain on the trees.

Climatic conditions in the Nelson district were exceptionally favourable to all horticultural crops. The good rains in the winter of 1947 were sufficient to keep the soils moist, with a consequent benefit to the crops and fruit-trees.

In Canterbury the season was dry, but was favourable to the production of fruit and vegetables. There were no serious losses because of frost.

Though stone-fruit and pip-fruit crops in Central Otago had a setback because of frost, the season as a whole was favourable for the stone-fruit crops. Apple crops in the Ettrick and Dumbarton districts were seriously reduced as the result of late-spring frosts.

Area and Number of Orchards

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

Taxable orchards (containing 120 or more trees)	1,911
Non-taxable orchards (less than 120 trees, but not including domestic orchards)	1,703
Total	3,614

This shows a decrease of 1,199 registrations from those of the preceding year.

The total acreage devoted to pip, stone, and citrus fruit trees at 31st March, 1948, was 16,300 acres, the areas utilized for commercial production of the principal kinds of fruit being approximately as follows:—

	Acres.
Apples	8,790
Pears	1,050
Stone-fruit	4,710
Lemons	610
Other citrus	960
Other tree fruits	180
Total	16,300

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

10	orchards over 50 acres.
55	„ 26–50 acres.
41	„ 21–25 acres.
116	„ 16–20 acres.
239	„ 11–15 acres.
503	„ 6–10 acres.
947	„ 1–5 acres.
1,911	orchards aggregating about 15,650 acres.

The average economic orchard unit is about 12 acres, but the size of such a unit depends mainly on the fertility of the soil in which the trees are established, efficient management, and the orchard practices adopted.

The most urgent problem confronting the industry is the continued shortage of fruit-trees required to replace unprofitable and declining trees in existing orchards and to establish new orchards. Until this tree shortage is overtaken, greater production, which is necessary to meet the increasing local consumption and to maintain the export trade, cannot be expected.

Production

The quantity of fruit produced in the Dominion during the 1946–47 season was :—

	Bushels.
Apples	1,933,221
Pears	286,846
Stone-fruit	395,895
Lemons	106,385
New Zealand grapefruit	69,675
Sweet oranges	16,280
Other citrus	610

Apples and Pears.—The quantity of apples produced was below Dominion average, but the pear crop was about 30,000 cases more than the previous year's crop.

The total production of apples and pears for the 1946–47 season was distributed as follows :—

——	Apples.	Pears.	Total.
	Bushels.	Bushels.	Bushels.
Distributed to consumers by Internal Marketing Division	1,332,729	207,261	1,539,990
Forwarded direct to factories by Internal Marketing Division	10,411	..	10,411
Sold privately by growers	351,543	70,153	421,696
Sold to canning-factories	111,591	8,773	120,364
Sold for dehydration, pulping, cider, &c.	126,947	659	127,606
Totals	1,933,221	286,846	2,220,067

The latest apple and pear crop estimates for the 1947–48 season indicates a total of about 2,842,000 bushel cases of apples and about 352,000 of pears. The substantial increase from the previous season has been caused mainly by the generally favourable weather conditions during the summer.

Export of Apples and Pears.—A feature of the marketing of fruit in the past year was the resumption of the export of apples and pears to Britain on a scale well up to pre-war quantities. Up to 31st March, 1948, 138,467 cases of apples of the 1947–48 crop have been exported to Britain, and it is expected that more than 1,000,000 cases of fruit will be exported before the close of the season. During the next few years it is anticipated that Britain will provide an assured market at reasonable prices for all the fruit that can be sent away from New Zealand.

In addition to the quantity of fruit to be exported, there are about 1,500,000 bushel cases of apples and pears to be consumed on the local market as the result of the larger crops harvested.

Stone-fruit.—The quantity of stone-fruit produced during the 1947–48 season was greater than that of the previous season. The increase in peach-production was caused by the large number of trees that have recently come into bearing in the Hawke's Bay district. The estimated quantities are:—

	Bushels.
Peaches	428,170
Nectarines	37,760
Apricots	96,800
Plums	139,000
Cherries	14,380

Small Fruits.—Growers continue to extend the areas planted in small fruits. The estimated production of small fruits in commercial areas for the 1947–48 season, compared with the previous season, is:—

	1947–48 Season. Tons.	1946–47 Season. Tons.
Gooseberries	317	270
Strawberries	552	380
Raspberries	763	530
Loganberries	29	25
Currants	145	120

In September, 1947, a representative selection of the best raspberry stocks was planted out on the Dominion Horticultural Station at Levin to compare their vigour and yield and to enable the nomenclature of raspberry stocks to be decided. In addition, black currant and strawberry plants imported from the East Malling Research Station in England have been acclimatized and are being propagated.

It is considered that the work now being done at the Station should be of the greatest benefit to small-fruit growers throughout the Dominion.

During the year Dr. C. H. Cadman, Pathologist in Charge of the Scottish Raspberry Investigation, visited the Dominion to investigate and report on the virus status of raspberry-plants in commercial gardens. In his report Dr. Cadman comments most favourably on the comparative freedom of New Zealand stocks from virus diseases, especially of the serious degenerative types.

