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NEW ZEALAND

AGRICULTURE IN UNITED STATES AND CANADA

(REPORT AND OBSERVATIONS ON INSTRUCTIONAL METHODS IN REGARD TO),

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Laid on the Table of the House of Representatives by Leave.

Introduction.

Early in the month of May last Mr. E. Clifton, New Zealand Commissioner to the Panama Pacific Exhibition, San Francisco, and Trade Commissioner on the West Coast of Canada, handed me a copy of a letter which he had received from the Right Hon. Mr. Massey, Premier and Minister of Agriculture, in which he stated that as soon as the New Zealand Commissioner considered that he would be able to manage without my assistance at the Exhibition it was desired that I should, while in America, spend a few weeks in visiting those instructional farms in the United States and Canada considered most likely to be of interest in connection with my work. While no precise time-limit was fixed for this purpose, it was to be understood that there was a necessity for occupying as little time and incurring as little expense as would admit of my obtaining a reasonable insight into the methods being pursued, and that on my return to the Dominion I should submit a full report of my observations to the Department.

Having been appointed by the President of the Panama Pacific Exhibition to act on behalf of foreign nations on group, departmental, and other juries in connection with exhibit awards at the Exhibition, I was unable to begin my visit to agricultural instructional institutions before the 5th August, 1915.

From inquiries made it was considered that it would take fully six weeks to visit institutions and complete the journey, and I am pleased to report that this was done in the time mentioned, the distance travelled by railroad being over seven thousand miles. The period of the year was autumn, from the 5th August to the 16th September, inclusive.

United States of America.

In connection with my journey east through the States, visiting farms and institutions, &c., Mr. C. I. Blanchard, Statistician, Department of the Interior, United States Reclamation Service at the Panama Pacific Exhibition, who was accredited by the United States Government, very kindly drew up an itinerary and furnished me with letters of introduction to many persons at the various institutions I should visit, as well as to officers of the State Departments, whose advice and assistance in regard to the objects of my visit proved most valuable.

The following are the institutions, farms, projects, &c., visited in the United States of America: University Farm, Davis, California; Truckee-Carson Irrigation Project, Fallon, Nevada; Truckee-Carson Experimental Farm, Fallon, Nevada; Grand Valley Project, Grand Junction, Colorado; State Agricultural College, Fort Collins, Colorado; State Agricultural College, Ames, Iowa; Dairy farms (fifteen) the property of W. W. Marsh, Waterloo, Iowa; State Agricultural College, Madison, Wisconsin; Dairy Farm of ex-Governor Howard, Port Atkinson, Wisconsin; United States Department of Agriculture, Washington, D.C.; Arlington Experimental Farm, Virginia, near Washington, D.C.

Canada.

For my Canadian journey and visit to farms, &c., Colonel Hutchison, Commissioner-General, Canadian Government Exhibition Commission, San Francisco, handed me a letter of introduction to Mr. O'Halloran, Deputy Minister of Agriculture in Ottawa, who received me with every courtesy. After going fully into the objects of my mission he passed me on to Mr. J. H. Grisdale, Director Dominion Experimental Farms, who did everything possible to further the objects of my visit, and gave me every facility to acquire information regarding farming methods and experimental work throughout the Dominion of Canada.

I put in four days very profitably at the Central Experimental Farm of the Dominion, which is situated within seven miles of the City of Ottawa, Ontario, where Mr. Grisdale has his head-

quarters. Mr. Grisdale kindly prepared an itinerary for my Canadian journey and the farms, institutions, &c., I should visit, and also gave me letters of introduction to prominent officers in institutions and Agricultural Departments throughout the provinces of the Dominion.

Following are the departments, institutions, farms, &c., visited by me in Canada: Department of Agriculture, Ottawa, Ontario; Central Experimental Farm, Ottawa, Ontario; Experimental Station, Cape Rouge, Quebec; Government Exhibit and Annual Fair, Quebec; Department of Agriculture, Toronto, Ontario; Government Exhibit and Canadian National Exhibit, Toronto, Ontario; the Ontario Agricultural College, Guelph, Ontario: Department of Agriculture, Winnipeg, Manitoba; Manitoba Agricultural College, Manitoba; Department of Agriculture, Regina, Saskatchewan; Department of Agriculture, Victoria, British Columbia.

Since my return to the Dominion I have been requested not only to report on the methods pursued in regard to agricultural experimental work in the United States and Canada, but also to report generally on my observations in regard to agriculture in these countries.

The States of America on the western slopes of the "Rockies," owing to their climatic conditions, present many problems in agriculture and the successful treatment of arid and semi-arid regions by means of irrigation. These are dealt with in this report at greater length than the eastern States because some of the conditions are similar to those obtaining in some as-yet-undeveloped areas in New Zealand.

With regard to the eastern States and the institutions, beginning with the Agricultural College of Colorado and following on eastward to the Arlington Experimental Farm in Virginia, near Washington, D.C., it will only be necessary to deal with the experimental work being carried on at one institution—viz., that at Madison, Wisconsin—as the major portion is somewhat similar at all institutions.

Agricultural Education in the United States.

There are over a hundred colleges (or schools) of agriculture in the United States. Nearly all colleges have agricultural experiment stations attached which co-operate with other educational efforts and movements, all seeking to standardize and build up country-life education. Agricultural secondary schools are connected with agricultural colleges of nearly forty States. Over eighty distinctly agricultural high schools of different types have been established since 1888, almost all of which are supported wholly or in part by State funds. In addition to these there are 289 public high schools receiving State aid for agriculture, and over 1,600 unsubsidized public and private high schools and academies are giving instruction in agriculture. A considerable number of privately endowed secondary institutions also give instruction in agriculture. Nearly two hundred State and county normal schools are undertaking to prepare young people to teach agriculture. In some States county agricultural high schools are equipped at the expense of the counties where they are located. In the State of Wisconsin these schools receive £800 annually to aid in paying running-expenses. In most States agriculture has been made a required study on a par with reading, arithmetic, history, and geography.

Agricultural extension departments in the agricultural colleges work in conjunction with farmers' institutes and boys' and girls' clubs, high schools, and associations of farmers for the promotion of agricultural college training. Extension work is that phase of instruction which is carried on among people who are not resident at an educational institution. The Department of Agriculture and State agricultural colleges have, during the past ten years, been developing special methods of agricultural work to make their knowledge and discoveries available to the farmers. The farmers' institute has expanded and become a part of the life of every agricultural community. Every year many thousands of farmers in the different States go for a day or a week's instruction and training. This work is promoted by and largely in the hands of the State Agricultural Departments. In 1914 farmers' institutes were carried on by State Departments of Agriculture in twenty-one States and by colleges of agriculture in twenty-seven States. Over 1,800 persons were employed as institute workers; 2,660,000 persons attended regular sessions of farmers' institutes; last year 112,498 persons attended movable schools of agriculture; and over a million people attended other meetings conducted by institute workers.

University Farm, Davis, California.

This farm is situated in latitude 39° N., at Davis, eighty miles distant from the university at Berkeley, and comprises 779 acres. The soil is typical of a great portion of the Sacramento Valley. It is considered one of the best general-purpose soils in the region, and is adapted to a wide range of crops. The mean annual rainfall amounts to 16·54 in., the greater part of which falls from the beginning of December to the end of March: very little rain falls from the beginning of May to the end of October. The farm is provided with buildings for instruction in practical agriculture and horticulture, including a commercial creamery, stock pavilion, horticultural building, cereal building, mechanical shops, buildings for horses, cattle, sheep, swine, and poultry, two dormitories, and a dining-hall. Instruction is given at the university farm to university students, university farm-school students, and to short-course students. Several divisions carry on extensive investigations, notably agronomy, animal husbandry, dairy industry, irrigation, and poultry husbandry.

At the time of my visit to instructional institutions throughout the United States the autumn vacation was on, and the presidents of the universities, as well as a number of the heads of divisions, were attending an agricultural conference at the University of California at Berkeley. At Davis I was unable to obtain much informaiton regarding agricultural experiments, as the Professor of Field Husbandry was at the conference.

Cereals.—The cereal crops had been harvested some weeks before my visit, but I was given to understand that experiments on an extensive scale were carried on annually, including variety trial, fertilizer experiments, rotation experiments, and a number of special experiments. All

important experiments were conducted as far as possible on summer-fallowed land or in a biennial cropping system. The variety trial with cereals was carried on in two groups, nursery planting and plot planting. The nursery planting included row trials with varieties of wheat, barley, and oats. About a hundred strains of hybrid wheats were also grown in rows for the purpose of comparison and for the establishment of type. The nursery planting also included breeding and straight selection with wheat, barley, and oats, using Centgener methods. By this process of selection strains of wheat and barley have been secured which yielded 10 and 15 per cent. respectively higher than the stock from which they originated.

The plot experiments included variety trials with wheat, barley, and oats. The plots were one-twentieth to one-tenth of an acre in size.

The fertilizer experiments were carried out on about thirty plots, upon which various amounts and combinations of commercial fertilizers were applied to determine their effect upon the yield and composition of wheat. These plots have been cropped for many years.

Rotation experiments were conducted on about fifteen plots. These are designed to determine the effect of summer fallow, and the use of various green-manure crops upon the yield of wheat as compared with continuous cropping.

Forage Crops.—Trial plots of maize, sorghums, Kaffir corn, and lucerne were also carried on.

Soudan Grass: An experiment with this new grass was being conducted to determine its value as a forage plant. No definite data regarding results was procurable. The crop was vigorous and healthy. Soudan grass is a true bunch-grass, after the manner of timothy, and is just as easily handled. It grows very tall, is very leafy, and produces splendid crops of seed. Depending on the rainfall, it can be cut from two to three times in a season. Sheaves of this grass sown in the Kansas State exhibit, Palace of Agriculture, Panama Pacific Exhibition, San Francisco, were 10 ft. high. It is said to grow well in moist soils in Kansas State, and makes excellent forage —superior to Kaffir corn or sorghum, because it is easier to handle and cures more rapidly. It is said to be a drought-resistant plant suitable for semi-arid regions; stand frosts; grows rapidly from seed. For a hay crop it should be cut when 3 ft. high. This would probably prove a suitable forage grass for northern parts of New Zealand.

Burr-clover.—A large number of varieties of this legume are under test. At time of my visit a crop for seed-production had been harvested but not removed from the plot: thus I had an opportunity of observing the many varieties as distinguished by their seed-pods. Many of the varieties would become a menace to wool-production if introduced into New Zealand, owing to the burr on the seed-pods. Burr-clover is used as a cover-crop in South California. The University of California has inaugurated an experiment to determine the value of legumes as winter-grown manure crops for citrus fruits. For this experiment the seeds of the following legumes are sown in September: Purple vetch, Tangier peas, species of melilotus, fenugreek, common vetch, lentils, burr-clover, bitter vetch, and Canadian field-pea. When the plants have grown they are ploughed under to a depth of 9 in. to 10 in. The soil is thus prepared for the planting or sowing of summer crops, which forms the second part of the experiment, from which the results of the nitrogen added by the various legumes are obtained. Vegetable and forage crops such as potatoes, sugar-beet, maize, sorghum, &c., are sown so that each cover-crop has growing upon it during the summer the same-sized plot in duplicate of each vegetable or forage used. Uniform cultivation and irrigation are given to all plots. Purple vetch (*Vicia atro-purpurea*) in these experiments has given the highest yield per acre of green crops, exceeding by 4½ tons that given by Tangier peas, which is the next highest, and 9½ tons more than Canadian peas, which gave the lowest yield.

Dairy Herd consists of Holstein, Jersey, Guernsey, Ayrshire, and grade cows. The soiling system is adapted to the feeding of the dairy herd—that is, they are not depastured, but are kept in a large yard adjoining the barn or milking-shed, and the food is placed for their consumption in racks and feed-boxes according to the nature of the food supplied. This consists largely in spring and summer of green crops, usually cut the day before they are to be fed to the cows in order that a portion of the moisture may be removed by drying in the sun and air, thus allowing the crop to wilt, which prevents the cows from becoming blown or hoven. This precaution is necessary with such succulent green crops as lucerne, clover, and tares. Corn or maize, both in its green stage and as ensilage, is largely fed to the herd; also lucerne in the form of hay is extensively used, as well as ensilage made from the roughage of the farm. A grain ration consisting of barley, bran, and in some cases oil-meal is fed in addition. A two-year-old Holstein Friesian heifer, bred and raised on the farm, and fed as above mentioned, produced 18·57 lb. of butter-fat in seven days. This is the Californian record for an animal of that age, and ranks well with the world's record for this age and breed.

Throughout the United States considerable interest is being attached to investigations of problems connected with the feeding of dairy cows with grain while at pasture, these being conducted at several of the experiment stations. For some years at the University Farm, Davis, investigations in connection with the value of barley for dairy cows fed alfalfa (lucerne) have been undertaken. The majority of dairy-farmers in the irrigated valleys of the Californian State depend upon lucerne for feeding their cows, and, as a rule, these receive no other feed the year round. The cows are pastured on lucerne during the summer, or are fed green lucerne in feed-racks in corrals (yards), and during the winter season they are fed lucerne hay either in the yards or in the barn (byre or cowhouse).

I was fortunate in meeting two of the principal investigators of these feeding problems when at the Davis Farm—viz., Gordon H. True, Professor of Animal Husbandry, and Fritz W. Woll, Professor of Animal Nutrition (the latter I had previously met and with him had acted as a member on several international juries of awards at the exhibition, San Francisco), who very courteously placed all the information available at my disposal.

Barley is the main grain crop of the Californian State, and, as a rule, the cheapest concentrate available for feeding farm animals, hence this grain is generally used for feeding dairy cows supplementary to lucerne. In order to secure definite information as to the value of this system of feeding the Animal Husbandry Division of the University Farm took up the subject for study.

Fourteen cows in the university dairy herd were made available for this experiment the first year, and eighteen cows the second year. These were separated into two lots as nearly alike as possible with reference to breed, age, weight, and production. The animals on the experiment were placed on one side of the University Farm dairy barn, the two lots being separated by an alleyway. Two small yards were thus available. One of these was assigned to each lot. The treatment accorded both lots of cows, and the conduct of the experiment in general, was identical for all cows except as regards the system of feeding adopted. The plan of the experiment initiated in 1913 called for three periods of three weeks each, and in 1914 for two periods of four weeks' duration each. For the 1914 experiment the cows in the two lots were fed as follows: Period 1 (23rd July to 20th August)—Lot A, lucerne only; lot B, lucerne and barley. Period 2 (27th August to 24th September)—Lot A, lucerne and barley; lot B, lucerne only. The food was placed for consumption in racks and feed-boxes in the corral or yard.

While on lucerne and barley the cows ate, on the average, an equivalent of 63 lb. of green lucerne, 13·6 lb. of lucerne hay, and 5·8 lb. of ground barley per head daily, and on lucerne only 75 lb. of green lucerne and 14 lb. of lucerne hay. On the former ration they produced on the average 19·3 lb. milk and 0·73 lb. butter-fat per day, and on the latter 17 lb. milk and 0·64 lb. butter-fat.

The results of these two experiments with feeding barley to cows on lucerne show that an immediate increase in production will be secured as a result of the grain-feeding, but that this increase will not, as a rule, pay for the extra cost of the ration. On account of the increased production obtained and the increased value of the manure from grain-fed cows, as well as the favourable influence on the condition of the cows and their offspring, it may be concluded, however, that the practice of feeding grain to cows on lucerne is economically sound and may be recommended. This holds true especially for heifers and young cows, as well as for heavy-producing animals which cannot be brought to a maximum production on roughage only, even if this be as excellent and palatable a feed as green lucerne or good lucerne hay.

National Irrigation.

Irrigation in the United States has increased from less than 100,000 acres fifty years ago to about 12,000,000 acres now. In North-west Canada more than 1,000,000 acres are irrigated. In California irrigated farms increased from 25,675 in 1900 to 39,352 in 1910, and the irrigated acreage increased from 1,446,114 to 2,664,104.

It is claimed for California that the agriculture of the future will be irrigated. All of California is not arid, but if plants are to be kept green and vigorous in midsummer recourse must be had to irrigation. The benefits are not difficult to trace. It is stated that wherever one finds the most valuable crops, the highest-priced land, the most compact and the most prosperous communities, there irrigation is found. The object-lessons are many and so convincing that the trend of public opinion is towards irrigated agriculture. The farmer with a water-right knows exactly what he can do. The element of chance is eliminated, crop-failure is reduced to a minimum. If he would put the benefit arising from irrigation into a single phrase it would be "the assurance of a good crop." Go into an irrigated district anywhere in our valleys and this is the confidence expressed: "We know what the harvest will be; we can figure out months in advance the tonnage from our lucerne-fields, from our beet-fields, or our potatoes."

Under the clouds the farmer's business is a good deal of a lottery. The questions are always, "Will it rain?" "Will it rain enough?" "Will it rain too much?" "Will it rain at the right time?" and he watches the weather-signs, lies awake at night, goes through anxious days. All this is dropped when he has water at his command: he gets moisture when he wants it. His lucerne-fields needs flooding, but over there are 10 acres of sugar-beet just maturing and needing the sun to store up sweetness. The strawberry-patch wants moisture, but the orchard just now would be injured by turning on water.

But the point is the quality and certainty of the crop. He is not only practically sure of a crop each year, but the crops are always of superior quality, grading No. 1. If the year is an ordinary or extra dry one the crop, as compared with dry farming, is increased two- and sometimes three-fold.

It is said there is nothing difficult or intricate about irrigated farming, and a single season suffices to master all its details as well as to show its great advantages. Of course, for the highest success, the farmer must be intelligent and must understand the elements in the composition of the soil on his farm, the crops best suited to that soil, and the value of rotation, and he must know also how much water or how little is necessary to perfectly mature his varied crops.

It is stated that the amount of time irrigation takes is about one-third of the time that the rainfall farmer loses by rains when he ought to be working, and by bad roads when he wants to haul his stuff. The crops by irrigation (according to the United States Government) average a little more than 50 per cent. more than the crops by rainfall. Following are the census figures:—

	United States at large.	Irrigated Lands.
Barley	20·40	30·30
Oats	29·60	31·40
Wheat	12·30	19·00
Potatoes	80·80	114·30
Hay (tons)	1·28	2·16

At the University Farm at Davis, and at several of the agricultural colleges visited, field laboratories for testing and demonstrating the use of standard irrigation measuring-devices are in process of development. These devices are installed to enable the farmer to view them and decide which is most suitable for his purpose. These water-gauges are a necessary concomitant to successful irrigation, enabling the farmer to apply just what quantity of water he desires to any given area.

Only a small portion of the University Farm (25 acres) is set aside for irrigation. The experiments, which were begun in 1907, are planned and carried out for determining the water-requirements of various standard crops—lucerne, barley, sugar-beet, corn, and potatoes.

From the experiments conducted with lucerne certain conclusions can be drawn from the results obtained, and the knowledge may be of service to farmers in New Zealand who purpose sowing this crop under irrigable conditions—viz., that "heavy spring irrigation, when followed by long periods throughout the summer without water, did not benefit lucerne." Examination of the root-growth under these conditions shows that water applied to the little plants in the early spring produces a root-growth outwardly along the surface of the soil rather than downward, and when this is followed by long dry periods the soil, drying out, leaves the young plants stranded above the moisture-zone. Far better results were obtained by delaying irrigation until the root-growth was well established, and even until the little plants seemed to be stunted and suffering from want of moisture. Well-developed, deep-rooted plants mean heavier yields. Late and very late summer irrigations tend to produce sturdier plants and heavier yields the following summer.

After the root-growth is well-established the growth may then be forced by frequent and, if the soil will stand it, heavy irrigation. In general, however, experience indicates that frequent shallow irrigations are to be preferred to occasional heavy floodings. From observations an irrigation of about three acre inches ten days before cutting the lucerne brings the best results on most soils. Irrigating at this time before cutting has a tendency to overcome leaf-shedding, and it should be remembered that the best part of the food-value of lucerne is in the leafage. Lucerne should not be allowed to become too mature before cutting, as when this occurs there is sure to be considerable leaf-dropping and food lost. There are two good rules to follow in determining time to cut. The first is to cut when an occasional blossom is to be seen in the field —this is a fairly good rule; but the second is to cut when new growth appears at the crown of the plant, and is perhaps more reliable.

Finally, the lucerne-planter should remember that he is dealing with a growth of high food-value, capable of being used as a ration for all farm-animals, and a plant that will continue to produce well through a generation and perhaps longer, and he should therefore spare no pains in getting the best results from his plantings. Proper care at all points is eminently essential, particularly so in the initiatory stages in having the land thoroughly clean, a good firm seed-bed, the seed drilled in in straight rows to admit of intercultivation being given, and the keeping thoroughly free from weeds until the plant becomes properly established.

Although farming by means of irrigation is to play a most important part in the future development of the State of California, still there is much land which must be farmed without water or not at all. On many extensive areas dry farming is largely practised. California is a large producer of cereals, wheat and barley being the principal ones. Large tracts are therefore farmed for their production, and dry farming is practised, which necessitates one-half of the land lying idle in summer fallow to retain sufficient moisture for the succeeding crop. This practice of dry farming is tersely summed up as follows: "Soil-moisture moves upward as oil climbs a wick, by capillary attraction. To prevent its rising to the surface and evaporating is the first aim of the wise farmer. This he accomplishes by cultivating, by extra and repeated harrowing, breaking the surface connection with the soil-pores or capillaries, and at the same time forming an open porous bed upon which the rain falls and percolates into the unstirred soil beneath. The 'Campbell method,' as it is called, involves the use of special instruments for packing the subsoil and for stirring and pulverizing the surface, but we need not consider these. Deep ploughing, harrowing the surface well as fast as ploughed, and then harrowing it after each rain until ready to seed, drilling the seed in deeply, and still harrowing the ground after every rain until the growing crop is too far advanced to make this safe, are the main features."