Citrus Fruits.—The estimated citrus production for the 1947–48 season is:—

	Bushels.
Lemons	107,200
New Zealand grapefruit	75,300
Sweet oranges	17,400

Viticulture

The grape crop harvested in 1947 was not of such high vintage quality as that of the previous year. The mild summer temperatures and humid, wet conditions were factors in preventing the fruit from maturing fully.

Indoor Grapes.—The estimated production of grapes under glass is about 600,000 lb.

Wine Grapes.—The weight of grapes harvested is estimated at 2,200 tons, about 200 tons in excess of the previous season's production. This increase can be attributed mainly to the vineyards that have recently come into production.

Wine Cellars, Machinery, and Equipment.—Winemakers are continuing to make extensive alterations to their existing buildings and plants to meet increasing needs. New buildings are being laid out on approved lines and are being equipped with up-to-date machinery.

Pests.—Pests and fungous diseases were not very prevalent in the vineyards during the 1946–47 season. The use of D.D.T. insecticide promises to be useful in the control of mealy bug in glasshouses.

Wine-production.—The area used for growing outdoor grapes for winemaking is about 850 acres. The production of 205 licensed winemakers was about 428,000 gallons, mostly of the sweet red and sweet white varieties. In addition, a further 83,000 gallons of wine was made from fruit other than grapes.

Cidermaking.—The production of the 32 cidermakers is about 95,000 gallons.

Te Kauwhata Horticultural Station.—After a cold and wet spring at Te Kauwhata, warm and humid conditions prevailed up to April. The grape crop this season is about 20 tons greater than that of last season.

As a result of favourable weather conditions, vine cuttings in the nursery have "taken" very well. During the year nearly 12,000 cuttings were sold and about 14,000 planted out, replacing unprofitable vines and extending the vineyard.

The cellar capacity is being increased by 8,500 gallons through the temporary conversion of some fermentation vats into storage tanks and through the recent purchase of eighty hogsheads.

To meet the sustained demand for the grape and apple wines made at the Station, quantities of grapes and apples were purchased from neighbouring growers for winemaking.

Fruit Cool Storage

The cool-storage space available for fruit in the Dominion shows a small increase, the estimated capacity being 1,173,488 bushel cases, which is distributed as follows:—

—	Public Cool Storage.	Growers' Private Cool Storage.	Total.
	Bushel Cases.	Bushel Cases.	Bushel Cases.
North Island	832,238	63,800	896,038
South Island	201,080	76,370	277,450
Totals	1,033,318	140,170	1,173,488

The stocks of pip-fruits held in cool store on 30th June, 1947, amounted to:—

	Bushel Cases.
Apples	583,183
Pears	105,895

The quantity held in shed storage in orchards was about 18,800 cases of apples.

Commercial Vegetable-production

Registration.—During the year ended 30th September, 1947, the number of registrations made in accordance with the provisions of the Commercial Gardens Registration Act, 1943, was 3,059, involving 18,121 acres, 716 acres of which were devoted to the production of glasshouse crops.

The New-Zealand-grown Vegetables Regulations, which came into operation on 1st July, 1947, require each registered grower to brand on his vegetable-containers the registered mark allotted to him by the Director of the Horticulture Division.

Commercial Vegetable-growing.—The control of diseases affecting the production of vegetables continues to receive the attention of officers of the Division and officers of the Plant Diseases Division of the Department of Scientific and Industrial Research. During the year several experiments and trials to find practical means of controlling the carrot-rust fly, potato-tuber moth, white butterfly, red-legged earth-mite, and other pests and diseases of vegetable crops were made, and the results were promising.

Reports by Divisional officers show that diseases play an important part in reducing the quantity of vegetables produced. Eelworm is still a serious pest of tomatoes in glasshouses. Growers are being urged to sterilize their soil in glasshouses by steam or by chemical means to control pests and diseases and to eradicate weed seeds.

Bulb-growing Industry

The best bulbs produced in New Zealand compare favourably with those grown overseas, but unfortunately many bulbs of poor quality are offered for sale. A number of problems of bulb-growing need investigating, such as the effect of cutting flowers from tulip and daffodil bulbs grown for sale and the effect on bulbs of different systems of spacing and manuring.

Rehabilitation of Ex-Servicemen

Officers of the Horticulture Division have kept in close touch with the ex-servicemen who have been established or are engaged in horticultural activities. Officers of the Division have also inspected properties for the Rehabilitation Department and reported on their suitability for rehabilitating ex-servicemen.

Tobacco Industry

The tobacco-growing industry continues to expand. The comparative figures for the 1946 and 1947 harvesting years are :—

	1946.	1947.
Acreage cropped	3,405	3,933
Poundage of leaf sold	4,080,135	4,706,723
Number of licensed growers	553	661

Hop Industry

The 1947 yield of hops was greater than that of 1946, when unfavourable weather conditions caused production to be very low. In 1946, 1,828 bales were produced, and in 1947, 2,511 bales.