My next objective was the Truckee-Carson Irrigation Project, Nevada. Before dealing with this project it is advisable to refer to the "reclamation law" under which the vast irrigation projects throughout the United States are carried out.

Following a series of National Irrigation Congresses and extensive discussion during a number of years throughout the western country, an Act of Congress was finally passed, and approved 17th June, 1902. This Act, with its various amendments, has come to be known as the "reclamation law." The main provision of the law is for setting apart all moneys derived from the sale of public lands, and for the expenditure of this fund, under the direction of the Secretary of the Interior, in the construction of irrigation-works. Provision is also made for the perpetuation of the fund through repayment of the construction-costs to the Government by the beneficiaries of the system. Under these provisions the settlers on the reclaimed lands are virtually given a long-term loan without interest, the Government and local communities secure the productiveness and the settlement of their lands, while eventually the cost of reclaiming and utilizing these great latent resources in land and water is paid back into the fund for successive use in the same manner.

This Act, appropriating the receipts from the sale and disposal of public lands in certain States and Territories to the construction of irrigation-works for reclamation of arid lands, refers to Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Utah, Washington, and Wyoming, in all of

which, with the exception of Kansas, irrigation projects had been initiated up to 1914. In fifteen of these States up to that time thirty separate projects had been constructed at a total cost of nearly £16,000,000. The building cost of irrigation-works for the 1,200,000 acres now under ditch has averaged about £10 per acre.

To understand the magnitude of these great reclamation projects it is necessary to consider the following work which has so far been carried out and completed in building these: 5,000,000-acre feet capacity of reservoirs; 9,000,000 cubic yards of material in dams; 2,000,000 cubic yards of cement masonry; 100,000,000 cubic yards of material excavated; 8,000 miles canals constructed; 22 miles tunnels; 82 miles dykes and embankments; 14 miles bridges; 22 miles culverts; 160 miles pipe-lines; 76 miles flumes; 51 miles railroad; 2,300 miles telephone-line; 360 miles electric transmission-line; 33,000 electric and steam horse-power developed; 400,000 barrels cement manufactured; 1,600,000 barrels cement used; 30,000 tons coal mined.

The Truckee-Carson Irrigation Project.—This project embraces a total area of about 206,000 acres of land in western Nevada. Of this area, over 50,000 acres are under irrigation, most of it lying near the Town of Fallon. About half of these irrigated lands are public lands under homestead entry, and the balance are in private ownership covered by water-rights more or less complete. Similar lands to those already occupied are available for purchase at prices averaging £1 10s. per acre.

The ruling size of farm is 80 acres, containing usually not less than 40 irrigable acres. It is possible for lands in private ownership to acquire water-rights up to 160 acres, but with further extensions of the project and improved methods of cultivation the tendency will be, it is said, toward the adoption of the 40-acre-farm unit, which is found to be ample when intensively cultivated for the support of a family.

The project is situated in latitude 39½° N. The general elevation of these project lands is 4,000 ft. above sea-level. Temperature ranges from zero to 100° above zero. The annual precipitation or rainfall averages 4 in. Snow rarely falls, and usually does not remain more than a day or two. The air is extremely dry. It is said that humidity is seldom felt, and the climate generally is temperate and delightful. Owing to the altitude early and late frosts are to be expected, but these, as a rule, do not interfere with the great variety of crops usually grown. Wind and dust storms, however, are occasionally experienced. Although disagreeable, it is said that they are not usually destructive.

The water-supply is obtained from the Truckee and the Carson Rivers. These rivers, like all other streams flowing eastward from the Sierra Nevada Mountains, extend a comparatively short distance into the arid plains, where, under normal conditions, they are evaporated from the lakes or sinks which characterize this region. None of these intermountain streams have an outlet to the sea. The water-supply comes almost wholly from the accumulated snowfall on the high Sierras. This deep deposit of snow is rapidly melted during the spring and summer, and this produces the floods which it is the object of the Reclamation service to conserve and utilize.

The cost of building the irrigation system is now fixed at £12 per acre. The terms of payment cover a total period of twenty years for payment of the building-cost, with graduation of payments so as to favour the settler in the earlier years when he needs all his money for farm development.

The soil varies greatly. While sand, sandy loam, and volcanic ash predominate, clay and adobe soils also occur. Certain areas in every portion of the project may be found where the soil is covered with a crust or layer of alkali, and on some of these lands, where the alkali is not disturbed by irrigation, the deposits are said to be annually getting thicker.

The valley produces under irrigation every variety of crop grown in the North Temperate Zone. Lucerne, wheat, barley, and oats grow luxuriantly, and sugar-beets are a profitable crop. Potatoes, celery, asparagus, cantaloups (a variety of musk-melon of delicate flavour, greatly esteemed by Americans and extensively used) are shipped for special dining-car and hotel consumption. Onions and other vegetables are raised at a good profit. Lucerne is the great money crop of this region. It is sown any time after the 1st March until the end of August. April, May, and August are found to be the best months. The rate of seeding is from 12 lb. to 20 lb. per acre. It is generally broadcasted and harrowed in, but it is preferable to put it in with the grain-drill to a depth of 1½ in. in sandy soils and in heavier land not so deep.

An up-to-date creamery costing £2,400, which is well established, is now taking the produce from 1,503 milk cows. The average price per pound paid for butter-fat in 1914 was 27·3 cents, or 1s. 2d. of our money.

A modern beet-sugar factory equipped for handling 500 tons of beet daily is situated in the Town of Fallon within the irrigation area.

Clearing and levelling the land: This irrigation project is situated in one of the driest regions in the United States. The native vegetation is extremely sparse, and is chiefly greasewood (*Sarcobatus*), rabbit-brush (*Chrípomanthus*), and sage-brush (*Artemesia*). To prepare the desert soil for irrigation it is first necessary to clear the land of the brush that grows on practically all the soil suitable for crop-production. This can be done by grubbing, dragging a rail-road-iron over it, or, where it is not too large, by disking with the common disk harrow. Some of the land on the project is naturally almost level, consequently the cost of getting it ready for crops is very low. Other areas are covered with small sandhills. The cost of clearing and levelling the land varies from £1 12s. to £20 per acre. Most of it can be cleared and levelled at a cost of £3 to £7 10s. per acre.

The object of my visit to this part was the Truckee-Carson Experiment Farm, which was established by the Bureau of Plant Industries of the Department of Agriculture, United States of America, in 1906.

The farm is situated one mile south of the Town of Fallon, Nevada, within the irrigation project, and consists of 160 acres. Mr. F. B. Headley is farm superintendent, and he very courteously showed me around the farm and over a considerable area of the irrigation project.

The reclamation of lands containing alkali salts in excess of the amount tolerated by lucerne and other cultivated crops is the problem to which the greatest amount of attention has been given since the establishment of the farm in 1906.

A large part of the soil of the experiment farm is non-productive; some of it is of such a nature that no crops have been produced therefrom although farmed for seven years; other portions are as fertile as could be desired, and heavy yields of lucerne and truck (garden vegetables) crops are obtained. The low productivity of these soils is owing to the presence of an excessive amount of one or more of the alkali salts.

The experiments already conducted go to show that to reclaim permanently lands of this alkali character it will be necessary to cut off the seepage or lower the water-table by means of drainage to such a depth that there can be no further rise of water from beneath. When this is done the salts, being once removed, will not again return to the upper soil, and the reclamation is permanent so long as the water-table remains at a sufficient depth beneath the surface.

One of the important lines of work at the experiment farm is the testing of trees and shrubs to determine which kinds are best suited to the conditions of the project. It must be borne in mind that the lands of the project are naturally almost barren of vegetation, so that it is important that suitable plants for shade and ornamental purposes be found and that their growth be encouraged. The following trees and shrubs have been found to be well adapted to the project: Carolina poplar, Norway poplar, Chinese balsam poplar, black-locust, Russian golden willow, Russian oleastis, American elm, Karagatch elm, and a tall-growing willow from China; and these are distributed in large numbers each spring to residents of the project.

Eleven varieties of lucerne grown from seed sown three years ago are grown in a duplicate planting of rows 30 in. apart. The results of a test covering three years have been quite uniformly favourable to the Grimm, which is one of the hardiest varieties known.

Eighteen varieties of tomatoes were tested in duplicate lots in 1914. The highest-yielding variety was Perfection.

Sweet or Bokhara clover has been grown for a number of years at the experiment farm, usually on soils where lucerne does not grow well. The experience gained is that it can be grown successfully on soil containing more black alkali than is tolerated by lucerne. It has been found that if the crop is cut before blossoming live-stock soon learn to eat it. It has been observed that some horses and cattle eat it as readily as they do lucerne, while it is apparently disliked by others.

Mr. Headley does not recommend that this crop be grown on land that will grow lucerne successfully. Sweet-clover has been considered an undesirable crop to grow in some parts, but farmers on the Truckee-Carson Project have come to think well of it.

Co-operative work with farmers: The soil of the experiment farm not yet being considered in suitable condition for experiment crop work, it has been found advisable to conduct some of the more urgent crop tests on adjacent older farms where the soil is better adapted for the work. These consisted of variety tests of the following: Fodder-corn or maize, sorghum, wheat, oats, maize, potatoes, and onions. All were tested in duplicate lots.

The success of this great irrigation scheme is beyond question when it is considered that this project is recovering from desert conditions 206,000 acres of what was once called the Forty-mile Desert. Converting that desert, which formerly only produced sage-brush and other allied desert scrub, into luxuriant fields and beautiful gardens on which now grow extensive areas of cereals, forage, and other crops giving high yields and of excellent quality, vegetables, fruits, and flowers, where dairying is now one of the established industries, and cattle are bred and fattened, and where sugar-beet is one of the staple products, produced in such quantities as to be capable of supplying a modern beet-sugar factory equipped for handling 500 tons of beet per day, one cannot but realize what possibilities there are in New Zealand, with its unlimited water-supplies, were such a scheme adopted and carried out on many parts where there are extensive areas suitable for irrigation now producing little or nothing.

Grand Junction, Colorado.

The area of the State of Colorado is 66,526,720 acres. The area of the arable land is, approximately, 22,400,000 acres; the area of lands which can be placed under irrigation is 6,000,000 acres; the area of land irrigated and in actual cultivation is 3,000,000 acres. The average annual cost of water per acre to the farmer is 3s. The population of the State of Colorado at the last census (1910) was 799,024.

Diversified farming is carried on in the State. Fruit and vegetable production is amongst the principal industries, and the ability to irrigate the lands enables wheat, oats, and barley to be grown successfully and profitably. Lucerne is the staple hay crop in all parts of Colorado, growing in localities as high as 8,000 ft. in altitude. Four to six tons to the acre is the average yield of lucerne hay.

Colorado is the largest beet-sugar-producing State in the Union, so that a very extensive area of sugar-beet is annually grown to keep some twenty or more sugar-factories in operation. Potatoes are extensively grown. Poultry-raising and egg-production also are amongst the industries to which considerable attention is given.

Colorado claims to have produced the first irrigated fruit in the United States. It also claims that in open competitions and in market returns for the last quarter of a century Colorado remains the banner fruit State of the Union. About one-fourth of the annual value of the

agricultural output of Colorado comes from the fruit-farms. Year after year more trees are being planted. The fruit regions of Colorado are all on the western side of the "Rockies," with the exception of a few well-sheltered valleys on the eastern slope. The apple is the great staple fruit crop. It is grown on both slopes, and as high as 7,000 ft. in elevation.

The peach is said to be the bonanza (mine of wealth) fruit crop of Colorado. Elberta is the queen of Colorado peaches: its superiority is acknowledged, as it has never failed to dominate every market it has reached. Peach-trees in Colorado come into profitable bearing in three years, and after twenty crops are still vigorous, producing excellent crops. In the fruit section of Colorado the canning of peaches is a growing industry. The canneries pay £6 per ton for fruit just as it comes from the tree. Yields of 15 tons per acre are not uncommon. The net return, after paying all expenses of packing and delivering, frequently runs above £60 per acre.

The worst enemy of the Colorado orchardist in the past has been spring frosts. Now he does not fear them. Armed with orchard-heaters or "smudge-pots" he can fight the frosts. In 1908 these were first tried to any extent. It can now be taken as an accepted fact that a Colorado orchard in the fruit-belt can be depended upon for a crop every year if the owner will simply provide himself with a means of protection. A peculiar advantage that Colorado enjoys is that these cold snaps come without violent winds, and therefore it is possible to heat an orchard and hold the heat in the trees. There are two types of heaters used by Colorado orchardists, one burning coal and the other crude oil. It is said the coal heaters seem to have some advantage in cost of fuel, while the oil heaters claim supremacy in the production of heat and quickness and ease of operation. The coal heaters are sheets of iron or wire baskets. A handful of cotton-waste soaked with oil is put at the bottom; over this is put dry wood, and on top about 10 lb. of coal. When the alarm of "Falling temperature" is given the orchardist lights the oil-soaked waste, and in a few minutes the coal is a glowing mass, radiating a large amount of heat, while the smoke hangs about the upper branches of the trees, acts as a blanket, and prevents radiation.

The oil heaters are of various patterns, ranging from a common sheet-iron bucket to elaborate and complicated Argand burners.

An average crop of fruit in Colorado is generally worth from £60 to £200 per acre net, and to equip an orchard with heaters, including a year's fuel-supply, ranges from £5 to £9 an acre. Once equipped the heaters will last indefinitely. The average cost need rarely exceed £1 per acre per annum, including fuel and labour—surely a cheap way of insuring against spring frosts!

My visit to Grand Junction was to view the land which comes under the Grand Valley Irrigation Project; to note the effects of irrigation on hitherto desert lands; to visit the large sugar-factory, the first established in Colorado, and one stated to be uniformly successful; and to gain some knowledge of co-operative marketing and the aims and working of associations like the Fruitgrowers' Association. In this connection I have to acknowledge the courtesies extended to me by Mr. Aupperle, secretary of the Water-users' Association; Mr. L. Antles, secretary, Chamber of Commerce, Grand Junction; and Mr. W. Harrison, County Agriculturist, Mesa County.

The plan of the Grand Valley Irrigation Project provides for the irrigation by gravity of 42,750 acres, and of 10,250 acres by electrically operated pumping plants located on the gravity canal.

Situated in latitude 39° N., the average elevation of the irrigable area is 4,700 ft. above sea-level; the temperature ranges from 15° below to 100° above zero, and the rainfall on the irrigable area is about 8·5 in. annually. The Denver and Rio Grande and the Colorado Midland railroads connect the Project with markets of the Mississippi Valley and the Atlantic and Pacific coasts.

The lands included in the Grand Valley Project consist of two general types—sandy loam and heavy soils; the former adapted to the growing of the fancy fruits for which the valley is justly famous, and the latter for the general crops of cereals, sugar-beets, lucerne, &c. The co-operative spirit is strongly developed in the district in producing and marketing, and in manufacturing organizations.

The foundation upon which the growth and prosperity of Grand Junction rests is fruit. The town and its environs has a population of over eight thousand people. Directly about Grand Junction is 25,000 acres of land in fruit or suitable for fruitgrowing, with about 8,000 acres in full-bearing orchards. The town itself is on low-lying ground close to the Grand River, surrounded by orchards, which spread out, rising ridge upon ridge, in all directions. North of the town is the celebrated Fruit Ridge district, a series of red sandy ridges, where are, it is said, the finest and most successful apple and pear orchards in the country. It is contended that the Grand Valley ships every year more fruit than some of the States that are considered fruit-producers. Frequently there have been over a hundred cars a day loaded and shipped, and in the shipping season, from August to March, from twenty to thirty cars per day are loaded and shipped away to various parts of the United States. I had an opportunity, through the kindness and courtesy of Mr. Harrison, County Agent, of seeing a very large area of the country around Grand Junction and the splendid orchards stretching everywhere laden with fruit.

The value of orchard-heaters was conspicuously noticeable where orchardists by using heaters had saved their season's crop of peaches, whereas in other orchards where the owners had neglected to take precautions to prevent injury by spring frosts the trees were bare. That this new form of "crop insurance" pays there can be no doubt. It is seldom necessary, as spring frosts are not frequent, but effective when needed.

The local beet-sugar factory is an important industry, and is well supplied from year to year with the raw material for the production of sugar. The residue is readily bought up by the dairy-farmers, who feed it to their dairy herds along with other suitable foods. The price

paid to farmers by the factory for sugar-beet averages £1 per ton of 2,000 lb. It is reckoned that it takes a crop of from 12 to 15 tons per acre to pay the grower.

The Grand Junction Fruitgrowers' Association is a very live concern, and is stated to be of incalculable benefit to the fruitgrowers in the district. Growers deliver their fruit at the depot, which is situated on one of the railroads in the town, where each case of fruit is at once opened and graded according to the variety and quality of fruit it contains. All fruit graded the same quality is shipped in cars and sold as one lot no matter to whom it belonged. The association knows where the best markets are to be met with and the quality of fruits required in different places, and so regulates the supplies to markets and prevents glutting. The system of handling, booking, and selling, &c., adopted by the Fruitgrowers' Association is on the most up-to-date lines. Immediately the grower delivers his fruit at the depot he need take no further concern regarding it, as he knows that the best possible price will be obtained and at the lowest cost for marketing.

Travelling eastward from Grand Junction by railroad, 1,428 miles from San Francisco the crest of Tennessee Pass, in the Rocky Mountains, is reached, at an altitude of 10,240 ft. above sea-level. Here the Pacific slope is changed for the Atlantic. This is the top of the continental divide. As the train travels down the eastern side of the "Rockies" through the valley of the Upper Arkansas amidst hay and cattle ranches, the contrast between the arid and desert country left behind on the Pacific slope and the verdant aspect of the country on the eastern side was great. This I was given to understand was owing to the abnormal rainfall on the Atlantic side during the summer and autumn months of last year.

Colorado State Agricultural College, Fort Collins.

In the absence of the president of the college, Professor C. A. Lory (to whom I had a letter of introduction from Mr. Blanchard), Mr. Alvin Kezer, Professor of Agronomy, Dr. E. P. Sandsten, horticulturist, and Mr. L. M. Taylor, secretary and purchasing agent, all members of the college staff, very courteously showed me around the college grounds and farm and gave all information desired.

The college is situated in latitude 41° N. The area of the farm is 450 acres, and at the foothills and hill country 1,300 acres, making 1,750 acres available for educational operations. For the use and support of the Agricultural College 90,000 acres have been set apart.

Iowa.

The State of Iowa consists approximately of 35,934,080 acres. It is claimed for it that although it ranks fifteenth in population and twenty-third in area of land, in percentage of land improved and total area in farms it ranks first. In the report of the Bureau of Crop Estimates of the Department of Agriculture for 1914 Iowa stands first in production of bushels of oats and corn (maize) and also in tonnage of forage crops. In 1913 there were 3,000,000 acres under hay crops, which produced 4,440,000 tons (of 2,000 lb.) of hay, and its farm value being £8,526,000, Iowa therefore can be reckoned according to area to be the leading agricultural State. It also takes first place in regard to the value of its horses, cattle, and hogs. Its mean annual precipitation (rainfall and melted snow) is 34 in. The population of Iowa according to last census (1910) was 2,224,771.

The State Agricultural College is situated at Ames, in latitude 42° N. The college is recognized as being one of the foremost in the Union. In the absence of the president, Mr. H. L. Russell, Dean and Director, Mr. William H. Pew, Professor of Animal Husbandry, showed me every courtesy and went to a great deal of trouble to forward the objects of my visit to that institution, as did also Mr. Stevenson, Professor of Agronomy.

The cereal crops had all been harvested before my visit. A large variety of other crops were also grown on the experimental area at the college. The season had been a very wet one.

The educational ramifications of the college are very extensive throughout the State, and embrace many projects for the advancement and mutual help of the State settlers. As many of these educational branches are common to all colleges in the United States they will be dealt with under one head. One only need be given here, "The Iowa Agricultural Experiment Association." This is an organization in which the farmers of the State and the Iowa Agricultural Experiment Station co-operate for mutual help. The president, vice-president, and twelve district representatives are progressive, practical farmers; and the treasurer and secretary and director of experiments are members of the experiment station staff.

The general objects of the association are set out as follows: To foster a spirit of investigation and co-operation among the farmers, and to develop a more intimate relationship and a more complete bond of sympathy between the farmers and the experiment station, as well as to assist the farmers in solving their local problems by means of local experiments on their own farms; and to encourage the growing and handling of improved varieties of crops in a careful businesslike way for seed purposes, so that, as far as possible, there may be a good and pure local supply for every need, and so that by co-operation of the members in a given locality car lots or even train lots of uniform quality and of a single variety may be furnished to the trade on demand.

The immediate objects of the association are to encourage a more general use of lucerne as a farm crop, and to enable the farmers to learn, by experimenting on a small scale, how best to grow and handle this crop under various local conditions; to conduct such local experiments and demonstrations as will enable the farmers, if possible, to secure a good stand of red clover year after year, instead of failing very frequently, as they now do; to make tests of the use of lime and rock-phosphate applications on the various soil types of the States; and to distribute

pure seed of superior pedigreed varieties of cereal grains, which may be originated at the experiment station from time to time, for many local tests, in order to determine their areas of adaptability and to introduce them into general culture in those areas.

The experiments conducted are in connection with wheat, corn (maize), oats, barley, lucerne, red clover, and liming of land, &c.

In 1914 there were over a thousand co-operators at work, each conducting an experiment on his own farm.

In the wheat experiment two proven quite superior varieties to the parent varieties, and two commercial varieties in tests made at the experiment station, were distributed. For No. 1 experiment 1½ bushels seed of one variety was provided, and for No. 2 experiment 5 lb. seed of each of two varieties. No. 1 experiment required two plots, 1 acre each in size—one plot to be sown with the variety commonly grown in the locality, the seed for which the farmer provided, the other plot to be sown with the new variety provided by the experiment station. No. 2 experiment required three small plots, each one-twentieth of an acre in size—one plot to be sown with the locally grown wheat, and the other two plots with the two new varieties furnished by the experiment station. The experiment station charged the farmer 10s. for the seed-wheat of the new varieties supplied. No special preparation of the land was required, but both plots had to be treated in the same way, and the seed had to be sown at the same rate and on the same day so as to make a fair comparison. It was particularly stipulated that no farmer need apply unless he was prepared to make the test carefully and report results on forms furnished, and in his application for the experiment was required to sign an agreement to that effect.

Oat Experiments.—Experiment No. 1: Two special varieties of oats besides the variety usually grown by the farmer were required to be sown on three plots each one-twentieth of an acre in size. The seed was supplied free, the experimenter paying carriage to farm. Experiment No. 2: This experiment required two plots each 1 acre in size: 2½ bushels of seeds of a special variety was furnished by the association for one plot, for which the experimenter had to pay 12s. to cover the cost of seed and carriage; the seed for the other plot was to be supplied by the experimenter, the variety usually grown in the district. Only one of these 2½-bushel plots to be given in each county.

Barley Experiments.—Testing two special varieties against the variety usually grown, three plots each one-twentieth of an acre in size being required. Seed furnished free; experimenter to pay carriage.

Corn Experiments.—A comparison with special variety against the variety usually grown. Two plots, quarter-acre each, required. Seed free.

Lucerne Experiments.—No. 1: A test of application of lime and inoculated soil. Four plots, each one-twentieth of an acre in size. Seed and inoculated soil furnished free; carriage to be paid by experimenter. No. 2: Inoculation of soil and seed sown at different dates. Four plots, each one-twentieth of an acre in size. Seed and inoculated soil furnished free; carriage to be paid by experimenter.

Red Clover Experiments.—No. 1: Seeding clover with oats as a nurse-crop, using different quantities of oats per acre. Three plots, each one-twentieth of an acre in size. Clover-seed furnished free; carriage of seed paid by experimenter. No. 2: Same as previous experiment excepting that plots may be any size. This experiment is designed for men who prefer to furnish their own seed and use larger plots. The association furnished instructions only.

Lime Experiments.—Applications of ground limestone or limestone-dust to the soil to study its effects on succeeding crops, particularly clover. Two plots of equal size, each plot being from 1 to 2 acres. To any group of farmers at a single shipping-point who will club together to conduct this test a car of limestone will be shipped free, the farmers to pay freight only, and each farmer to take an equal share of the limestone for an experiment on his farm. Complete instructions are furnished, and farmers undertaking this experiment are asked to report on it for two seasons at least.

The association points out that these tests are for the benefit of the farmer, for the benefit of the locality, and for the benefit of the State, and asks that these be conducted according to simple instructions furnished by the Director of Experiments, Iowa Agricultural Experiment Station.

Experimenters are asked to make the plots exactly the right size, and to be as accurate as possible with the work throughout; to keep the plots and roadways clean and neat, so that they will feel like inviting their neighbours to see the test; and that they make close and accurate observations themselves, call the attention of as many as possible of the neighbouring farmers to their experiments, and discuss the results with them. They are also asked to be careful to prevent the mixing of varieties, so that if the new variety proves good the association can handle their crop for pure-seed purposes.

Dairy Farms at Waterloo.

My visit to these farms was at the instigation of Mr. W. W. Marsh, of Waterloo, Iowa, State Commissioner at the Panama Pacific Exhibition, San Francisco, who, being aware of my mission through the United States, kindly arranged for me to visit his dairy farms (fifteen in number) in the rich agricultural district of Waterloo. Mr. Marsh is a prominent member of agricultural institutions, and well known throughout the States as one who takes a keen interest in all phases of agriculture, besides being a breeder and owner of the finest purebred Guernsey herds in the United States. He rendered great service to my mission by using his personal influence with persons in agricultural institutions prior to my visiting these, in a manner preparing the way for me and making my journey eastward very pleasant, for which courtesy I desire to express my sincere gratitude.

To keep his herds up to the highest standard Mr. Marsh makes periodical visits across the Atlantic to the Island of Guernsey and the south of England, and secures the best animals that money can buy, with the result that his herds are famed throughout America and hold the highest positions in the show-ring as well as records in milk-production. As the Guernsey breed is not so well known in New Zealand as some of the other breeds, it may be of interest to give particulars in regard to a few cows comprising this famous herd :—

Glencoe's Bopeep, 18602: Official yearly record, 13,121·70 lb. milk, 622·61 lb. fat; thirteen times grand champion at State fairs and National Dairy Shows; grand champion over all breeds at 1912 National Dairy Show. Jessy Rose, 28373: Official yearly record, 12,694·60 lb. milk, 646·03 lb. fat; grand champion cow at National Dairy Show, 1913. Elberon's Glenwood, 28934: Official yearly record, 15,689·80 lb. milk, 825·90 lb. fat. Dairymaid of Pinehurst, 24656: World's champion of all breeds; 860·26 lb. fat; one time Guernsey champion rising four-year-old; official record, 17,285·30 lb. milk, 910·67 lb. fat.

His herds were all in the pink of condition at time of my visit, quite a large number being ready for exhibition and competition at the forthcoming cattle fairs or shows throughout America, showing great quality and with the points indicating great milk-production very pronounced. One could not but be impressed with their size, being large-framed and evidently hardy and strong-constitutioned. They were very docile and easily managed. I was given to understand that the Guernsey breed in America stand fairly severe weather-conditions.

In the State through which I travelled the dairy cattle are housed in summer as well as in winter. Many of the barns (byres or cowsheds) on Mr. Marsh's farms are built on the most modern and up-to-date lines, where both light and ventilation with perfect sanitary conditions are marked features.

University of Wisconsin Agricultural Experiment Station.

This station is situated at Madison, Wisconsin, approximately in latitude 43½° N. The area of the State of Wisconsin is 35,882,240 acres, and the population at the last census (1910) 2,333,860. The mean annual rainfall amounts to 31 in.

In the absence of the President of the University, Mr. E. H. Farrington, Professor of Dairy Husbandry, whom I had met at the Exhibition at San Francisco, where we both acted as members of the International Juries of Award, kindly undertook to show me over the college buildings and experimental farm, and, together with Mr. R. A. Moore, Professor of Agronomy, gave me every facility to acquire information in relation to the scope of the operations, experimental work undertaken, and means adopted for the dissemination of agricultural education and development throughout the State.

The departmental activities of the college are very extensive, embracing, amongst others,—

Examination of Soils and Analyses.—The fee for this service is £1 for the field examination and chemical analysis of areas not exceeding 160 acres, with an additional charge of 12s. for each quarter-section or part thereof.

Soil-fertility Demonstrations.—These consist of demonstrations as to the use of phosphorus fertilizers on upland soils; use of lime for correcting acidity; management of marsh soils, including the fertilizer requirement, methods of tillage, and crops to which they are adapted; management of sandy soils so as to improve their fertility and water-holding capacity; the management of heavy clay soils, especially with reference to tillage; and special methods of tillage, such as deep tillage on clay and silt-loam soils.

Drainage-work.—In this farmers desiring to improve their wet lands by drainage are assisted by the Soils Department. Where possible the department sends a staff member to make the necessary preliminary examination to determine the feasibility of drainage and the best and most economical methods of accomplishing these results.

The Legislature has enacted a drainage law under which drainage districts are organized, making it possible to reduce the amount of time necessary to conform to proper Court procedure. It also requires the College of Agriculture to submit a report on the quality of the soil in the proposed district, the feasibility of drainage, the probable benefits of such improvements, the approximate cost of construction, and the probable distribution of the benefits throughout the district.

Crop Demonstrations on County and State Farms.—Demonstration work on the various county asylum farms and some of the State institutions has proved a most admirable method of disseminating desirable agricultural practices, while at the same time it has served to develop community life. A large number of experiments have been projected, and the managing authorities of these farms have co-operated most cordially in the execution of the necessary work which would best portray the lesson to be learned.

In this way it has been possible to test nearly all soil types and different climatic conditions found in the State of Wisconsin. The work is done on large fields under normal conditions, so that the criticism which is often made that work under such institutions is not on the same basis as the farmer's work cannot obtain. By repeated trials of this sort on any farm for a number of years the natural variation due to abnormal weather-conditions is overcome. Some of these farms have thus become very important seed-producing centres.

Every effort is being made to encourage lucerne-growing, using inoculated soils and cultures. Lime trials have also been made.

Towards the end of summer and the beginning of autumn what are known as basket picnics are held at most of these farms, and the surrounding farmers are thus given an opportunity to see the plots and fields in a growing condition. A large number of these meetings are held annually, the aggregate attendances at these in 1914 being 4,845.

Seed-grain Dissemination.—The Agronomy Department (the department versed in the science and management of the land) has developed a number of avenues through which it has been possible for it to disseminate the pedigreed and selected grains which it has found best adapted to the varying conditions in the State. The main channel of this dissemination-work is the Wisconsin Agricultural Experiment Association. In 1914 1,500 members of this association co-operated with the college in testing the grains and forage plants on their farms before the seed was disseminated.

The appointment of a field inspector to examine the condition of growing grain has greatly improved the quality of the seed product. The members of the Agronomy Department aid in this work. A large amount of acclimated seed is also distributed by the department. Over four hundred farmers carried out tests with barley, maize, oats, peas, ryecorn, soy beans, spring wheat, or winter wheat. Through the medium of the schools contests have been held.

Bankers' Seed-grain Contests.—Through the medium of the State Bankers' Association, one of the most fruitful co-operative enterprises in which the Wisconsin Experiment Station has been engaged has been developed. For several years pure-seed contests have been held under the auspices of the local banks in the several communities. In 1914 sixteen such contests were held. Not only have these meetings been very helpful in the dissemination of improved seeds, but the co-operation of the business man and the farmer has aided much in the development of the community spirit.

In 1913 there was started the *Wisconsin Bankers' Farm Bulletin*, and this has been continued by the State association. Members of the college staff write the material for such a publication, which is issued monthly, and 30,000 copies per month have been distributed by ninety different banks.

Young People's Grain Contests.—For nine years grain-contest work has been carried on by the State Agronomy Department, county superintendents of schools, and county fairs. The interest developed in these contests continues to increase from year to year in no uncertain way. Through the provision of the Lever Bill, which is explained and dealt with further on under the heading "Agricultural Extension Service," this development has received a great impetus. Thirty-four contests were held in 1914 in thirty different counties. Sufficient seed was sent out to supply 12,200 young people with grains for small-plot work. Professor Moore informed me that for the coming season he expected that fully 25,000 young people would participate. The winners in these county contests are given scholarships which defray their expenses in attending boys' courses at the university during the farmers' week. Last year 154 boys were thus brought together for a week's work at Madison. For the coming year efforts have been made to emphasize the acre contests of maize, barley, &c., and those who have been in quality contests in the past will be encouraged to grow in the yield contests. The seeds for these acre contests are pedigreed varieties tried out at the college, and are supplied free. The boys are all sons of farmers living on farms, and under sixteen years of age. The boys have to send a report to the college *re* cost of growing, &c. Then they exhibit the product at the county fair in the fall, and the boy making the best exhibit gets his expenses paid and a scholarship to attend the college for the short course, which is for two years of fourteen weeks' duration.

Weed-eradication.—It has been found that co-operation with farmers in weed-eradication can be secured only by educational demonstration. This is effected mainly through the county representative or agent, whose status and duties are dealt with further on, and some of the members of the Experiment Association arranging for co-operative work to be done on farms where the progress of the work could be closely followed. During the past year thirty-seven co-operative trials in nineteen counties have been carried out, devoted particularly to couch-grass and Canadian or Californian thistle (the former name is the correct one to use).

Lucerne Work.—The importance of lucerne, and the fact that the great majority of farmers have had no first-hand experience with this forage plant, has made it quite essential that thorough trials should be carried out in order to determine the most suitable methods of cultivation and management. The propaganda work with reference to this forage plant has been rapidly extended through the organization of the Alfalfa Order of the Experiment Association. This association began three years ago with a charter membership of twenty-one; there are now over fifteen hundred paid-up members enrolled. Through this agency it has been possible to secure widespread co-operation in many problems of importance to the cultivation and handling of the crop. Last season there were 1,120 co-operative field tests. A feature of the operations of the association is the co-operative buying of lucerne-seed for its members. During the year over 60,000 lb. were disseminated in this way, at a saving of from 8s. to 12s. per bushel on the price of seed, while at the same time seed of uniform quality and of definite varieties was secured.

White-grub Control.—This pest has assumed such ominous proportions in recent years in many parts of the State that the Legislature in 1913 made a special appropriation for remedial work to be done by the Nursery and Orchard Inspection Service. Through posters and Press bulletins, information regarding the effect of early ploughing, summer fallowing, and rotation of crops has been given. Considerable relief can be secured by the exercise of these preventive measures. Experiments were also instituted with trap-lanterns to catch the adult beetles which are the mature insects producing the white grub. By means of brilliant lanterns of over 300 candle-power suspended over containers of kerosene and water it has been possible to catch hundreds of thousands of the adult beetle.

Community Live-stock Breeding Associations.—This movement has attained such vast proportions that Wisconsin is regarded as the leading State in the Union for organized community breeding operations. Ninety-one associations are now organized and banded together for better animals and better methods of management of live-stock. At thirteen association meetings lectures

or demonstrations have been given by the Department of Animal Husbandry. The department has conducted in stock-judging work at county fairs and elsewhere 214 exercises.

Agricultural-extension Service.—This is a feature in connection with agricultural propaganda work which in recent years has been widely expanded through the different States. When an important method has been devised or a discovery made by the agricultural-experiment station the work is then only half-done. To render the results effective and of use it must be applied, and to do this effectively the final stages of experimentation require testing under diverse field conditions to prove or disprove the applicability of the discovery or method to common practice. Only after it has stood the test of these conditions is it ready to be used or applied by the farmer in his regular operations. The most effective means of inducing a farmer to take action is by practical demonstration methods conducted under the supervision of the staff of the department on his own farm. At the present time a growing percentage of the energy, time, and resources of the college staffs throughout the States is being turned into these practical channels, carrying the results of research to the man on the farm who is to apply directly the results of science.

Through the passage of the Smith-Lever Extension Bill by Congress it is made possible to organize this service on an adequate basis. This law came into operation on the 1st July, 1914. Its scope is as follows: The Bill provides each State with a basal appropriation of £2,000 annually. Supplementary funds are then to be made available, which amounts are to be increased annually for a period of eight years, provided the State appropriates for specific agricultural-extension purposes an amount which is equal to that furnished from federal sources for all sums in excess of the initial £2,000. This supplementary federal appropriation for the year 1915 consists of £120,000, which sum is to be divided among the several States in the proportion which the rural population of each State bears to the total rural population of all the States. This additional sum for Wisconsin will amount in 1915 to £3,220. This sum is to be increased by additional federal appropriations amounting to £100,000 each year thereafter for a period of seven years, to be divided on the same basis. This makes in all a federal appropriation for use in all the States amounting in nine years to £916,000 annually. On the basis of the last federal census, at the end of nine years from the 1st July, 1914, Wisconsin's share will be £21,940 annually, provided the State meets the federal appropriation pound for pound after the first £2,000. These funds can only be used for definite extension projects in agriculture and home economics, which must first be approved by the Secretary of Agriculture. It is anticipated that the provision incorporated of making this appropriation available only upon the specific appropriation by the State will doubtless result in much more cautious expenditure than would be the case if federal grants were made without restriction.

The agricultural-extension service at the University of Wisconsin is organized under three main groups—(1) Departmental extension, which is largely demonstration work carried out mainly under field conditions; (2) the county agricultural representative system, in which resident instructors are located in the several counties for educational work, mainly along demonstration lines; (3) the combined or collective activities of two or more departments, presented mainly through the medium of extension courses, schools, educational trains, exhibits, &c.

Instruction by Extension Teaching and Demonstration.—The extension activities of the various representatives cover the widest possible range. The county agricultural representative is expected to study the local needs of his community so as to enable him to take up those problems that are of the most value to his special section. While the demonstration-work that is directly associated with the departmental activities is carried on during the growing season, when it is possible to do this work in the field, the winter work in the main consists of the collective activities in which several of the departments join forces in the presentation of work through meetings. These collective extension activities take the form of courses, schools, conferences, educational trains, exhibits, &c. Arrangements with reference to these activities are made through the Director of the Agricultural Extension Service.

Barley-culture.—Wisconsin produces 25,000,000 bushels annually, or one-eighth of all the barley grown in the United States. The growing of this crop is confined to a comparatively small area.

In the United States and Canada barley is used for military purposes and as feed for farm animals. A limited amount is used in the preparation of breakfast foods and for pearl-barley.

Farmers are learning the value of barley as a part ration for dairy cattle and young stock, and much more, it is stated, will be used as animal-food in the future. In the Pacific Coast States barley is quite generally grown as a hay and feed for horses. When used as a hay it is cut in the milk stage shortly after heading and cured like ordinary grass hay. When the grain is used as a feed it is either fed whole or the kernels crushed by passing between rollers. If finely ground the gluten therein makes a sticky mass as soon as it is brought in contact with moisture, and it is not then readily masticated or digested. Professor Moore informed me that as far back as 1899 experiments were started at the experimental station which had for their ultimate purpose the improvement of Wisconsin barley. Twelve years of barley-improvement by selection and breeding have been completed, the result being the production of the new Wisconsin six-rowed bearded pedigreed varieties, which have demonstrated their superior value by returning higher average yields than any of the two-, four-, or six-rowed common varieties of barley grown in the State of Wisconsin. I was credibly informed that Professor Moore has developed a strain of barley which gives a yield almost double that of ordinary barley. Investigations show that the majority of maltsters in America prefer the six-rowed bearded barley.

Arlington Experimental Farm.

The Arlington Experimental Farm is situated in Virginia, two miles out from Washington, D.C., the capital of the United States. The area of the farm is 500 acres, largely given over to

investigational work, for which it is well adapted, being near the headquarters of the Agricultural Department's experts. The following investigations, amongst a large number of others, were being conducted: Forage-crop investigations; pathological investigations; electro-culture investigations; bacteriological investigations; soil-fertility investigations; cotton and truck disease investigations; nitro-culture investigations; fibre-plant investigations (principally hemp); a bureau of chemistry investigating fruit-juices and the dry potato; forest-service, confined to basket-willow culture; bureau of soils; manufacture of fertilizers; horticulture; pomology; agricultural engineering; making of public roads; testing of slabs, &c., for use in bridge-building.

Washington, D.C.

The capital of the United States. I had a number of letters of introduction to chief officers in many of the divisions of the Department of Agriculture, and received valuable information and assistance from them in regard to many matters in connection with my mission.

CANADA.

The Dominion of Canada is comprised of eleven provinces, having a total land area of approximately 1,400,000 square miles, together with an area of 2,300,000 square miles unorganized and only partially explored. Its most southern boundary is at 42° north latitude. Except the Yukon Province, the present limit of occupation is about 55° north latitude, in the Province of Alberta. The occupied lands amount to about 100,000 square miles. Only about two-fifths of the entire Dominion has yet been included in the organized provinces, and only about 3 per cent. of the entire area is as yet occupied.

As reference and comparisons will be made in other parts of this report to certain of the provinces, it is well for the better understanding to set out the population of each as at the last census (1911) and the area:—

Province.	Population.	Area in Acres.
Alberta	374,663	163,382,400
British Columbia	392,480	227,747,200
Manitoba	455,614	161,172,298
New Brunswick	351,889	17,910,498
Nova Scotia	492,338	13,713,771
Ontario	2,525,274	260,647,636
Prince Edward Island	93,728	1,397,991
Quebec	2,003,232	452,373,601
Saskatchewan	492,432	161,088,000
North-west Territories	18,481	132,528,640
Yukon	8,512	795,023,360
Total	7,206,643	2,386,985,395

The census of 1911 showed the rural population to be 3,925,502 and the urban to be 3,281,141. According to the Census Bureau, Canada's estimated population at 31st March, 1914, was 8,075,000

Canada is larger than the United States; as large as thirty United Kingdoms or eighteen Germanys; twice the size of British India; almost as large as Europe; eighteen times the size of France; and thirty-three times the size of Italy.

Canada has more miles of railway in operation than Australia, New Zealand, Italy, and Spain combined; more than Sweden, Norway, Denmark, Belgium, Holland, Switzerland, and Roumania joined together, with Portugal and Turkey thrown in. By the end of 1915 35,000 miles of lines will have been completed. The completion of such an extensive mileage has given an impetus to the country, and has been the means of throwing open to settlement enormous tracts of country, giving to new settlers immediate facilities of reaching the markets with their stock and produce.

Ontario is the most important province in the Dominion from an agricultural standpoint. The Dominion Department of Agriculture maintains an experimental farm at Ottawa, Ontario, with branch farms and stations at nineteen other places throughout the provinces. Agricultural colleges are conducted as follows: At Guelph, Ontario, by the Ontario Provincial Government; at Winnipeg, Manitoba, by the Manitoba Provincial Government; at Truro, Nova Scotia, by the Nova Scotian Provincial Government; and at several other places.