Plant Nurseries

The number of plant nurseries registered throughout the Dominion during the year was 810, an increase of 58 over that of the previous year. Special attention was paid to inspecting the trees and plants in the nurseries. Generally the standard of the plants was good and the nurseries were well maintained. In cases where diseases were found, the nurserymen concerned were required to treat the trees to the satisfaction of Inspectors before the trees were distributed to purchasers.

In general, nurserymen are finding it difficult to meet the demand for fruit-trees, ornamental trees, shrubs, trees for farm planting, and bedding-out plants.

Diseases of Horticultural Crops

The majority of growers have continued to give close attention to disease and pest control.

Brown-rot of Stone-fruits.—This disease still causes serious losses to growers in the Auckland district. Apart from Hawke's Bay, brown-rot was not of great importance in other districts.

Fireblight.—Fireblight infection has not been much in evidence this season, except in some of the domestic orchards at Hastings.

Silver-leaf.—This disease is becoming a major problem to stone-fruit growers in the Gisborne and Hawke's Bay districts.

Red Mite.—Weather conditions in the Auckland, Canterbury, and Otago districts have been favourable for the development of red mite on fruit-trees.

Codlin-moth.—Fruitgrowers who used D.D.T. for the control of the codlin-moth were well pleased with the results obtained.

Citrus Canker.—Officers of the Division have maintained a thorough inspection in all citrus groves to detect this disease. A small number of citrus trees near Tauranga and in some non-commercial districts had to be destroyed because of the disease. However, the rigorous measures taken in the past have kept the disease down to a minimum.

Mealy Bug.—Mealy bug has been prevalent in the Hawke's Bay district, and some lines of apples and pears intended for export had to be rejected because of it.

Wax Scale.—The hard-wax scale is widely distributed among the citrus orchards at Kerikeri. Though soft-wax scale is not so widespread, it is proving difficult to control.

There are many diseases affecting vegetable crops throughout the Dominion. By the more general use of D.D.T. it has been found that the white butterfly and diamond-backed moth can be kept reasonably under control.

Beekeeping

The beekeeping industry in New Zealand is recovering fast from the effects of conditions during the war, when many beekeepers were obliged to reduce their hive stocks because of a shortage of necessary labour and restricted transport facilities. Statistics show a sharp increase in the number of apiaries and hives kept by beekeepers. There are now 7,285 beekeepers in New Zealand, who own 11,386 apiaries containing 154,508 colonies. The distribution in the various apiary districts is as follows :—

Apiary District.	Number of Beekeepers.	Number of Apiaries.	Number of Hives.
Auckland	1,757	2,079	18,584
Hamilton	1,015	1,781	38,910
Hastings	938	1,427	16,389
Palmerston North	1,346	2,167	25,834
Nelson	554	691	7,177
Christchurch	789	1,801	26,031
Dunedin	886	1,440	21,583
Dominion totals	7,285	11,386	154,508

The establishment cost of the beekeeping industry in New Zealand (bee stocks, hives, and plant) based on present registered holdings is estimated to be £1,036,000.

Climatic Conditions and Production.—Spring and early-summer conditions were favourable for beekeeping in most parts of New Zealand. Mild temperatures with almost complete absence of strong winds induced the bees to build up colony strength generally much earlier than usual.

Beekeepers, however, experienced some difficulty in maintaining colony strength during prolonged spells of dry weather, which reduced nectar secretion on stony and light-soil areas. Though heavy crops of honey have been obtained in some northern areas of New Zealand, disappointing results were obtained in the Hawke's Bay, Central Otago, and Palmerston North districts, where pastures dried up early and did not recover in time for normal honey-production.

The estimated quantities of honey and commercial beeswax harvested during the year were 4,750 tons and 118,750 lb. respectively.

Research Work.—Valuable research work on problems affecting the beekeeping industry in New Zealand has been carried out in conjunction with the Department's Animal Research Station at Wallaceville and with the Department of Scientific and Industrial Research. This has included diagnostic work on bees submitted for examination, investigation of fermentation and sour flavours in honey, chemical constituents of beeswax produced in New Zealand, pollination of red clover by honey bees, economic use of pollen substitutes, use of chemicals for control of wasps, and identification of pollens found in New Zealand honey.

Part-time Apiary Inspection.—Seventy-eight competent beekeepers were employed during the season as part-time Apiary Inspectors to assist the permanent Instructors in the detection and control of bee-diseases. In this way 1,844 apiaries, containing 13,378 hives, were inspected in selected areas, in addition to the work done by the Apiary Instructors during the year.

Expansion of Beekeeping Industry in New Zealand.—Many good beekeeping districts are now fully stocked with bees. A survey on a county basis completed during the year shows that there is scope at present for the expansion of apiary holdings and for the establishment of separate economic units up to a total of at least 18,000 hives in good beekeeping areas. Expansion beyond these limits will depend largely on increased liming and manurial top-dressing of permanent pastures and the establishment of fresh clover pastures on undeveloped lands.

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