At St. Anne de Bellevue, Quebec, near Montreal, is the Macdonald College of Agriculture, which has been munificently endowed by Sir William Macdonald.

Probably no other country in the world is better served in regard to agricultural education and development than the Dominion of Canada. The operations and ramifications in connection with the work undertaken by the provincial Departments of Agriculture are very extensive and far-reaching. The Minister of Agriculture for the Dominion of Canada, through a well-organized department, directs agricultural matters connected with trade and transportation. Each of the provinces has a Minister of Agriculture who, through his department, directs the educational side of agriculture. In no other British possession are farmers so well organized as in Canada. Live societies, institutions, and associations are to be found in all the provinces, and agricultural education and advancement is given the foremost consideration. The Canadian Government in 1913 voted £2,000,000 in aid of agricultural instruction, to be spread over some years.

Central Experimental Farm.

The Central Experimental Farm is situated in latitude 45° N., about seven miles from Ottawa, the capital and seat of the Dominion Government. The annual average precipitation is 34·93 in. It is some 465 acres in extent, of which about 70 acres are devoted to arboreta, and 32 acres to ornamental lawns and forest-belts, both of which areas form the campus or grounds on which the extensive buildings necessary for the successful carrying-on of the various activities are erected. I might mention that the campus is a striking feature at all agricultural colleges both in the United States and Canada. The area devoted to this varies at different institutions, being from 40 acres to over 100 acres in extent. These grounds are not enclosed inside a fence, but are open, beautifully laid out with lawns, trees, and shrubberies, with well-kept roadways, drives, and walks in all directions. On these grounds or campus are erected the necessary educational buildings, each division having its own building entirely apart and at some distance from the others. The public are admitted to the grounds at all times, there being no fences or gates to bar them.

At the Central Farm, Ottawa, are the headquarters of Mr. J. H. Grisdale, Director Dominion Experimental Farms, and the technical and administrative staff under his control. From here the work of the Dominion branch farms and stations is guided and supervised, although the superintendents of the latter are allowed a free hand to work out the problems peculiar to their districts. Here also the scientific study of agricultural questions along indicated lines is carried on by officers having charge of the various branches of such work.

The Dominion experimental-farm system in Canada, and its purpose, may be briefly stated as follows: To conduct researches and experiments designed to test the value for all purposes of different breeds of stock and their adaptability to the varying climatic and other conditions which prevail in the several provinces; to examine into scientific and economic questions involved in the production of milk, butter, and cheese; to test the merits, hardiness, and adaptability of new untried varieties of wheat and other cereals, and of all field crops, grasses, and forage plants, fruits, vegetables, plants, and trees, and disseminate among persons engaged in farming, gardening, or fruitgrowing, upon such conditions as are prescribed by the Minister of Agriculture, samples of such surplus products as are considered to be especially worthy of introduction; to analyse fertilizers, whether natural or artificial, and conduct experiments with such fertilizers in order to test their comparative values as applied to crops of various kinds; to examine into the composition and digestibility of foods of various animals; to conduct experiments in the planting of trees for timber and shelter; to examine into the diseases to which cultivated plants and trees are subject, and also into the ravages of destructive insects, and ascertain and test the most useful preventives and remedies to be used in each case; to conduct any other experiments and researches bearing upon the agricultural industry of Canada which may from time to time be approved by the Minister of Agriculture.

The work at the Central Experimental Farm under the direction of Mr. J. H. Grisdale, Director Dominion Experimental Farms, is carried out under various divisions, each with a chief officer who supervises the work, and are as follows: Division of Field Husbandry; Division of Animal Husbandry; Division of Chemistry; Division of Horticulture; Division of Cereals; Division of Botany; Division of Entomology; Division of Forage Plants; Division of Poultry; Division of Tobacco.

Division of Field Husbandry.—The operations are very practical in nature, and, briefly, consist of soil-management, crop-management, and agricultural engineering. Its scope is indicated by the following features: Crop-yields, rotation of crops, cost of production of field crops, weed-eradication, soil-cultivation, use of barnyard manure and commercial fertilizers, irrigation and underdrainage, clearing land, fencing, &c.

A comparatively small number of field experiments were conducted on account of the limited amount of land suitable for experimental work. This is due to the soil being too variable in composition for satisfactory field tests.

Rotation of crops: This is a phase of the work carried out which is worthy of consideration by New Zealand farmers. The aim in view is to obtain definite results as to the relative values of different rotations with varied cultural methods, these results to serve the farmer as a basis for the management of general farm crops. That certain crops do better when following after certain other crops has long been known, hence rotation of crops is considered an essential part of the programme to successful farming in the older countries of the world. Farm practice in the newer settled countries, however, seldom keeps pace with knowledge in such matters, and to this particular phase of crop-management work especially too little consideration is usually given.

For the past eleven years experiments have been carried out at this farm to determine the relative value of different rotations suitable for live-stock purposes, and to this end fifteen rotations are now in operation. The line of farming engaged in must, however, determine to a great extent the kind and relative amounts of crops that should be grown. The climatic conditions prevailing in Canada, where stock require to be housed and hand-fed, are so dissimilar to New Zealand conditions, where stock are in most cases in the open and fed there all the year round, that it would serve no purpose to detail the rotations followed. A brief consideration, however, of a few facts relating to this important farm practice may not be out of place.

A systematic rotation of crops means a certain regular succession of crops so arranged that after each the land is left in the best possible condition to receive the crop which follows. The order in which crops follow makes a great difference in the yields from year to year, because different plants have different manurial requirements—they vary in their power to abstract certain foods from the soil. All plants do not feed to the same depth in the soil, nor are they alike in the residue they leave behind. Some tend to produce better tilth than others, and vary in their

power of resistance to bacterial and fungus diseases and to insect enemies. The requirements of any rotation to be considered suitable should supply the crops needed in the proper proportions, and should be so constituted that a hoed crop should form part, so that weeds can be kept under control. It must yield a reasonable net profit, and must, under properly regulated treatment, maintain soil-fertility. With regard to the latter, Mr. Grisdale, the Director Dominion Experimental Farms, is very emphatic. He has no sympathy with farming conducted by means of constant applications of artificial fertilizers, so prominent a feature of farming methods in some districts in New Zealand. His aim is to build up soil-fertility in a natural way under the rotation system by means of growing and ploughing under some green crop. To this end, when grain is sown the land is also seeded down to legumes and timothy-grass, the quantity of seed varying slightly according to the length of the rotation—usually, however, 10 lb. red clover, 2 lb. alsike, 6 lb. lucerne, and 6 lb. timothy per acre. The following year two crops of clover hay are expected, and the next spring following the clover and grass sod is turned under for the succeeding crop, which is a hoed one, these latter forming a large proportion of every rotation. The rotations are generally of a five- or three-years duration.

Commercial fertilizers as a part substitute for barnyard manure: Experiments designed to supply information concerning the relatlive merits in regular farm rotation have been completed. The results show a distinct advantage in barnyard manure alone over commercial fertilizers alone for the soil on the farm, but point to the possibility of combining the two to good advantage when barnyard manure is scarce or high in price.

Division of Animal Husbandry.—The scope of work of this division includes directly the care, breeding, feeding, housing, and marketing of horses, cattle, sheep, and swine and their products on the Central Experimental Farm, together with the testing of methods in care and management and of all machinery pertaining thereto. In consultation with the branch farm superintendents, this division also assists largely in these various operations on all branch farms where live-stock are maintained, thus systematizing and consolidating all the live-stock experimental work on the Dominion experimental farms.

For the farm-work purebred and grade Clydesdale mares are kept. The pure breeding herds are Ayrshire, Canadian, Holstein, Guernsey, and Jersey. The sheep are Shropshires and Leicesters. Three breeds of swine are kept—Yorkshire, Tamworth, and Berkshire.

Division of Chemistry.—Research work upon the solution of problems affecting Canadian agriculture claims first attention, but no less important is the educational and advisory work for the individual farmer.

Division of Horticulture.—The work of this division is subdivided under the heads of "pomology," "vegetable-gardening," "ornamental gardening," and "plant-breeding."

Division of Cereals.—The investigations carried on within this division are—Testing of varieties, importation of new sorts, selection, cross-breeding, and distribution.

In a series of test plots comparisons are made every year between the best varieties of grain which are commonly grown in Canada and such sorts as have been recently imported from other countries. The plots are usually one-sixtieth of an acre in extent, and are laid out in regular blocks with suitable spaces between. It is impossible to obtain, even under the most favourable conditions, perfectly trustworthy information in one season in regard to the relative merits of similar varieties, so that when making comparisons the average results of a series of years are always taken. With regard to new varieties, these are tested for at least five years unless they clearly show some serious defect, when they are at once discarded. At the time of my visit all the crops had been harvested.

Division of Botany.—The work includes two main groups—viz., plant pathology and economic botany. In addition the Dominion Botanist has charge of the Botanic Gardens and that part in the administration of the Destructive Insects and Pest Act dealing with diseases of plants due to fungi and bacteria.

Division of Entomology.—This division has the administration of the Destructive Insect and Pest Act—viz., the prevention of the introduction of insect pests into Canada, and the control or eradication of injurious insects already existing in the country.

Division of Forage Plants.—The work of this division is in general of an entirely scientific nature, the aim being to produce superior varieties and strains of forage crops, to ascertain the value of the different varieties of the different environments of Canadian soils and climate, and to investigate thoroughly the value of both native and foreign plants that are or may be used for fodder. As this division has only been in existence for a few years, no definite results of experiments will be available for two or three more years. The breeding-work demanding the greatest amount of attention up to the present is that with leguminous forage plants and grasses. In the breeding of leguminous forage plants such as lucerne and clovers the main object kept in view is breeding for increased hardiness and for increased yield and superior quality.

Division of Poultry.—The work undertaken is to investigate all poultry problems that are of interest to farmers and poultrymen. The experimental work includes breeding, incubation, brooding, rearing, feeding, housing, the production of flesh and eggs, diseases, &c., and to carry out this work turkeys, geese, ducks, guineas, and ordinary fowls are utilized.

Division of Tobacco.—The experimental work of this division is conducted at the Central Farm, Ottawa, and at the tobacco stations St. Jacques, l'Achigan, and Farnham in Quebec, and Harrow in Ontario. An extensive area was under this plant at the Central Farm at time of my visit.

Value and Purpose of Branch Farms and Stations.

Of the nineteen branch farms and stations, several have now been in existence for close on thirty years. Rapid settlement and development, especially in the western provinces of Canada,

has demanded a considerable increase in the number of these, and has enlarged the sphere of work carried on. One great cause of the expansion, other than the need of newly-settled districts for some such institution within easy reach, has been the fact that each section of country opened to the settler has presented new problems possible of solution only by experimental work carried out in that locality. The increased complexity and number of questions studied are also to a great extent the result of the educative influence of the farms themselves and the greater interest in correct methods of farming which they have helped to arouse among the farmers of Canada.

At the request of Mr. Grisdale, Director of Dominion Experimental Farms, I had the pleasure of accompanying him on a visit of inspection to one of these, the experimental station for Central Quebec, Cape Rouge, Quebec. The farm is situated approximately in latitude 47° N., about nine miles from Quebec City. The property consists of 326 acres. It is all tillable with the exception of about 25 acres. The soil varies from a sandy to a heavy clayey loam. It is said the soil is suitable for every cereal, vegetable, or fruit which will thrive in Central Quebec. The site of the station, 150 ft. above the mighty St. Lawrence River, is admitted to be one of the most beautiful to be seen in any land.

The work and farming methods carried out on this farm are in keeping with the varied soils, agricultural requirements, and climatic conditions of Central Quebec.

The live-stock consists of horses, dairy cattle, sheep, and swine. Poultry and bees are also kept on a small scale. A stud of registered French-Canadian thoroughbred horses has been established. This breed is very popular, especially for light-harness work, in eastern Canada. The dairy herd is comprised of over fifty head of pure and grade French-Canadians, a very healthy breed of dairy cattle, black or dark-brown in colour, small in size, but with good constitutions, giving a fair average yield of milk per day, with an average of from 4½ to 5 per cent. of fat in the milk.

The field crops consist of swedes, maize, carrots, oats, and hay. Crop rotations of three, four, and six years are being conducted since 1911. It is yet too early to give definite results. A large number of variety tests are being carried out with swedes, mangels, sugar-beets, and carrots on duplicate plots of one-fiftieth of an acre each; with Indian corn, to ascertain the best yielding varieties for silage; with wheat, barley, oats, and peas, on one-sixtieth-acre duplicate plots; and with close on four hundred varieties of vegetables. Seed-growing from many varieties of beans, corn, cucumber, lettuce, musk-melon, peas, peppers, radish, squash, tomatoes, water-melon, &c., is becoming a source of profit.

Conifers, deciduous trees and shrubs, roses, perennials, annuals, and bulbs are grown for ornamental gardening.

The farm buildings are modern, well lighted and ventilated, and with many up-to-date facilities.

Growing Field, Root, Vegetable, and Flower Seeds.

The present war in Europe has disorganized the usual sources of seed production and supply (in the past principally from France and Germany), and Canada has been quick to see that the time is ripe for establishing and developing certain industries in the Dominion which were either not in existence before or were conducted on a small scale. One of these is the production of root, vegetable, and flower seeds. Now Canada is moving in the direction of making herself independent of foreign markets and producing at home what had in the past to be bought abroad. Experiments at the Dominion Central Experimental Farm have shown that when the plants and seed have been properly selected, as good or better results are obtained by using home-grown seed than imported.

Medicinal Plants.—Some attention is being given to the cultivation of these, but as the total quantity used in commerce of many of the drug plants is comparatively small, it is evident that the area devoted to their growth on a single farm will also be small, and hand labour will have to be largely used in the production of these for market.

Co-operative Demonstrations.

With the view of securing wider dissemination of agricultural knowledge the Dominion Department of Agriculture, on the advice of Mr. J. H. Grisdale, Director of Dominion Experimental Farms, has, after mature consideration, decided that the best way to achieve this object would be to secure certain areas of from 2 to 45 acres each, depending on the nature of the demonstration—small areas for lucerne, maize, &c., larger areas for cultural methods—for a term of years, having a frontage on main roads as near to towns or villages as possible. The nearer the marketing-point the more people, farmers and townspeople alike, will see it, and the better it can be supervised.

This scheme was put into operation in 1915, when twenty-nine farms were selected by the Director, and he stated at the time of my visit that forty more farmers in central situations had made application for such demonstrations. I understand that it is entirely in the hands of the Director or a representative of the Dominion Department of Agriculture to decide as to whether a farm is suitable or not. Further, a feature of these experiments is that the farmer selected should be a man who believes in the work, who is already a competent farmer, and who has the respect of the community. The idea should be not to have to educate the demonstrator more than one can help, but give the stamp of approval and prestige of the Department to work he would perhaps be doing anyway.

If the areas selected are too small the results will be subject to criticism as not being obtained under field conditions; if too large it will be hard to get good conditions and to supervise the work. It is better not to have more than two or three demonstrations under way on any one farm at one time.

The following are particulars of the agreement between the Department and the farmer on whose property the demonstrations are carried out:—

The farmer agrees with the Dominion Department of Agriculture to place under its direction a portion of his farm—say, 45 acres—for demonstration purposes in connection with cropping systems and cultural methods.

The Department agrees to furnish the farmer with grain and such other seeds as are thought best by the Department, and with formalin for treatment of same, said grain or seeds to be sown on such of the 5-acre fields as shall be decided upon each year by the Department, said fields to be contiguous to each other and to be selected and approved by a representative of the Department, and the grain to be seeded at such time and in such manner, and the land to be given such cultivation and treatment, as said representative of the Department shall direct.

The farmer agrees to follow the directions of the Department in the measurement of the plots, in the treatment of the seed, in the cultivation of the ground, and in the rotation of the crops, and to seed the several plots at such time and in such manner as directed by the Department or its representative, and to perform the labour connected therewith as directed; to harvest said fields when crops mature or when directed to do so by the Department or its representative; to carefully stook same if of cereals, and to thresh or properly harvest each plot separately, and to record the exact production of each plot, and to keep these and such other records as may be agreed upon, such as amount and date of rainfall, &c., and at the end of the season to submit to the Department a complete and accurate report of the season's work and the results thereof.

The Department agrees to furnish addressed envelopes, and a diary (in duplicate) in printed form, properly dated from 1st April to 1st November of each year.

The farmer agrees to enter a report of each day's or part of day's work, and to make other notes on the growth of the crops, &c., and to mail each week, as directed by the Department or its representative, the week's report, and to retain the duplicate copy in his office. The Department will notify the farmer of the failure of receipt of report.

The farmer agrees to keep a record of the time and cost of each field operation, and to report the same on the daily report form in such manner as directed by the Department.

The farmer agrees to assist the Department to measure and stake off eight fields, with a road 1 rod wide running between fields and all round the outsides, said fields to be numbered consecutively from A to H, the crops to be grown on the said fields each season to be as per diagram attached, but subject to revision if such revision is deemed advisable by the Department. The work of laying off plots and roads to be done in the year.

It is further agreed that the farmer will permit the placing in front of each field a sign stating briefly the method of preparing the land for the crop-growing thereon, or the treatment being given the plot that year, thus:—

THIS PLOT IS BEING SUMMER-FALLOWED, *or* WHEAT: LAND WAS SUMMER-FALLOWED LAST YEAR,

or such other legend as will indicate the work under way on the plot in question, and two larger signs, one at each corner of the field on the road, thus:—

DOMINION GOVERNMENT DEMONSTRATION WORK IN CROP-PRODUCTION.

The Department reserves the right of entering upon any or all of these fields under crop and of collecting small samples free of charge for exhibition or other similar purposes if so desired. Further, the farmer agrees to sell to the Department, if the Department desires to purchase, any or all of the grain or other seeds grown on these fields at an advance of, say, 5 cents (2½d.) per bushel on grain, and a proportionate advance on other seeds, over the price being paid for grain or seeds of a similar grade at the nearest railway or shipping port. In the event of the Department desiring to purchase grain and seeds from the said fields, the farmer shall each year have the right to reserve as much of this seed as may be necessary for his own use as seed on the above-described area the next year if the Department deems it suitable for use on said area, otherwise the whole crop would be the property of the farmer and subject to his disposal.

The Department or its representative may at any time during the currency of this agreement enter upon said land and examine the crops growing on said fields.

In consideration of the farmer doing this work according to instructions set out, and under the supervision of an inspector who will visit the farm from time to time during the growing season, keeping the necessary records, sending weekly reports, &c., the Department will undertake to pay the farmer at the rate of 5 dollars (£1) per acre for all land occupied—say, 45 acres, or 225 dollars (£45) in all—payment to be made at the end of the cropping season when approved by the inspector. The Department agrees to furnish the necessary seed, for the first year at least, to sow such of the above-mentioned 5-acre fields as it is decided to put under crop that year. In subsequent years the farmer would be expected to save enough of the best of the crop grown on these fields to do the necessary seeding—this, of course, provided the seed produced was satisfactory as to purity and germinability. The Department to supply the signs as above described and to help set them up; furnish the boundary or corner stakes for the fields and help set them up.

This agreement is for three successive years, but should the farmer fail to fulfil the conditions outlined in this agreement it may be revoked at the end of any one year by the Department.

This agreement shall extend to and shall bind and shall enure to the benefit of the successors of the Department, and to the heirs, executors, administrators, successors, and assigns of the farmer.

Seasonable Hints.

The officers of the Canadian Experimental Farms are trying to get into touch with every farmer in Canada through the printing-press, and a novelty that was adopted in the beginning

of 1915 and continued as an assured success was the publication for particular months of *Seasonable Hints to Farmers*. This was an informative bulletin of a dozen pages or so giving timely hints on live-stock in the matter of feeding and so on, instructions about poultry, clover and timothy, hoed crops, grain, Indian corn, forage plants, potato-growing, lucerne, loose smut in wheat and barley, blights and cankers of fruit-trees, summer fallow and weed-control, general hints about the orchard, the apiary, tobacco-culture, and the farm water-supply.

The Dominion Experimental Farm and Station System in Canada.

The purpose is to cover as thoroughly as possible all those branches of agriculture adaptable to its varied soils and climatic conditions. While the chief object of the work at the Central Experimental Farm is to obtain by repeated experiments useful data on the seeding, cultivation, and harvesting of farm crops, on the breeding, feeding, and housing of various classes of live-stock, and on the conversion of milk into other marketable products, the management of the whole is, as far as possible, conducted for profit, all operations being carried on after the most approved practical methods and a record of cost in each case kept.

During the four days of my visit to the Central Experimental Farm, through the courtesy of Mr. Grisdale, the Director of Dominion Experimental Farms, I had an opportunity of meeting the chief officers of the respective divisions and obtaining from them valuable information in respect to their several activities.

Ontario Agricultural College and Experimental Farm, Guelph.

This institution is situated approximately in latitude 43½° N., about forty miles west from the City of Toronto. The college was established forty years ago. It holds a very high position as an agricultural instructional institution throughout America, and also a high reputation throughout other countries of the world, for its efficient teaching of agriculture in all its branches, drawing many students annually from countries outside of Canada.

The regular college course leading to the degree of B.S.A. covers a period of four years. During 1914 the attendance in all departments at the college and Macdonald Institute, Montreal, was 1,551.

A qualification desired for candidates at the college, but not always insisted upon, is that they must have been brought up or worked on a farm for some years previously—at least two years. No town boys are admitted unless they have had farm experience. Girls are admitted to learn domestic economy.

As there are many farmers and farmers' sons who cannot spare the time to take the college course, and others who might find the time but have not the means to do so, to meet such cases the college has supplemented the regular work by adding short courses, which are largely taken advantage of. The President of the College, Dr. G. C. Creelman, in his annual report for 1914, in making an announcement in regard to short courses, says that "better men are wanted to manage our cheese-factories and creameries; to give instruction to our cheese and butter makers; to judge the live-stock and farm-produce at our fall fairs; to grasp the opportunities in fruitgrowing and beekeeping; and the boys and girls of the farm would be benefited by a better knowledge of the poultry industry." The courses are offered for the purposes above indicated.

The Department of Agriculture in 1914 had offered as scholarships in their acre profit and pig-rearing competition a two-weeks course at the college. Sixty-eight of these young men, successful competitors who through these competitions won distinction in Canadian agriculture, joined these short-course classes. Four hundred and eighty-five attended these short courses in 1914. An outline of the short-course system is given further on in this report.

The campus or grounds on which the college buildings are erected are extensive and beautifully laid out, and, as with like institutions both in the United States and Canada, these grounds are not fenced but are open to the public at all times. The area of land attached to the college is about 700 acres.

The President of the College, Dr. G. C. Creelman, to whom I had a letter of introduction, showed me over the college buildings, and with Mr. C. A. Zavitz, Professor of Field Husbandry and Director of Field Experiments, very courteously took me around the most interesting portions of the farm and gave me every facility to acquire such information as I desired in regard to field experimental work.

The experimental grounds at the Ontario Agricultural College, which are under the direction of Professor Zavitz, cover about 75 acres of land, which are divided into upwards of two thousand plots, and on which experiments are being conducted with varieties of grain, root, tuber, grass, clover, fodder, silage, and other crops with artificial, green, and barnyard manures; with methods of cultivation, selection of seed, dates of seeding, mixtures of grains, pasture-grasses, &c. In addition the Field Husbandry Department directs co-operative experiments on five thousand farms throughout the Province.

The experimental grounds are on undulating country, and the soil is an average clay loam. The greater portion of the land is worked on a four-years rotation, the rotation being—first, grain crops; second, cultivated crops; third, grain crops; and fourth, pasture. This is a special rotation well suited to the experimental work as carried on at the college. About one-fourth of the land is manured each year at the rate of 20 tons of farmyard manure per acre—thus most of the land receives an application of farmyard manure once every four years. The manure is applied previous to the cultivated crops. No commercial fertilizers are used except in distinct fertilizer experiments, and these occupy a comparatively small area each year. One green crop has been ploughed under on each section of the grounds within the past sixteen years. The plots vary in size to suit the requirements of the different experiments, and the yields per acre

are determined from the actual yields of the plots in every instance. All experiments are conducted with the greatest care, and for several years in succession, in order to secure strictly accurate results. These experiments deal with the crops grown on fully nine-tenths of the cultivated land in Ontario. As a rule all field experiments are conducted for at least five years before they are dropped. Many are continued for a longer period of time. It is recognized that it takes quite five years in most experiments before results of a reliable nature can be obtained. This in a great measure is due to the variations of the season's temperatures, rainfall, &c.

Co-operative Experiments in Agriculture.

These are conducted through the medium of the Ontario Agricultural and Experimental Union. Probably in no other country is experimental work amongst farmers carried out on so extensive and complete a system, which had its beginning in 1886. In 1914 co-operative work was conducted on farms throughout Ontario in agriculture, agricultural chemistry, agricultural botany, beekeeping, forestry, and, in connection with the public schools, in elementary agriculture, horticulture, and forestry. During 1914 4,519 farmers acted as experimenters on their own farms, which indicates that the work is appreciated and that it has become very comprehensive. Apart from the incalculable value of the co-operative experiments and the opportunities that farmers are given to inspect the experimental plots at the college, the whole subject is treated, with illustrations, in a bulletin which might run to eighty or a hundred pages, with clear and simple notes on the production of every imaginable crop.

Professor Zavitz, as secretary of the Ontario Agricultural and Experimental Union, in his report for 1914 has the following, which is worthy of quotation :—

"The Ontario Agricultural and Experimental Union has a peculiar field of its own. It is an organization of active workers. These men are doing things that count for much. They are furnishing material which forms the basis of talk and discussions at farmers' institutes and at farmers' clubs. Each experiment forms a centre of interest and of inspiration. Failures in the co-operative work as well as successes may have their lessons. The experimenters, who are active farmers, endeavour to interpret the results of their various experiments. The very act of experimenting, the interesting observations made during the growing season, the preparation of the records, and the endeavour to understand the real meaning of the results are all conducive to a more thoughtful and wholesome consideration not only of the experiments themselves, but also of the various other operations of the farm. It is probably safe to say that the successful development of a system of co-operative work rests not only with those actively engaged in carrying forward the work, but also upon the intelligence and the progress of the people as a whole. The fact that Ontario has been so successful with its system of co-operative experiments in agriculture indicates more than words can express the intelligence and the ability of the farmers of the province."

Loose-smut in Oats and Stinking-smut in Wheat.

At the Ontario Agricultural College for five years in succession experiments have been conducted for the prevention of the loose-smut in oats and the stinking-smut in wheat. Careful determinations were made each year to ascertain the comparative influence of different treatments. The following treatments were used throughout, with the exception of Nos. 3 and 6, which were omitted from the treatments for the stinking-smut in wheat :—

(1.) Untreated. One sample of oats and one sample of wheat of each variety was left untreated, in order that the influence of the various treatments might be better observed.
(2.) Immersion in hot water.
(3.) Immersion in bluestone-solution for five minutes.
(4.) Immersion in bluestone-solution for twelve hours.
(5.) Sprinkling with bluestone-solution.
(6.) Immersion in potassium-sulphide solution.
(7.) Immersion in diluted formalin.
(8.) Sprinkling with diluted formalin.

The results show that the greatest yields of both winter wheat and oats per acre were produced from the grain which was immersed for twenty minutes in a solution made by adding half a pint of formalin to 21 gallons of water. They also show that this treatment was effectual in completely killing the smut. The formalin which was used in the experiments was the same as a 40-per-cent. formaldehyde solution.

Short Courses.

The short courses provided at the agricultural colleges of Canada and America are designed to meet the case of those who have not the time or the means to take a longer course. An outline of the short courses at the Ontario Agricultural College, Guelph, Canada, will give an idea of the thoroughness and value of the instruction provided. Board and residence is obtainable cheaply in Guelph, and the farmer or farmer's son or daughter has merely to attend the classes and demonstrations set out in the syllabus. No tuition fee is charged, nor is any entrance examination required.

The stock and seed judging course was timed to start on the 11th January and close on 22nd January. A judging-pavilion, with a 50 ft. ring and with a seating-capacity of three hundred, has been built specially for those taking the short course in live-stock. Into this ring classes of horses, beef and dairy cattle, sheep, and swine are brought, the college herds and other notable herds being drawn on for the purpose. From 10 a.m. until noon and from 1.30 to 4 p.m. each

day is taken up in practical work in judging under the direction of leading experts, and by talks with those in charge, and the actual handling of first-class animals, the students become familiar with the various types. In carrying on this work individual animals are brought in for criticism, and afterwards a number of animals are brought in to be judged by the members of the class themselves, and finally judged by some recognized authority, so that students will have an opportunity to compare their judgment of live-stock with that of others.

Fat cattle, sheep, and hogs are judged alive by the class and by recognized experts. Some of the animals are then slaughtered and the carcases brought before the class to be cut up to illustrate the relative values of different parts.

At the close of each day's practical work it is customary to have lectures on the breeding, feeding, and management of live-stock. Discussions upon unsoundness and upon some common diseases of stock are also conducted.

In the seed course the morning is spent in the study of the seeds of the principal farm crops and most troublesome weeds. Lectures are then given on purity, germination, cleaning, selecting, grading, and improvement of seeds, and judging is a prominent part of the course. In the evenings lectures are given on agricultural subjects of a more general nature, chosen for the most part by the students themselves.

The poultry-raising short course, which was timed from the 11th January to the 5th February, making a special appeal to men, women, boys, and girls, has no tuition fees. The course, which is made more highly instructive by the fact that the college is wonderfully well equipped, offers a regular routine of practical work, in addition to the instructional lectures. This consists in feeding breeding-stock, fattening, killing, and dressing market poultry, operating incubators, candling and grading market eggs, and constructing poultry appliances.

Two weeks' instruction on the same free terms was also offered in all phases of commercial fruitgrowing, the lectures and discussions covering all matters of importance both to beginners and experienced growers, and a large number of fruitgrowers return year after year for new information. Some of the points covered in the course are location, selection, and preparation of the soil; varieties; nursery stock; tillage and tillage implements; sprays and spraying; frost-protection; fertilizing; pruning; co-operative packing and selling; markets, &c. The course covers thoroughly the culture of apples, pears, plums, peaches, cherries, grapes, raspberries, blackberries, currants, gooseberries, and strawberries.

A special week's course at the end of the fruit course gives thorough instruction in both box and barrel packing.

The dairy courses are naturally a good deal longer. The short courses for factory cheese and butter makers, and the farm dairy course for men and women, were timed to open on the 3rd January and extend to the 24th March. The factory course, however, is limited to those who have had a year's experience in a creamery or cheese factory. There is a longer summer course for butter and cheese makers, from the 1st May to the 30th September. There is a six-days course for cow-testing, and a five-days course for dairy instructors. A herd of about fifty cows, heifers and calves, representing four different breeds of dairy cattle, gives an excellent object-lesson in handling, feeding, and caring for a dairy herd, besides supplying specimens for class-room work. A record is kept of each cow's milk that students may see the importance and simplicity of a cow record. The cheese, butter, and farm dairy branches are well equipped with modern dairy appliances. The chemical and bacteriological laboratories are the best that can be provided.

The fortnight's course in beekeeping, which had an enrolment last year of eighty-six, covers lectures and demonstrations of a very practical nature, calculated to meet the needs of both beginners and advanced students. In addition to methods of management, special attention is given to the diseases of bees and their treatment. Queen-rearing is a special feature of the course. Different races of bees are kept in apiaries at the college.

Province of Manitoba.

I visited the offices of the Department of Agriculture, which are situated in the Government Buildings at Winnipeg, the capital and seat of the Provincial Government. Mr. S. A. Bedford, Deputy Minister of Agriculture, to whom I had a letter of introduction, very kindly gave me considerable information on various subjects in connection with my mission. I also visited the *Manitoba Agricultural College*, situated six miles from Winnipeg, where Professor G. A. Sproule, of the university staff, showed me over the college buildings and a portion of the experimental farm attached, and very courteously gave me much useful information in respect to their activities. The college is situated approximately in latitude 50° N. The elevation above sea-level is 757 ft. The rainfall for the year 1914 was 18·86 in., the average for the last eleven years being 14·35 in. The land around the college is flat and of good quality, and extends to 537 acres, 137 acres of which is to be given over to the university, leaving 400 acres for college purposes.

The institution was originally established in 1906, and was situated on the Assiniboia, but this position was considered unsuitable, and the erection of the new college buildings on a more commodious site on the Red River, West Winnipeg, was begun some few years ago. The buildings have now been completed; some have been occupied for two sessions and others only for one session.

The Manitoba Agricultural College buildings are the most recently built in America, and were constructed according to plans submitted by a special commission set up to visit other like institutions in Canada and the United States, thus securing data of much value, the result being that Manitoba is now possessed of one of the best-equipped, most modern and up-to-date agricultural college buildings in America. As no words can adequately describe or portray the nature

and extent of the buildings, and as there are none such in the Dominion of New Zealand, I herewith append photographs of these, together with others showing many phases of agricultural instruction and advancement.

The completed structures comprise ten magnificent fireproof buildings of brick and stone. The main building, which stands in the centre of the campus, contains the offices of administration, the Field Husbandry Department, the Home Economics Department, the Department of English, the library and reading-room, and the post-office. The other buildings are the Chemistry, Physics, and Soils building, the Horticulture, Biology, Bacteriology, and Forestry building, the Agricultural Engineering building, the power-house, the President's residence, and the students' residence. Besides these ten buildings, there is the horse-barn, the beef-cattle barn, the dairy-cattle barn, the sheep-barn, the swine-barn, and five poultry-houses. The students' residence has accommodation for five hundred students, and is provided with dining-room, kitchen, sitting-rooms, gymnasium, and swimming-pool.

It would be well to remember that the population of the Province of Manitoba at last census (1911) was only 455,614. This magnificent group of buildings therefore goes to prove in a most emphatic manner that the people of the provinces of Canada are alive to the necessity for providing for the teaching of the sciences related to agriculture and home economics, agriculture and its allied branches being the main industry and revenue-producing factor of the Dominion; in fact, like New Zealand, agriculture is its great and fundamental industry.

Manitoba Agricultural College may be taken as an example of a most vigorous educational centre that has got beyond the experimental stage. Formally opened in 1906, it has widened its activities until it has now the power to confer degrees in agriculture. It is purely a State undertaking, the Provincial Legislature making appropriations from year to year for maintenance and equipment, and its government rests in a board of ten directors, four elected by the agricultural societies of the province and five by the Governor in Council, with the Minister of Agriculture an *ex officio* member. The appropriation by the Provincial Legislature for maintenance in 1914 was £10,000, and in addition the moneys collected in fees and so on amounted to, roughly, £14,000. The total enrolment in general courses was 363, and in short courses 437, a total enrolment of 800.

The work of the college is grouped under three sections—agriculture, home economics, and extension service—but these three are subdivided into a series of courses that give the widest possible opportunities for study.

The principal course in agriculture is one covering three winters of five months each, the idea being, of course, that the farmer's son may work on the farm in the invaluable summer months of the year. During the first winter at the college much time is given to the study of principles, and in the second and third winters to a more extended application of the principles to the various phases of the work on the farm.

The course in home economics is a two-winter course of five months each, though a complete course may be given in the first winter for those unable to give more time. The two-years students may proceed to a degree in home economics by completing three additional winters' work.

Of the greatest importance among the special courses (given in addition to the regular and degree courses) the teachers' course has been specially provided at the request of the Education Department, and it is compulsory for all second-class teachers attending normal schools. Canada has decided that as a large number of its rural population acquire in the public schools the only special training they receive for their life's work, it is necessary that those who control country schools should be in sympathy with agriculture.

Farmers' week is for the benefit of farmers who cannot spend more than seven days at the college, but during that time they may take part in lectures and discussions or attend a short course.

The estimated expenditure for a year at the college is well under £30, which includes board for (roughly) five months, tuition fees, and everything else.

The course of study is complete and exhaustive. As an instance of the nature of the study, the list of subjects in each year may be given, with the number of credits against each indicating the relative amount of time spent on each subject.

FIRST YEAR.

	Credits.		Credits.
Field husbandry ...	400	English ...	300
Animal husbandry	400	Book-keeping	100
Veterinary science	200	Physics ...	100
Dairy husbandry ...	200	Arithmetic	200
Horticulture, &c. ...	200	Soils ...	100
Botany ...	300	Gas-engines	100
Forage-work	200	Military drill	100
Woodwork	200		

SECOND YEAR.

	Credits.		Credits.
Field husbandry ...	300	Physics ...	200
Animal husbandry	300	Agricultural engineering	400
Veterinary science	200	Chemistry	300
Dairy husbandry ...	200	English ...	350
Entomology	100	Agricultural economics	100
Botany ...	200	Poultry husbandry	200
Bacteriology	200	Soils ...	200

THIRD YEAR.

	Credits.		Credits.
Field husbandry ...	... 300	General history ...	... 200
Animal husbandry	... 300	English ...	... 500
Farm dairying ...	... 200	Chemistry ...	... 200
Mathematics ...	... 200	Poultry ...	... 100
Physics	... 150	Farm forestry ...	... 100
Soils	... 200	Agricultural engineering	... 600
Veterinary science	... 200		

This is for the diploma course, but for the degree of Bachelor of Science in Agriculture the student may go on to the fifth year on a more comprehensive programme of study.

The course for girls in home economics is called, appropriately, the "homemakers' course." It runs from cooking, dietetics, home-management, nursing, physiology, and hygiene down to home-planning, drawing and design, and infants' clothing and dressmaking.

The college extension work is considerable. While the different phases of this work are closely related, they are, for convenience, described under the following heads: (1) Agricultural society fairs; (2) agricultural and arts associations; (3) seed-fairs and poultry-shows; (4) agricultural special trains; (5) better-farming short courses; (6) ploughing matches; (7) home economic societies; (8) boys' and girls' clubs.

The Government grant to agricultural societies for 1914 amounted to £6,700, and the municipal grant to £4,600.

The total membership of agricultural societies in 1914 was 8,779. The amount paid out in prizes by these societies was £9,656. The Government grant in 1914 for other purposes, such as seed, grain fairs, ploughing matches, and buildings was £959.

In 1914 there were sixty-eight agricultural societies, and of these sixty-seven held successful summer fairs, and thirty-eight held seed, grain, and poultry shows later in the year. Judges were supplied to all of these by the section of the college-extension work.

A feature of all societies participating in extension work and receiving Government grants throughout the Dominion is that the judges are selected by the Department of Agriculture or Agricultural College, and only experienced men specially trained, and having the confidence not only of breeders and exhibitors but also of the Agricultural Department or College, are appointed judges.

The object and aim of the Government, Dominion or Provincial, is to utilize these judges to educate the farming community in respect to the merits or demerits of the exhibits, and make such fairs, competitions, &c., educational in the highest degree. A judge therefore requires to be thoroughly competent and well versed in the excellence or otherwise of the subjects on which he has to adjudicate, be they animal, grain, seed, crop, &c., and must be able to point out and elucidate in plain and understandable language to the inquiring public the points on which awards were made by him, so that the people can understand why one animal or other exhibit was placed ahead of another.

Provincial Demonstration Farms.—There are well on to twenty of these distributed throughout the province, each dealing with the soils peculiar to the respective localities in which they are situated, and experimenting to discover the variety of crops most suitable to grow under the climatic conditions and environment, and thus enable settlers and prospective settlers to know what grains, vegetables, fruits, &c., are best adapted to the locality.

The Province of Saskatchewan.

I visited the offices of the Department of Agriculture, which are situated in the Government Buildings at Regina, the capital and seat of the Provincial Government. Mr. F. Headley Auld, Acting Deputy Minister, received me most courteously and gave me the fullest information regarding the activities of the Department, and also went to considerable trouble in furnishing me with information on many points in regard to agricultural education throughout the Dominion, which I have embodied in this report.

The word "Saskatchewan" is an Indian word meaning "rushing water." The estimated population of Saskatchewan in 1914 was 691,000, 80 per cent. of which are engaged in agriculture.

The province lies in the same latitude as the British Isles. No settled portion of the province is so far north as Edinburgh, the capital of Scotland. Saskatchewan's elevation above sea-level varies from 1,500 ft. to 3,000 ft. The annual precipitation is comparatively light, slightly over 17 in., but the greater part of the rain falls during the growing season, therefore it is particularly effective agriculturally. The average mean temperature during the past ten years was 34·4° F.

The soil is rich, and splendid crops of grain are grown annually, also roots and fodder crops. Saskatchewan stands first amongst the wheat-provinces of Canada. The value of Saskatchewan's grain crop is greater than that of the provinces of Manitoba and Alberta combined, greater than that of any State in the United States of America, and claimed to be greater than that of any single province in the world. Its grain-production in 1913 was 243,513,000 bushels. All grain-dealers in the province must be licensed and bonded.

In few provinces at the present time are farmers so well organized for the protection of their own interests. They have the Grain Growers' Association and the Saskatchewan Co-operative Elevator Company. Both of these look after the grain-raiser. There are horses, cattle, sheep, swine, and poultry breeders' associations, and numerous agricultural societies, all of which are liberally aided by the Provincial Government. The cash grants to these associations in 1914 amounted to £12,920.

The Province of Saskatchewan has an area of 161,088,000 acres, but its total land area is only 155,764,000 acres, of which 76,216,863 acres have been surveyed and 13,520,490 acres are under cultivation. Of the surveyed area 26,000,000 acres are under homesteads, 5,400,000 acres under pre-emptions and purchased homesteads, 15,177,063 acres granted to railway companies, 2,000,000 acres for forestry, 9,100,000 acres are now available for entry. The value of land has increased fully 25 per cent. within the last two years. The average price of improved land runs from £4 12s. to £6, and for unimproved from £3 to £4 10s. per acre. The prices depend more on the situation of the land than on the quality, land in older-settled districts and nearer to a railway being naturally more expensive.

It is said two-thirds of the province is admirably adapted to sheep-raising, and every encouragement is being given to those desirous of taking up this work. The English Down breeds are preferred, on account of their hardiness, prolificacy, and early maturity.

Helpful Bulletins.—The departmental printing-office turns out a continuous supply of leaflets and bulletins, mostly printed in large type, and of a size suitable for posting up with the idea of catching the eye. The Saskatchewan Department of Agriculture issues a sheet of "Ten Dry-farming Commandments." Wherever a particular crop is considered profitable a leaflet is issued giving the most precise information as to its production. A live-stock market bulletin is issued regularly, giving the average ruling prices of cattle, sheep, and pigs in, say, Winnipeg, Calgary, Toronto, St. Paul, and Chicago. Or it may be that a warning leaflet will be issued concerning some dangerous weed or thistle, with an accompanying coloured cut of the weed and a word about its eradication. "The Advantages of Early Fall Cultivation" was the heading of one wall-sheet which illustrated by diagrams the increased yields that had actually been recorded in field experiments by early as against late ploughing and disking.

In another direction the Department assists farmers, and gets in touch with him by means of posters: this is in securing labour for the farm, a direction in which no fee is charged. The farmer is asked in a prominent poster to send word of the class of man he requires, and the Department does the rest.

"Better-farming" Trains.—The "better-farming" trains of Canada are a direct means of educating farmers by placing before them the best specimens of stock or crops that can be obtained, and lecturing to them on the particular branch of farming in which they are engaged. A farming train, consisting of eight or more cars containing, say, a field-crops section, demonstration section, a domestic-science section, and a boys' and girls' section, will visit eighteen railway-stations in a week, spending three hours (9 a.m. to noon, 2 p.m. to 5 p.m., and 7 p.m. to 10 p.m.) at three stations per day, the stations being selected not necessarily consecutively, but with an eye to getting in touch with all the farmers, particularly in the more newly settled portions of the country.

The Saskatchewan Department of Agriculture ran "better-farming" trains in the summer of 1914, and it was such a great success that the experiment was repeated in 1915. In view of the nature of the province and the shortage of feed in 1915 it was decided to lay emphasis on soil-tillage, crop-production, and weed-control, and these phases of farming were dealt with very thoroughly in the form of demonstrations and discussions by leading authorities who accompanied the train.

The very thorough manner in which the "farming trains" are advertised represents only one small branch of activity in what must be a huge Government Printing Office. Handbills and posters are distributed broadcast, giving the date and hour at which the train will reach each station. The railway companies also offer single fares for the return trip from any station within twenty-five miles of a demonstration station.

A train that traversed the south-western portion of Saskatchewan in 1915 was equipped with four sections. The first section included two lecture-cars in which leading agricultural authorities dealt with various phases of soil-cultivation and crop-management, each address being followed by a discussion of problems arising out of local conditions. A domestic-science section included two cars—one for demonstration and addresses on women's work in cooking, sewing, home nursing, poultry-raising, and so on; and the other (in charge of a matron) where the younger children were looked after during the demonstrations. The third section consisted of a car containing models of farmsteads and farm buildings, the proper location of shelter-belts, and so on; while models of various farm appliances were also shown. A boys' and girls' section, which completed the train, provided an hour and a half lecture on western birds and insects, illustrating with lantern-slides in life colours all the common insect pests and the useful and useless birds.

The value of farming-trains, however, is not limited to one or two sections of farm-work. In some cases the farmers are induced to bring their stock forward during each visit, and an expert explains good and bad points, and indicates the best direction in which selection should be pursued.

Needless to say every train carries an abundant supply of free leaflets and bulletins on farm topics.

Each train also carries a "sleeper" and a "diner" for the accommodation of the lecture staff. The personnel of the lecture staff changes from week to week, and during the itinerary a part of the programme is taken by some well-known authorities on agricultural subjects.

The trains in one tour travelled two thousand miles and were scheduled to stop at 133 stations, some of them sidings with barely the traces of a village. The attendance at the first thirty-six meetings was about ten thousand persons, and it is reckoned that the persons served by the train number thirty-eight thousand.

Agricultural Instruction Funds.—Through the medium of the grant received from the Dominion Government under the provisions of the Agricultural Instruction Act it has been

possible to greatly enlarge and extend the scope of extension activities in Saskatchewan. The grant for the year 1914–15 was £12,230.

The Province of British Columbia.

Vancouver Island and British Columbia, united in 1886 as "British Columbia," became a province of the Dominion of Canada in 1871. The capital and seat of the Provincial Government is situated at Victoria, Vancouver Island, some sixty-five miles in a south-westerly direction from the City of Vancouver on the mainland. Victoria, British Columbia, is the Pacific gateway of Canada. It is claimed that it is the best-paved, best-lighted, and cleanest city in Canada.

It is stated for British Columbia that it has the largest trade of any country in the world per head of population. Its population at the last census (1911) was 392,480.

Canada has the most extensive and best-stocked commercial fishing-waters in the world. The fishing-area includes 5,000 miles of Atlantic and 7,000 miles of Pacific coast, and 220,000 square miles of fresh water. The fisheries exports for 1913–14 were valued at £4,146,969. Of the provinces British Columbia comes first with a production valued at £2,891,097.

British Columbia holds a high position in the markets of the world for fruit-production. In December, 1913, British Columbia won the Premier Gold Medal for apples at the Royal Horticultural Society, London, also at Sheffield and Edinburgh.

British Columbia's forests now constitute more than half the lumber-supply of Canada, and the capital represented by forests is set down at £2,200,000,000.

The offices of the Department of Agriculture are situated in the Provincial Government buildings at Victoria, B.C. Mr. W. E. Scott, Deputy Minister of Agriculture, to whom I had a letter of introduction from Mr. J. H. Grisdale, Director Dominion Experiment Farms, Ottawa, gave me every facility to understand the methods and activities of his department, and, having had some years experience of sheep-farming in Otago, New Zealand, was much interested in the splendid progress being made by New Zealand in recent years.

A feature of the agricultural activities of the Department of Agriculture of British Columbia in connection with farmers' institutes is the field crop and seed competitions and the boys' and girls' field-crop competitions. To supervise this work there is a Soil and Crop Instructor, who issues in bulletin form rules and regulations governing these. The bulletins are circulated in the month of January each year, and they also contain the awards made in these competitions for the past year.

For the field-crop competitions, farmers' institutes desiring to organize these must notify the Soil and Crop Instructor on or before the 1st May, stating the kind or kinds of crops for which competitors are to be provided.

For competitions open to members of farmers' institutes there are two sections, one for farmers who own, rent, direct, or work not more than 10 acres of cultivated land, for which prizes of £5, £3, and £2 are given, and also for farmers who own, direct, or work more than 10 acres of cultivated land, for which prizes of a similar value are given. The crops for which competition may be made are oats (seed only), wheat (seed only), barley (seed only), peas (seed only), potatoes, turnips, mangels, field-carrots, fodder-corn, kale, red clover, lucerne (new seeding), lucerne (second year), and lucerne (third or over), mixed grain for feed, grain-hay. The size of the plots in competitions for areas under 10 acres are from $\frac{1}{8}$ acre to 1 acre in extent; for farmers who have more than 10 acres under cultivation from $\frac{1}{4}$ acre to 2 acres in extent.

For "good seed" competitions any member of a farmers' institute may compete, but must be a member of a "Good Seed Centre." The competitions are for best field of oats for seed; best field of potatoes for seed; best field of corn for seed; best field of red clover for seed; best field of lucerne for seed; best field of mangels for seed; best field of turnips for seed; best acre of carrots for seed. The areas are from $\frac{1}{4}$ acre to 1 acre, and the prizes in each class are £5, £3, and £2.

For seed competitions there are prizes of £2, £1 10s., and £1 each for the following: Best 2 bushels of spring wheat, best 2 bushels winter wheat, best 2 bushels white oats, best 2 bushels six-rowed barley, best 2 bushels field-peas, twelve ears fodder-corn, best bushel potatoes, best bushel lucerne-seed, best bushel alsike-seed, best bushel red-clover seed, best bushel timothy-seed, 20 lb. potatoes grown by competitors in the boys' and girls' competition, 2 bushels of registered white oats, 2 bushels registered spring wheat, 2 bushels registered potatoes, 20 lb. registered mangel-seed, 20 lb. registered turnip-seed, and 10 lb. registered field-carrot seed. All exhibits must be grown by the exhibitor in that year.

Every winner of a first prize at a seed-fair who wins with an exhibit from his plot entered in the field crop competition will be paid a bonus of £1 by the Department of Agriculture.

Boys' and Girls' Competitions.—Any farmers' institute desiring to organize a boys' and girls' competition shall appoint a committee composed of three of their members, the president and secretary of the institute, who shall make and carry out the necessary arrangements for the holding of the potato competition. Competitors must not be under twelve or over eighteen years of age on the 10th May of year on which the entries close. The plots require to be exactly one-tenth of an acre. Provision for a prize-list is also made wherever local seed-fairs are organized by the farmers' institutes, for which liberal prizes are given.

As showing the popularity of these competitions in 1914 the following were the number of competitors in the different sections and classes—Section 1: Potatoes, 205 competitors; wheat, 10 competitors; peas, 5 competitors; oats, 93 competitors; carrots, 16 competitors; mangels, 19 competitors; lucerne, 14 competitors; kale, 17 competitors; turnips, 4 competitors: total, 383 competitors. In the boys' and girls competitions, 149 competitors.

GENERAL OBSERVATIONS.

Apart from individual agricultural institutions visited in both the United States and Canada, and their activities, there are a number of matters of particular interest in both countries which can best be considered when grouped together under one head. These are as follows :—

Agricultural Education in the United States and Canada.

It has already been shown in this report what is being done in this direction by the Province of Manitoba in Canada, with a population of less than half a million, establishing a college to educate its rural population in regard to its primary industry—*i.e.*, agriculture. The State of Oregon, in the United States, may be cited as another instance where, with a population of 672,765, agricultural education is kept in the front. The Agricultural College of Western Oregon is typical of the agricultural institutions of the United States. The Agricultural College located in Williamette Valley is in close touch with the movement of rural population, and it is claimed that recently Oregon has been getting an exceptionally large proportion of the most desirable citizens.

The Oregon Agricultural College at Corvallis is one of the most successful examples of what are known as "land-grant colleges." The regular registration of students at the end of 1912 was 1,142. The short courses brought a registration of 1,583, and the summer session 143, making a total of 2,868. The college is well organized and equipped, and its work is thorough and exceedingly practical. The courses include agriculture, pharmacy, forestry, domestic science and art, engineering, commerce, industrial pedagogy, or training of teachers for industrial work.

The Dominion Government of Canada in 1913 appropriated £2,000,000 to be expended during a period of ten years, at an average of £200,000 a year, on agricultural instruction. In Canada education is regarded as the prerogative of the provinces, and the money is handed over to them for expenditure through their Departments of Agriculture and Education. The basis of division was as follows: £4,000 a year was set aside for two veterinary colleges, one in Toronto for English-speaking students and one in Montreal for French-speaking students; £4,000 was given to each of the provinces irrespective of population, area, or natural production. The balance of each year's appropriation is divided according to population.

The federal grants have furnished about £50,000 for buildings and equipment for agricultural instruction throughout the provinces; they have provided for 155 permanent instructors; they have made possible an extension of the lines of demonstration in every province; they have enabled several provinces to organize for instructing women on the farm; and they have made great progress in initiating and extending the work of teaching agriculture in the public schools.

It is intended to hold a general conference each year with representatives of the provinces in order that the work may be co-ordinated, and so avoid duplication between federal and provincial departments. There is also in contemplation a central publication office by means of which the people of Canada will be kept informed continually as to agricultural work in progress in all parts of the country.

In Ontario alone the appropriations for agricultural work carried on through the Departments of Agriculture and of Education for 1914 were (in round numbers) as follows :—

	£
Civil government, printing reports and bulletins, statistics, and miscellaneous	14,000
Agricultural College	80,000
Agricultural and Horticultural Societies Branch	32,000
Live-stock Branch	11,000
Institutes	8,000
Dairy Branch	13,000
Fruit Branch	13,000
Colonisation and immigration	30,000
Ontario Veterinary College	42,000
District representatives	8,000
Demonstration farm	2,000
*Director of Elementary Agricultural Education	500
*Instruction in agriculture and horticulture, and grants to school-gardens in public and separate schools, and contingencies	900
*Instruction in industrial arts and household science, grants, and contingencies	400
*Travelling-expenses of normal-school students to rural public schools and for nature-study	250
*School-gardens for normal schools	200
*Agricultural training in high schools by the district representatives	8,750
*Special industrial and agricultural education	1,000
Total	£265,000

The amounts included a certain sum in capital expenditure on buildings, but the greater part of this was represented in the erection of the Veterinary College.

* Granted by the Department of Education.

British Columbia appointed a Commission on Agriculture in 1912, and its recommendations in regard to agricultural education may be summarized as follows:—

(1.) Beginning with the rural schools, nature-study and the fundamental principles of agriculture should be taught, aided by the use of school or home plots, with the object of giving boys who do not continue their education beyond the primary schools some knowledge of botany, soils, and kindred subjects, and where possible some manual training; and providing for girls a useful course in domestic science.
(2.) Training for teachers for the particular work.
(3.) In rural schools the teaching of some simple form of farm book-keeping.
(4.) In the curriculum of high schools a place for such special work as would prepare a boy for entrance to an agricultural college, or better fit him for the business of farming, without further theoretical education.
(5.) The replacing of all educational bulletins by a monthly magazine to be issued by the Department.
(6.) The appointment of district instructors who should inspect and report on all farms and orchards, each of which should be numbered and visited once a year at least for advice and instruction and the detection of pests.
(7.) Provision for the analyses of soils for members of farmers' institutes.
(8.) The preparation of agricultural charts to make plain to prospective settlers what grains, vegetables, fruits, &c., are best adapted to every locality, and the respective advantages and disadvantages of each district.

In particular the Commission advocated the establishment of Government training-farms for everyday work on the farm, from clearing land to milking cows, with the use of a library of agricultural text-books and a course of lectures taking up an hour or two a day.

The Smith-Lever Act of the United States corresponds in many ways with the Agricultural Instruction Act of Canada, but differs from it in specifying that no appropriations under it shall be used for the purchase, erection, or repair of buildings, or the purchase or rental of land, or in college course teaching, promoting agricultural trains, or other purposes not specified in the Act, and in specifying also that not more than 5 per cent. of each annual appropriation shall be applied to the printing and distribution of publications.

Canadian Seed Work.

The Canadian Department of Agriculture has a Seed Commissioner, who conducts a special branch of seed-growing, seed-testing, and seed-inspection. Under "seed-growing" is included educational and other work directed toward encouraging the production and use of better seed. Financial and other assistance towards conducting field crop competitions, seed-fairs, and provincial seed exhibitions is given every year, and nearly £10,000 is available annually for the provinces in the way of subsidies. The growing of field, root, and garden vegetable-seeds in suitable localities is encouraged by subsidies. In addition to their regular work the officers co-operate with local agricultural organizations in conducting seed-judging classes and other educational work. Seed-testing involves the analysis of samples which are sent to the laboratories at Ottawa and Calgary by seed-merchants and farmers, as well as many other tests. The system of inspection for the enforcement of the law governing the sale of seed in Canada consists in visiting the seed-merchants and farmers who have seed for sale. It has been the policy to enlist the co-operation of seed-merchants in the attempt to rid the trade of badly contaminated seed, and the response has been very encouraging.

The Canadian Seed-growers' Association, which is a very active body, also encourages the production and use of pure seed of high quality and of known origin. This object is attained by enlisting as members farmers who desire to make a specialty of growing high-class seed under expert direction. When stock seed of approved quality has been secured its natural increase up to and including the third generation is eligible for registration as registered seed providing it complies with the standards. The final judgment as to the eligibility of seed is pronounced by laboratory tests of samples taken from the threshed product, and the tests include determinations both of percentage, vitality, and the degree of purity as regards freedom from weed-seeds and seeds of other cultivated varieties.

Sale of Seed regulated by Law.—The sale of clover, lucerne, grass, field, root, vegetable, pasture, and fodder-crop seeds, as well as grain, when sold for seeding purposes in Canada is regulated by law.

Timothy, red clover, alsike, and lucerne seed must be marked according to its quality with one of the four following grades: Extra No. 1, No. 1, No. 2, and No. 3. Seed below grade No. 3 is prohibited from sale except for recleaning or export.

Farmers may sell clover and timothy seed to seed-merchants for recleaning before having it graded. They may sell seed which is grown and delivered on their own premises without the grade being marked, provided that it is not below the standard for No. 3. If a farmer ships seed to any other farmer, sells it to retailers as being in good condition for seeding, or offers it for sale in a public place, it must be marked with the grade. All other seed, including grass, millet, and seed grain, must be free from the seed of noxious weeds or be labelled to show the kinds contained. All kinds of seed must germinate in the proportion of at least two-thirds of the standard for good seed of the kind, or be labelled to show the actual percentage germination.

Any seed-dealers or farmers violating the provisions of the Seed Control Act are liable to prosecution.

A staff of thirty-five Seed Inspectors is employed to enforce the Act, but any farmer or purchasers of seed may put it into effect.

If the quality of any seed is suspected a sample may be sent to the seed laboratory at Ottawa or Calgary for test. These laboratories are maintained for the services of seed-merchants and farmers.

Co-operative Organization.

Co-operation is the watchword throughout the farming communities of the west, and for many years past the members of many of the local grain-growers' associations have joined together to purchase such lines as binder-twine, building and fencing material, flour, feed, and so on. But attention is being paid officially to the proper form of business co-operation to be adopted by farmers, and the tendency is towards non-profit corporations, as the result of organizing so-called co-operative associations under the usual stock corporation laws leads to the passing of these institutions into the hands of non-producers or of rival interests, while one of the ever-present difficulties is that the stockholders generally demand an unusual interest on the capital paid in, taking a huge dividend before returning the proceeds to the growers. It is maintained that membership in a co-operative organization should be confined exclusively to those who are producers and who as producers use its facilities.. It should never include those who contribute capital alone, and a fundamental principle should be "one man one vote." The outcome of a co-operative organization formed to handle the grower's product will succeed or fail on the skill and integrity with which the product is harvested, handled, graded, and packed, and a uniform standard of quality in the brands shipped by an association is fundamental to success.

Every form of rural organization is being encouraged and written about. One plan that seems to find favour with educationists is the division of rural needs into, say, ten different headings, and the setting-up of a committee to deal with each particular phase of rural improvement. This is, of course, a very comprehensive programme, which could not be given effect to unless there was a need for organization towards a definite end. Meanwhile there is a gradual finding-out of the best lines on which co-operative organization can go safely forward, and the results are reflected in the large number of farmers' mutual insurance companies, co-operative creameries, and cheese-factories, co-operative elevators, and so on. There have been conspicuous failures as well as successes, and there is need for a permanent body of some kind to begin a comprehensive study of the whole problem, and keep a permanent record of successes and failures.

Agricultural associations in British Columbia are incorporated under an Act which also provides for advances to settlers through an Agricultural Credit Commission. The Act provides for the incorporation of all co-operative farmers' institutes, co-operative women's institutes, fruit-growers' associations, agricultural fairs associations, stock-breeders' associations, dairymen's associations, and poultrymen's associations, as well as farmers' institutes. Power is taken by the Parliament to set aside money each year for farmers' institutes and women's institutes, the subsidy being, roughly, 2s. a head of membership for the first hundred and 1s. a head for membership above that number. Power is given to municipalities to grant money in aid of any duly appointed farmers' institute. The Minister of Agriculture is also empowered to pay to each association formed under the Act such moneys as he thinks fit. Power is also given to incorporate any twenty-five persons with share capital for any purpose approved by the Minister and having for its object the development of agriculture, and these associations may group themselves together in district exchanges, the objects of which, as defined by the Act, are "to develop and improve the industries of agriculture and horticulture by the introduction of improved methods, the supplying of agricultural requirements on the best terms by economizing in the marketing of agricultural produce and stock, by carrying on the business of dealers and agents, and by doing all things necessary or expedient for the accomplishing of its objects." Provision is also made for the creation of a central exchange for the province.

Marketing Organization.—Funds are set aside by the United States Government for an Office of Markets and Rural Organization, whose sole work is the "collection and distribution of useful information on subjects relating to the marketing and distributing of farm-products" and the study of co-operation among farmers. As far as possible the marketing problems are being studied from the points of view of producer, dealer, and consumer. A large part of the rural investigations has consisted in a study of the work of rural-credit associations.

The individual grower frequently finds that working alone he is unable to do certain things which economically are essential. Therefore a general demand for co-operative effort has arisen. The investigations of the office to this end include a study of buying and selling organizations in America and elsewhere, and the reason for success or failure. Experiments are being made to ascertain the advantages of direct dealing between organized producers and organized consumers in such commodities as eggs, poultry, butter, fruit, and vegetables. Suggestions are given regarding co-operative organizations, where they are warranted, and how they should be organized, with forms on constitution and by-laws, incorporation, control, and management. It is hoped that through such organizations production may be adapted to meet market requirements, waste may be eliminated, brands and trade-marks established, special local products advertised, special transportation used, new markets discovered and old ones extended, methods as to securing information as to crop and market conditions devised, by-products utilized, cold and common storage facilities obtained, and the holding of crops financed, supplies purchased, equipment and material secured and used, and all the advantages and economics gained that accrue to enterprises that are conducted on a large scale.

The marketing of agricultural products is being put on a businesslike foundation by the Office of Markets, which is paying particular attention to office organization, accounting systems, methods of auditing, office appliances and equipment, and plans of financing. Systems of accounts are being devised for various types of organizations and other agencies, and after a

thorough test of their practicability these systems are made available to all, and where possible active assistance is given in installing them. Systems of accounts are also being outlined for firms doing a commission business in agricultural products, with a view of devising something that will be adopted ultimately by "the trade" as a uniform system.

It has been found that present methods do not give to the consumer the benefits of the unusually low and sometimes ruinous prices that producers receive in seasons of abnormal production. At this point the office steps in with a market news service, designed to promote a better distribution of perishable crops. The marketing methods used in large cities are being investigated, and studies are being made of the current market quotations. This part of the work also relates to general studies of supply and demand, as well as a determination of the market surplus produced within defined shipping-areas, and the relation of prices to receipts with a view to determining the point at which the market becomes glutted. A force of market reporters is at work in the various centres, their duty being to follow the progress of certain products from the time they arrive in a given city till they reach the ultimate consumer.

Producer and shipper are being educated to the best method of gathering, handling, grading, packing, and shipping farm-products, and also to the necessity for fixed market standards and strict grading, even where legal standards are not fixed. Much of this work has been confined so far to perishables, but it is intended to apply to all classes of farm-products, even to the point of establishing marketing standards for use in grading and shipping potatoes. A collection of typical boxes, crates, and carriers used in all sections is being prepared. The Government established a standard barrel and pack for apples in 1912, and a standard barrel for fruit and vegetables was similarly established in March, 1915, and becomes effective on the 1st July, 1916. In the case of perishable products every handling is conducive to deterioration, and every change of ownership or possession means, as a general rule, added cost. Considerable attention is centred at present on the possibilities of municipally owned wholesale and retail markets, where modern facilities at minimum prices can be offered to the farmer and dealer, to the end that they may conduct the business as efficiently as possible. The best municipal markets of the country are being studied with reference to the details of location, cost, construction, sanitation, maintenance, and the service, or lack of it, which they render to the public. There is a constantly increasing demand from municipalities for advice and aid in improving their marketing conditions. Most large markets are tending more and more to draw their supplies from distant points on account of better and more uniform service, but to counteract this the Office of Markets is making special efforts to help cities to develop a neighbouring food-supply.

Transportation and storage are also being studied, advice being given to producers or consumers in difficulties, but so far this is only advisory work, except where the office might undertake direct handling for demonstration purposes. Marketing by parcel-post and express is also being exploited with a view to eliminating the middleman, and the real value of the office in this direction lies in its efforts to bring growers and consumers together.

The work of the Office of Markets takes in the marketing of live-stock and animal by-products, ascertaining whether the existing rates and customs are equitable, and paying particular attention to methods of feeding, yarding, handling, and charges. The same system of investigation is applied to the marketing of dairy-produce, the cotton crop, and so on.

The Canadian Agricultural Department is also pointing to the shortest route between farmer and consumer. In the early years of the province, when grain was the principal produce marketed, the farmers, after trying various methods of marketing, solved the problem by establishing the co-operative elevator system, through which they can dispose of their grain at a minimum of expense and risk. With the advent of mixed farming the marketing problem has become much more complicated, and one of the most serious problems confronting the farmer is how to dispose of his live-stock at its full value. The Stock Marketing Association is simply an organization through which the farmers in a district unite to make up truck-loads of live-stock to be forwarded to a central market where competitive bidding is assured. The advantages are evident, and not one of the least is that where a number of marketing associations have been organized in adjacent towns along a line of railway they are able to secure special stock-trains. This system, while not as suitable to New Zealand as it is to Canada, is combined in Canada with what is known as community breeding, and a development of the system might be fraught with very good results.

What is perhaps more significant to New-Zealanders than the mere organizing or stock-marketing associations is the manner in which the movement, like any other movement, is put before the farmers by the Agricultural Department. A bulletin of thirty pages, which has run beyond its second issue, was published a little time ago by the Department of Saskatchewan, in which, after discussing the advantages of the system, the fullest directions were given for organization, with points on the essentials of success, information about the various markets, with the best advice on classification and marketing generally, freight rates on all classes of live-stock, the cost of feed and watering at various points, and finally simple forms for keeping accounts. The manner in which the Department assists the farmer in these and many other ways through the printing-press is a most impressive feature of farming education throughout America.

Farmers' Co-operative Demonstration Work.

The farmers' co-operative demonstration work began in the United States as far back as 1903, and its value was firmly established in the following year, when the spread of the cotton-boll weevil in Texas caused an indescribable panic, in which farms were abandoned and counties depopulated. To arrest the panic and convince farmers that they could grow profitable cotton crops in spite of the weevil Congress made an appropriation, and a portion was set aside for

establishing "cotton-culture farms" throughout the infested portion of the country. Farms were established near the business centres, and thousands of farmers agreed to test the department's instructions on their own farms. The results were astonishing, and the simplicity of the plan and its phenomenal success commanded widespread attention, and the scope of the work was extended to demonstrations in corn, cow-peas, and winter cover-crops. In 1907 the demand arose for more intensive work, and to secure an agent exclusively for their counties several communities offered to pay a large portion of his salary. The experiment was a marked success, and the County Agent became an integral part of the demonstration plan. Active propaganda for more and better live-stock was begun, and special attention was given to hog-raising. Boys' corn clubs, and finally girls' canning clubs, were added as branches of the demonstration work. The general scope of instructions had meanwhile been broadened to include every practical phase of agriculture, the improvement of homes, better farms, improved implements, the production of forage crops and home supplies, and the conservation of soil-fertility and greater economy in production and expenditure.

It was realized in the beginning that the farmers should have an active part in the work, and as far as possible pay for what was done in their interests. Accordingly business men were asked to provide funds to pay for seed and fertilizers on the cotton-culture farms. The farmer furnished the land, teams, tools, and labour without other compensation than the expected increase in his harvest.

Co-operative relationships now exist with agricultural colleges, State Agricultural Departments, Boards of Agriculture, county organizations, railway and civic bodies. In round figures, last year £140,000 was spent in demonstration work in the Southern States, £70,000 of it being a Congressional appropriation, £40,000 voted by the States, counties, agricultural colleges, Boards of Agriculture, and other sources, and £30,000 from the General Education Board of New York. But all classes everywhere have been found enthusiastically promoting the work.

The co-operative demonstration work is now a system by which the fundamental principles of farming are taught directly to the farmers in each community on their own farms, as the dissemination of printed information by bulletins and agricultural papers, or sporadic oral instruction, did not reach far enough.

In beginning the work it is the aim first to impress a few definite principles necessary to a good crop, and see them worked out and verified by the farmers on their own land. The local or county agent undertakes to do a definite thing, and locates fifty or more demonstration farms, with an eye to an even distribution of the lesson. These he undertakes to personally supervise, in order to be sure that his directions are understood and observed. As many other farmers as possible are then induced to promise to use the same methods on some part of their farms. These are called "co-operators," and receive their instructions from bulletins and circulars from the Department, and letters and occasional visits from the agent. The first result of the work is to rouse healthy curiosity, rivalry, and competition, and it has even been found that neighbouring farmers who have scoffed at the idea of an instructor have resolved nevertheless to beat the Government farm unaided. During the season the agent sends notice to all co-operating farmers, telling them when he will visit the demonstration farm in their community, and inviting them and their neighbours to meet him there to discuss the work in progress. These are called "field meetings," and are of great help in arousing interest and securing co-operation. Farmers who would never attend an institute meeting or read a bulletin are drawn by curiosity to such meetings, and are interested and instructed. After the season ends and it is shown that the yield on the demonstration and co-operating farms is much greater than on others in the same community, confidence in scientific methods begins to grow. The agent therefore becomes the connecting-link between the farmer and agricultural colleges. Needless to say, the results of co-operative farming demonstrations have been of the utmost value, and phenomenal increases have been recorded in corn and cotton yields, in addition to which farmers and business men have been brought together in an invaluable spirit of co-operation and community interest.

Boys' corn clubs and girls' tomato clubs were the form in which work was first started among the juveniles, and finally prizes were offered for the largest production on a given acre of corn raised under the department's instructions, economy of production being a condition. The clubs have increased from year to year until they have a membership of seventy thousand in the United States. The girls, on their part, take to tomato raising, canning, or poultry-farming.

Agricultural agents and farmers' bureaux are doing good work in Kansas. The idea of an agent who will enter a man's farm and order things to be done is coming to be accepted in some of the States because of the undoubted results obtained, but this happy state of affairs is secured only by selecting for the work men of sound practical agricultural education and mature judgment and experience. The work in Kansas for, roughly, three years is worth summarizing. In that time the agents visited approximately three thousand one hundred farmers on their own farms, and had about three thousand farmer callers at their offices. Five hundred farmers' meetings were addressed with an attendance of forty thousand, besides fifty other meetings with an attendance of twelve thousand. Seventy-three farmers' associations were organized, including in particular two live-stock associations, one co-operative buying association, eight farmers' clubs, and one egg circle. In addition to frequent publications, five thousand personal letters of information were sent out. Eighty farmers were encouraged to make exhibits at agricultural shows. Farm buildings were planned on twenty-four farms. The suggestions of the agents led to the erection of 216 above-ground silos and 300 pit silos. Water-supplies and sanitary conditions were improved, and homestead grounds were planned or improved. Complete farm surveys or summaries of farm business were made on 175 farms, and farm plans, partial or complete, were prepared for sixty-eight farms. Rotations were planned and adopted on twenty-seven farms. Drainage systems were installed on forty-five farms, and irrigation plants on

fourteen. Crops on six hundred farms, approximately 20,000 acres, were handled wholly or in part according to the agent's suggestions. Orchards to the number of 105 were cared for according to the agent's suggestions. Seventy-five registered sires were secured, while five truck-loads of dairy stock, most of it purebred, was shipped and distributed among the counties. Educational campaigns were conducted in each county. Farm demonstration campaigns were adopted, and about seven hundred farmers in each county were reached with definite instructions concerning soils, crops, live-stock, or farm-management.

When the farm-bureau work first started in the State of Kansas it was financed largely by groups of bankers, commercial men, and farmers, who organized farm bureaux with by-laws and officers and subscribed certain sums for their support. Approximately half the salary of the agents is found by the Department of Agriculture, the remainder of the salary as well as the expenses of the bureau being found by the bureau itself by membership fees of about £1 a year, and voluntary subscriptions from banks, commercial firms, and others. But as the farm-bureau work will undoubtedly become a permanent part of the modern educational system there is a demand that it should be placed on a permanent footing financially by the appropriation of public funds for its support.

The farm bureau is the organization through which farming campaigns are conducted, but there must be a demand or purpose to justify the campaign, and the membership of the organization must be well distributed over the district concerned to secure a general personal interest in the plans. In the autumn of 1912, in the Leavenworth County of Kansas, a great many wheat-fields were injured by the Hessian fly, and in the spring the injury was still more evident, and a campaign for its control was instituted. The experience of many farmers and the experiments of agricultural colleges had definitely proved that the fly could be controlled by sowing the wheat after the fly-free date. This, therefore, was the theme of the campaign: "Destroy the volunteer wheat, sow after the fly-free date, and the fly is vanquished." The matter was placed before all members of the bureau through a circular, and other farmers were reached through the daily and weekly papers, and by means of posters setting out the plan of campaign. The campaign was repeated in the following year, with the result that the damage from the fly was reduced to a negligible quantity. In the same way the county was cleaned of the chinch-bug, another great pest in America. The advantages obtainable from the wider use of the silo were the subject of another campaign, and the manufacturers of silos were invited to erect models of their respective silos at a particular hall, where the farmers congregated to talk silos and silage. Following this, letters were sent out to all farmers urging them to build permanent silos. The result in one year was the erection of about seventy-five new silos. Campaigns were conducted amongst other pests, the uppermost idea in all being co-operation.

County Agent.—The activities of the County Agent are so numerous that he must avoid the danger of overwork and under-effect. It is possible for the County Agent to spend a great deal of time and energy in trying to reach many farmers in his county and answer their inquiries without having any definite plan for progress in the agricultural development of his district as a whole. He must study the situation and the needs of his people, and work consistently to lead them along the road to progress. It is necessary that the whole plan should be laid before the people. He should become nothing more than an educator, a counsellor, a guide, and an instructor. He should avoid becoming a business agent. He should avoid working only with the best farmers, as his most effective work can be done with those who need him most. He should avoid the error of trying to rush the farmer into any new programme. His three lines of work should be information, demonstration, and organization.

In California the Farm Adviser's salary is paid by the Colleges of Agriculture of the University of California. His expenses are paid by local agencies within the county, and the constant travelling means that expenses about equal salary. About £400 a year is estimated to be necessary in most cases for expenses, including the maintenance of an office and office facilities, the use of a small automobile for travel within the county, and expenses away from home. As the value of a Farm Adviser increases greatly as he becomes more familiar and expert with the problems of the county, it is highly desirable that the work should be made permanent, and that no county should start such an adviser at work without funds in sight for his expenses for at least three years, and the money actually in hand for the first year of his work. The Department of Agriculture in fact gives preference of appointment where the first year's expenses are lodged, and in order to facilitate his work it is almost essential that he should work in conjunction with some advisory body, a capacity in which the farm bureau serves.

In Canada the County Agent is known as the District Representative, and this year there are more than forty permanent officers in as many counties and districts, and a few temporary ones as well. The Act covering the matter merely gives the Minister of Agriculture authority to appoint local officers, who shall be graduates of the Ontario Agricultural College, and to define their duties. It also provides that the County Council shall contribute the sum of £100 per annum for the carrying-on of the work. As it has been found that the cost of maintaining the local office with a District Representative, an undergraduate assistant, and a stenographer is in the neighbourhood of £800 a year, it will be seen that the amount required from the County Council is more in the nature of an expression of goodwill and co-operation than an essential element in the maintenance of the service.

An important phase of the agent's work is the promotion of farmers' meetings to give each man the benefit of his neighbour's successes and failures, for not infrequently the agent finds the farmer wasting valuable time in trying some new method of planting or tillage that a neighbour has already found to be a failure. Motor-car excursions or trips from one farm to another have also been adopted, one trip being planned to include farms where there were different kinds of silos. At each farm time was given to inspect each silo, to note the quality of the silage, the

condition of the stock that was being fed on it, and the cost. Other phases of agricultural work were also studied in the same way, the parties sometimes consisting of seventy or eighty farmers. An enjoyable and attractive feature of each tour was the dinner provided in a central hall.

The American farmer is being taught, among other things, exactly how to compute the number of hours of horse and man labour required to raise each crop on his farm. Simple charts are prepared for this purpose, and the agent is of assistance in planning his cropping system of the farm so as to keep the horses busy. Just how thoroughly this problem is considered may be judged from an extract from a Kansas agent's report. "The expense of horse labour," he said, "may be reduced by having the teams composed of good brood mares. The period of least work runs from the 1st September to the 1st April (the months would be reversed for New Zealand). The mares might be bred to foal in September and suckle the colts until weaning-time the next spring, when they could be turned on grass. The mares should be large and draughty, and should be bred to purebred draught stallions of the best type."

County Agent or Farm Demonstrator.—In some parts of the United States the work of the County Agent or Farm Demonstrator is being organized without Government assistance, the funds being supplied by membership fees and subscriptions. In these cases the demonstrator gives his time only to members of the association. The definition of a Farm Demonstrator is not very easy, and the idea of an adviser or expert is being departed from in some cases, but the demonstrator is coming to be regarded as a common carrier of ideas—not his own necessarily, but largely those furnished by the successful farmers of the community where he is working, the ideas of demonstrators working in other sections of the country, the ideas of experiment-station and agricultural-college men, and the ideas of agricultural thinkers, writers, and workers in all parts of the world.

The Office of Farmers' Co-operative Demonstration Work in the United States is a division of the Bureau of Plant Industry. The present organization consists of a special agent in charge, Mr. Bradford Knapp, with a staff of assistants and a clerical force at Washington; a State agent in each State; in most States a special agent in charge of the boys' corn club work and a special agent in charge of girls' canning club work; from two to four district agents in each State; and, as far as possible, a local agent in each county in the State. The organization is somewhat military in character, giving close supervision over every phase of the work. The total agency force as at present divided is as follows: State agents, 12; district agents, 36; local agents, 625; boys' corn club agents, 39; girls' canning club agents, 146: total, 858.

Agricultural Extension Work.

The State agricultural colleges maintain a distinct administrative division for the extension work and home economics, co-operating with the department. At the head of each State division is a Director, controlling several men in charge of various lines of work. In addition to these supervising agents there are generally specialists engaged in conducting movable schools and in other ways co-operating with the County Agents in the instruction of farmers and their families. The principal work so far has been the farm demonstration and advisory work. The advent of the County Agent enabled the demonstrations to include all the standard farm crops, gardens, pastures, and in later years the breeding, raising, and feeding of live-stock. Meetings are held at demonstration plots to give information to a large number of farmers, and at these meetings the agent goes over the farm with those assembled, discussing the operations informally and inviting questions. The results of the demonstrations give the farmers confidence in the ability of the agents. For the last five or six years County Agents have been working with organized bodies of farmers such as farmers' unions, agricultural associations, and farmers' clubs, as it has been found that where such co-operation is secured the work becomes far more effective. Out of this experience has developed a systematic effort on the part of County Agents to work through organized bodies of farmers and create organizations in communities where there are none.

It is recognized that the County Agent should be a man of practical experience in farming, and of such personality as to enable him to become a leader among the farmers of his county. He must also have agricultural education and technical training, and, other things being equal, preference is given to graduates of agricultural colleges. One of his main duties is to bring to the farmers on their own farms the results of scientific investigations in agriculture and the experience of successful farmers, and to influence farmers, through demonstrations, to put these into practice. He gives instruction not only in improved agricultural practices, but also in farm-management, marketing, and purchasing supplies. In some of the States organizations called "farm bureaux" have been developed to co-operate with the County Agent. These are open to any person who is interested in better farming.

Under the heading of "extension work" comes the organization of boys' and girls' clubs, and girls' demonstration work, which includes gardening, canning, preserving, poultry-raising, and so on. Extension work is also being organized for women and girls on the farms, and where sufficient funds are available a well-trained woman agent is employed to give instruction in home economics. In this work, as in the ordinary extension work, there are agents, movable schools, "neighbourhood" meetings, conferences, and so on, with specialists to assist the agents. Among the problems now being taken up are children's welfare, the selection, preparation, and preservation of food, canning of fruit and vegetables on the farm, the selection and protection of water-supply, sewage-disposal, house-ventilation, household equipment and management, the use of labour-saving devices and machinery, and the control of insects and other pests.

The movable schools, for which the local arrangements are generally made by the County Agent, give short practical courses of instruction, accompanied by demonstrations, illustrated lectures, and exhibits, organized and conducted by specialists attached to the agricultural colleges. These schools commonly occupy a week, but in some cases longer or shorter periods.

Boys' and Girls' Clubs.—A condition not peculiar to America is that many of the boys and girls on the farm have very little interest in the farm-work, and the desire to get away to the towns is being overcome by making the youngsters partners in some line of work, giving them the income from certain crops, fields, or stock. The boys' and girls' club and contest work is the result, and in all contests the parents are urged to give the boys and girls a part of the crop or stock raised, even if a prize is not won. Indian corn and Kaffir corn (or millet) is the chief crop for the boys. In one country the boys were required to plant an acre of corn, do all the work on it, keep a record of the work done and the returns from the crop, and to write a report. Prizes were given for the following points: Yield per acre, 30; profit, 30; exhibit of a part of the crop, 20; history and report, 20. A uniform scale of prices for labour, rent, &c., was charged.

In pig contests prizes were offered to boys who secured the most weight from a single litter of pigs at the least cost per pound, the conditions, of course, being uniform.

In garden contests for girls, each competitor plants, say, a tenth of an acre, planning the garden and doing all the work. The principal crop is tomatoes, which are canned. Butter contests are also promoted for boys and girls.

The Province of British Columbia has a Soil and Crop Instructor, who is at the head of the boys' and girls' field-crop competitions. If the competition is for potatoes he issues a bulletin, a booklet of sixteen or twenty pages, with an introductory letter addressed personally to the boys and girls, and thereafter the most complete details for the selection of the plot, the variety, and the seed, preparation, cutting the seed-potato, the rate of seeding, planting, fertilizing, spraying, and so on. The conditions of each contest are as clearly set out, together with the method of scoring, and the rules. After the contest is over the competitors' points are published in another bulletin, which, in addition to setting out the rules for the next contest, will very likely contain a good many points about the mistakes made by competitors in previous contests.

The Community Egg Circle.—It is estimated that the annual production of poultry and eggs in the United States is in excess of £120,000,000, but there is a total loss of nearly 8 per cent. of the eggs marketed, due to improper handling between the farm and the market. The remedies are kept constantly before egg-producers in a series of bulletins, but it has been found that more can be accomplished in these essentials by uniting several producers in an association. One very successful egg company has a large incubator-house, with a capacity for twelve thousand eggs, where early chicks are produced for the members at a low cost. This is done in order to obtain early-maturing pullets, thus securing eggs during the autumn, when they are usually scarce. The company also has a receiving-room for eggs, where they are candled, sorted to weight (about 24 oz. to the dozen), packed in cartons, and shipped on contract orders. Their eggs are guaranteed to be according to grade. Twice a year dividends are paid to each member in proportion to the number of eggs marketed through the company and the time of year they were brought in, a higher dividend being paid per dozen for eggs brought in during the autumn and winter. A regular trade is established with discriminating consumers, the best class of hotels and restaurants, and with grocers, the reputation thus established enabling the association to fix its price above the regular market quotations. Egg circles, which are being taken up rapidly in the United States, may be formed by any number of producers, the aim being in the end to secure enough eggs to warrant a central station, with a manager to inspect, grade, and market the whole product. Marketing through the local creamery has also been successfully tried. The average constitution provides for a president, vice-president, secretary-treasurer, and two trustees, the five to form a board of managers, the secretary-treasurer performing the duties of manager. It is usual to insist that eggs should be gathered daily and kept in a cold place, that no eggs older than seven days shall be delivered to the collector, that members may deliver eggs only from their own hens, and that all eggs must be delivered to the circle. Eggs that do not average 24 oz. to the dozen are paid for by weight on that basis. The whole plan is very simple, and is being put before producers by frequent bulletins from Washington.

Women's Institute.

"For home and country" is the motto of the women's institutes of Canada. Their object is the study of home economics, child-welfare, the prevention of disease, the improvement of local and social conditions, and the encouragement of agricultural and other local and home industries for women. The State connection with the institute is definite and valuable. The Deputy Minister of Agriculture is Superintendent of Institutes, and with the Minister sits on an Advisory Board with four women chosen from different parts of the province, one of them being chairman. The Board advises the Department on the work of institutes and, in particular, the work of women in agriculture, at the same time seeing that the departmental policy is carried out. Besides supplying lecturers for meetings of the institutes, the Department provides all stationery, posters, and other matter.

The Province of Ontario alone has 843 branches of the Women's Institute, with a membership of nearly 25,000, which represents as many homes. The outbreak of war has turned the attention of women to Red Cross and other patriotic work, but nevertheless the women's institutes are increasing at a rapid rate. The annual membership fee is 1s., and every branch institute with a paid-up membership of fifteen receives a grant of, roughly, 12s. 6d., in addition to which the district institute, which undertakes organizing and advertising work, receives a fixed grant of £2, and a further grant of 12s. 6d. for each branch in the district. In addition to these grants other amounts are usually forthcoming from local bodies, in addition to receipts from entertainments, and so on. To every member the Department of Agriculture posts copies of all bulletins and of other Government publications that may have a bearing on the work of the institute.

Meetings are usually held once a month, in the afternoons, either in a hall or in the home of a member, with an occasional evening meeting, the regular programme of meetings being also diversified with entertainments. The subjects have a very wide range, two papers being usually read or demonstrations given in one afternoon, followed by a reading or a discussion of current topics and a general conversation.

A plan has been adopted in Ontario of sending instructors to give lessons on food-values in cooking and on sewing to members at several points concurrently, spending one or two days a week at each place until the course (consisting usually of ten lessons) had been completed. In other cases the classes have occupied four or five days in a week. The institute was required to thoroughly advertise the courses, and provide a suitable hall and the necessary supplies. The lessons were free to any woman or girl in the district whether an institute member or not. The course included twenty-six lessons in domestic science—sixteen morning lessons, planned especially for girls, and ten afternoon lessons, for the same girls as well as for experienced housekeepers. The last six afternoons were given up to lectures from special instructors in dairying, poultry-raising, and gardening. The afternoon programme was as follows:—

1. Fruit: Typical methods of cooking; combinations; different ways of serving fresh fruit.
2. Vegetables: Fresh, starchy, and dry.
3. Milk: Soups, puddings, and combinations, with especial relation to infant, children, and invalid diet.
4. Cereals and cheese: Various methods of cooking; their high food-value compared with more expensive foods.
5. Eggs: Correct methods of cooking; variations in methods; storage.
6. Meat: Roasting and boiling; braised dishes; stews and soups; uses of the different cuts, and food-value compared with other foods.
7. Baking-powder bread, yeast bread, and fancy breads.
8. Cake and little cakes.
9. Puddings and desserts.
10. Salads.

The morning lessons were arranged in correlation with these, going a little more fully into elementary principles, and including such additional subjects as invalid cookery, meat-substitutes, made-over dishes, hot-supper dishes, pastry, croquettes, table setting and serving.

A new feature in short-course work was introduced in the form of a written examination for those who had taken the complete series of lectures. The questions were—

1. Explain the uses of proteids, carbohydrates, fats, mineral matter, and water in the human system, and name some of our common foodstuffs in which each of these principals is found largely.
2. Give the recipe and explain definitely your method of making any two of the following —(*a*) Tea biscuits, (*b*) plain pastry and puff pastry, (*c*) cheese croquettes.
3. Make out suitable menus for the three meals a day for one week in July (1) for a farm family where there is access to a good kitchen-garden, a dairy, eggs, and a fresh-meat supply, or (2) for a family of five in town where £80 a year can be spent for the food-supply.
4. Explain, with reasons for your method in each case, (*a*) how you would pan-broil a steak; (*b*) how you would make a beef-stew.
5. Of what special medicinal or nutritive value is each of the following: (*a*) A salad of green vegetables; (*b*) the same salad with nuts added; (*c*) beef-tea; (*d*) coarse vegetables like spinach or cabbage; (*e*) a macaroni and cheese dish.
6. Give definite directions for making—(*a*) Any two light desserts; (*b*) any two hot-supper dishes. Give five salad combinations.
7. What are the characteristics of a good waitress? Give five general rules to remember in table-serving.

The results of this examination were gratifying, showing that there had been a thorough grasp of the lessons. It is proposed to extend this feature of education among women, and demonstrations by local women, not only to institute members but to classes of young girls, are being encouraged by the institutes. It is believed that the day is not far distant in Canada when there will be a systematic instruction for mothers in rural districts in the care and feeding of children. The institutes are already a factor in a few centres for bringing technical education to the rural districts not only for the boys and girls, but for the men and women as well. The requirement on the part of the Department that a local organization should be formed and do a certain amount of work on its own account before the locality can depend upon regular assistance from the Department is a strong factor towards effectiveness in the work. In addition to the ordinary educative and social work of the institutes, annual conventions are held at one or two centres, and they have been very highly appreciated, each session bringing with it a number of educative addresses on a great variety of subjects.

Farm Animals in the United States and Canada.

Horses.—In the United States the Percheron amongst draughts is well to the front, but there are indications that the Clydesdale and Shire breeds will assume the premier position as heavy draught horses. It is claimed that they are hardier and better workers than the Percheron. The Belgian horse is also popular. It acclimates splendidly, is strong, large, and massive, and is said to be well adapted for the large American farm implements. In Canada the Clydesdales and Shires are most favoured.

Cattle.—For beef-production the Shorthorn, Aberdeen Angus, Galloway, and Hereford are the principal breeds. The Hereford are considered the best range cattle, being great rustlers. For dairy purposes the Ayrshire, Guernsey, Holstein, and Jersey are the principal breeds.

Sheep.—In the United States the principal breed is the American merino. Of the mutton breeds the Shropshire takes front rank, then the South Down, Oxford Down, Horned Dorset, Leicester, Cotswold, and Lincoln. There are some Cheviots and Hampshires. In Canada the principal breeds are the Shropshire, South Down, Leicester, Oxford Down, Horned Dorset, and Lincoln.

Swine.—In the United States the Poland-China holds about first position. This breed was evolved in Ohio State. Many European breeds entered into the formation of this peculiar type. The Duroc-Jersey, another American-bred pig, is also popular. Amongst other breeds are the Berkshire, Tamworth, Hampshire, and Yorkshire. In Canada the principal breeds are Yorkshire, Berkshire, and Tamworth.

There is a general impression that the farmers of the United States of America and Canada are in a position to feed the rest of the world. Whilst both these countries are well to the front in the production of cereals, when it comes to live-stock statistics tell another tale. These, taken from reliable sources in regard to live-stock in the United States, Canada, and New Zealand, go to prove that, whether compared on a population or acreage basis, New Zealand leads in both cattle and sheep. In horses and swine both the United States and Canada are ahead of New Zealand, as the following figures show:—

POPULATION.

United States of America (census 1912)	95,410,503
Canada (census 1911)	7,204,772
New Zealand (census 1911)	1,021,066

FARM ANIMALS.

	Horses.	Cattle.	Sheep.	Swine.
United States of America (1914) ...	20,962,000	57,592,000	49,719,000	58,933,000
Canada (1914)	3,000,000	6,036,817	2,058,045	3,434,261
			(1915.)	
New Zealand (1911)	400,000	2,020,171	25,000,000	383,000

From statistics available of a reliable character it is evident that the consuming population both of the United States and Canada is increasing steadily, while their meat-supply is appreciably declining.

The market shortage in connection with the cattle-raising industry in both the United States and Canada is an important fact which the public of these countries have not yet fully realized. The consumers have complained about the high price of meat, and have accused the producers of securing too great profits from the business. The present shortage, however, is due primarily to the fact that farmers have found meat-production, particularly beef-production, less profitable than other agricultural enterprises. Overproduction and cheap meat in these countries, while possible, are extremely remote. It is said that an increased supply will come not as a result of lower prices, but only as a result of higher prices, and that for a generation or more consumers have been able to buy meat products at a price which does not cover the cost of production under present-day conditions. It is contended that the conditions which have brought about the increased cost of meat products will continue to operate even in greater force in the future than in the past. The development of improved and intensified farming methods, the introduction of maize silage, lucerne, and other forage crops, the more complete utilization of waste roughage, and increased attention to manure as a means of maintaining the fertility of the soil, will tend to render cattle-production more practicable.

In the United States, in cattle, sheep, and swine, there has been a positive decline in numbers extending back for over fifteen years. From the census of 1899 to that of 1909 cattle had declined from 50,000,000 head to 41,000,000; sheep from 61,000,000 to 52,000,000; swine from 63,000,000 to 58,000,000. The tendency since 1909 is still towards a further decline in numbers, and yet during the period since 1899 the population of the States has increased over 20,000,000.

So serious is the situation in the matter of meat-supply in the United States that a committee has been set up by the Federal Parliament consisting of the best authorities available to study the subject and report.

The effect of this absolute decline in meat-production on the fresh-meat export trade in the United States can be gauged by the following figures: Quantity of fresh meat exported in 1901, 351,748,333 lb.; quantity of fresh meat exported in 1914, 6,394,404 lb.

With the meat and meat-products market of the United States now thrown open, Argentina has become a large exporter to the States. From October, 1913, to September, 1914, inclusive, the Argentine exported to the United States meat as follows:—

	lb.
Fresh and refrigerated meat—Beef	139,963,528
,, Other than beef	7,296,340
Canned and cured meats	2,740,016
Other meat-food products	3,882,786
Total	153,882,670

Meat-production in the Argentine Republic.

As the Argentine is a competitor with New Zealand in the meat-export trade, it may be well to consider a few facts regarding it. The area of the Argentine is eleven times larger than that of New Zealand. On this area there are 29,000,000 cattle, 80,000,000 sheep, and 3,000,000 swine. Its population is about 9,000,000. The growth of the meat industry in the Argentine Republic has been remarkable. In the world's commerce its importance is the greatest in beef products. Its export of mutton was less than 200,000 carcases in 1884, and rose to 2,000,000 carcases in 1895. Since that year on it has grown slowly to 1902, when over 3,000,000 carcases were exported, and reached the highest point of 3,679,587 carcases in 1904. From then on to 1913 the number of carcases exported annually fluctuated from a little less to somewhat more than 3,000,000. In 1913 there was a decided decline in numbers. It would seem, therefore, that the maximum output of mutton has been reached in the Argentine.

The export of frozen beef from Argentina started in 1884, when 112 quarters were shipped. From that year onwards the frozen-beef trade grew rather spasmodically until 1899, when exported frozen beef-quarters jumped from 71,463 to 113,984. In 1904 over 1,000,000 quarters were exported, and in 1912 over 2,000,000 quarters were exported. In 1913 the export declined to 1,100,000 quarters.

In 1901 the chilled-beef industry had a beginning in the Argentine, when 24,919 quarters were exported. This trade has grown with only one set-back (in 1908) until, in 1913, 2,989,805 quarters were exported. The great change in 1913 in quantity of frozen beef and chilled beef exported doubtless indicates that Argentine exports will tend in the future to the chilled-beef class. The combined figures of frozen beef and chilled beef, however, in 1913 show a decrease of 263,511 quarters below 1912, which may indicate that slaughterings in Argentina are as great as present breeding-stock will permit.

Nearly all the Argentine beef is shipped to Great Britain. Argentina is now the mainstay of the British beef-market, as shown by the following figures for 1913:—

IMPORTS OF MEAT INTO GREAT BRITAIN.

Source.	Beef Chilled. Cwt.	Beef Frozen. Cwt.	Mutton Frozen. Cwt.
Argentina	5,216,022	1,955,853	1,012,347
Other countries	31,982	398,840	4,191,900

In the Argentine the increase in the supply of breeding-animals does not appear to be keeping pace with the slaughter of animals for beef. The sale and slaughter of females has been a matter of public investigation in Argentina. It is believed, however, that high prices have checked this practice, and that now there is a tendency to retain these for breeding purposes.

Breeding methods in Argentina are on a high plane. The universal custom of buying the best animals and best blood regardless of price, with highly enlightened and long-continued experience in breeding operations have given Argentina a stock of beef cattle of very high excellence.

In order the better to appreciate the position in regard to cattle that New Zealand holds, the following figures taken from reliable sources show the percentage of cattle compared with population in different countries:—

	Number of Cattle to every 100 of Population.
Argentina	322
New Zealand	197
Denmark	83
United States	69
Sweden	48
Switzerland	38
Canada	36
France	36
Austria	32
Germany...	31
United Kingdom	27

Baby Beef.

This is a phase of beef-production in America the demand for which is increasing yearly. Baby beeves eighteen to twenty months of age which will dress 500 lb. to 600 lb. of beef are preferred by the packers, can be handled to best advantage by the local butchers, and command, when finished, the highest prices. Baby beef means two things—viz., good blood and high feeding. Low down, blocky, purebred bulls that will produce calves capable of early finish are essential. The market will not tolerate poorly finished "babies." Early-maturing qualities are obtained only from the blood of one of the improved purebred beef breeds.

There are two main causes operating amongst feeders to put prime finish on yearlings of high quality—viz., a demand by consumers for small cuts of high-quality beef, and changes in beef-production brought about through increased cost of production.

In the early days cattle were kept on the ranges until three to five years of age, and then fattened. The use of suitable purebred bulls of high quality, and a general all-round improvement and early-maturing ability of market cattle, with heavier grain feeding, has revolutionized

the old practice to such a degree that just as much beef can now be put on the market at from thirteen to twenty months.

Cream and Ice-cream Consumption.

Persons from other countries, if at all observant, travelling through the United States and Canada cannot but be impressed by the enormous quantities of sweet cream and ice-cream consumed in the towns and cities. The ice-cream trade, from almost a negligible industry eight or ten years ago, has assumed enormous proportions, with apparently an ever-increasing market. Large establishments for the manufacture of ice-cream are to be found in all of the principal centres of population, and are even spreading to minor townships. The huge quantities of cream and milk being diverted into both these channels within recent years is phenomenal, and is having a marked effect on supplies now available for manufacture into butter and cheese. Ice-cream factories are now equipped with machinery capable of converting the whole milk product into ice-cream.

Mules.

In the United States there are 4,449,000 mules. The mule is a successful drudge. He has won universal esteem in America for his working-capacity. It is natural to find him and the horse working on the same corn-belt farms, the same western ranches, and the same city streets, each apparently doing his full share of labour. The mule has firmly established his reputation as a patient, indispensable slave, unequalled for sufferance of his driver's negligence, and for adaptability to varied climates. On the mountain-pass no other foot carries strength so great. In lugging the products of the mine from the dark, damp recesses of the earth his efficiency has given him a practical monopoly, and for use in front of an army-wagon or under an army-pack he alone is sought. He takes up his life's burden of work at an early age, and goes steadily on with it long after it would seem his days had been numbered.

America drew its foundation stock from all parts of the world, and has given the Jack a fair show in the breeding-stud and accorded his get full credit for work well done. The United States to-day owns more than half of the mules in the whole world, and their value as workers is so appreciated in that country that increasing numbers are bred every year. The average mule in America is always higher priced than the average horse. The draught mule weighing 1,650 lb. when a four-year-old is the ideal for work, and the money-maker. Canada up to within a year or two ago was not a mule-using country, but now large numbers are being introduced on the ranches of her north-west, and the demand is for big ones. There can be no doubt that in many places throughout New Zealand where development is in its earliest stages, particularly in rough and as yet almost inaccessable country, the mule would be found far superior to the horse for real drudgery.

Poultry.

As regards this industry, the features are the enormous consumption within recent years and the resultant high prices. Although the production has greatly increased—more than doubled—within ten years, it has not kept pace with the demand.

Agricultural Exhibitions or Fairs.

These are generally held in the late summer or early autumn months, at a time which makes it possible not only to have exhibits of live-stock, but also the products of the field and horticultural exhibits, thus making the exhibition or show more attractive to a larger number of people and of greater educational value to an agricultural community than purely live-stock shows.

I had an opportunity of being present at two of these in Canada—one at the City of Quebec, on the 1st September, and the other, the Canadian National Exhibition, at Toronto, Ontario, on the 7th September, 1915. This latter exhibition, which is held annually, is the largest of the kind on the Continent of America, and last year began on the 28th August and closed on the 13th September. In 1913, which was jubilee year, over 1,000,000 people attended the exhibition. Last year (1915) the attendance was 864,000. The grounds, which cover an area of 270 acres, are situated overlooking Lake Ontario, and can be reached by tram-car from the City of Toronto. They are beautifully laid out: wide, well-formed asphalted roadways extend in all directions, and wide flag-paved pathways are provided on each side of the roadways, with well arranged flower-borders and shrubberies in suitable places. The buildings, which are extensive, are of striking design and of a permanent character, being built of stone, brick, or reinforced concrete, the principal ones amongst many being the Government Building, Manufacturers' Building, Industrial Building, Transportation Building, Agricultural Hall, Women's Building, and Canadian Railways Building. The grandstand is a great structure. The Exhibition authorities claim that it is the largest covered grandstand on the Continent of America, a claim which is readily believed when one gets an opportunity to view the immensity of the structure.

The entries for competition in all classes and sections of breeds of horses, cattle, sheep, and swine were very large, and the quality of the exhibits was undoubtedly of a high order. The sheep classes consisted of the following breeds, with number of sections into which each breed was divided for competition: Cotswold, 13 sections; Leicester, 12; Shropshire, 20; Oxford Down, 12; South Down, 12; Dorset Horn, 12; Lincoln, 12; Hampshire, 12; Suffolk Down, 12.

There was also a special class in which prizes of £4, £3, and £2 were given by the Dominion Government for the best five sheep the get of one ram in each of the above-named breeds. All animals competing for these special prizes were required to be Canadian-bred.

The exhibits of agricultural products made by the Dominion and Provincial Departments of Agriculture were very extensive. Other prominent exhibits were dairying, horticulture, botany, poultry, fruit, apiary, mines, and fisheries.

Literature in pamphlet and leaflet form pertaining to all branches and dealing with all phases of agriculture was provided in profusion. A very pleasing and commendable feature about these was that they were written in plain language that any layman could read and understand, all scientific and technical terms being strictly avoided. I noticed that the departmental officials in charge of exhibits also avoided using scientific or technical words when conversing with and giving advice to the public. This practice, which is no innovation, and has also been endorsed and acted upon by the United States Department of Agriculture, is undoubtedly a step in the right direction, and coincides with the great national movement so universal throughout both these countries whereby every means and channel is taken advantage of to impart knowledge and educate both the individual and agricultural communities in matters agricultural, which are served up to them in such a way that he who reads cannot help but learn.

I also had opportunities during my sojourn in America of visiting a good many horticultural exhibitions or shows, and was much struck with the manner in which the greater number of exhibits were set up. Specimens of fruit, cereals, and vegetables were displayed in large glass exhibition jars, which were filled with a liquid that not only preserved the article for a number of years, but also had the effect of the article retaining its true colour no matter what that might be. Exhibits set up in this manner are undoubtedly of great advantage from an educational point of view, and wherever displayed caused a deal of attraction.

Exhibits in connection with feeds and up-to-date appliances, &c., used in the poultry industry also formed a prominent and attractive feature at all American exhibitions.

Potato-growing.

Potato-growing is extensively carried on both in the United States and Canada. The potato has acquired a position next to wheat for human consumption in the annual field crops of the world, and enormous quantities are utilized in the arts and for stock-food. The world's crop of potatoes exceeds that of wheat by some two billion bushels. The two greatest potato-growing countries are at war—viz., Germany and Russia. Germany annually grows 8,000,000 acres, producing over 1,600,000,000 bushels, which are dealt with as follows: 12 per cent. for seed, 40 per cent. for feeding live-stock, 28 per cent. for human consumption, 6 per cent. for alcohol, 4 per cent. for starch, and 10 per cent. for loss and waste. Russia produces over 1,500,000,000 bushels. In 1914 the potato crop of the United States yielded 450,921,000 bushels and that of Canada 85,672,000 bushels, whilst Great Britain and Ireland in the same year produced 272,516,000 bushels (weight of bushel in all cases 60 lb.).

In both the United States and Canada there is a great demand for and attention is given to the production of large-sized shallow-eyed potatoes of good quality for hotels, restaurants, and dining-cars, the practice being to bake the potato in its jacket, one being sufficiently large to do for a person's meal. Potatoes suitable for this trade always command a high price.

Forage and other Feed Crops for Farm-animals.

In New Zealand, situated as we are in the South Temperate Zone, surrounded by the waters of the Pacific Ocean, we are not subject to the extreme range of temperature both of heat and cold experienced in countries like the United States and Canada, which form part of the great Continent of America. Our annual average rainfall in both Islands also is greater, spread over the entire year, and more assured, having no real droughts, but sometimes experiencing dry seasons in local districts. Our comparatively mild climatic conditions are such, together with our vast acreage of pastures of introduced grasses, the latter supplemented by root crops, rape, kale, a little hay, and in some parts ensilage, that we are enabled to feed our stock almost entirely in the open field the whole year through, without having to make provision for housing and the storing of vast supplies of fodder to carry on for five to seven months of each year, as in some of the States and Canada; besides which, farmers in those countries are burdened with the providing of the necessary labour to hand-feed and tend stock during such a lengthy period.

Grain of all sorts and concentrated commercial feeding-stuffs also enter largely into the conditions under which dairying and stock-fattening are carried on.

With regard to "concentrated commercial feeding-stuffs," most States have enacted that manufacturers, importers, manipulators, or persons who become responsible for the sale of feeding-stuffs must register, and before offering or exposing for sale any feeding-stuff as defined in the law must submit the required certificate, accompanied by fees, and an order for State Chemist's labels to the value of £1 or some multiple, for each feeding-stuff it is desired to offer for sale. These Chemist's labels must be attached to every package of 100 lb. or fraction thereof. Great care has to be taken that all shipments or sales of feed equal or exceed the guarantee for crude fat and crude protein, contain less crude fibre, and have the net weight and materials printed on the State Chemist's labels, which require to be attached to each package. Heavy penalties for breaches of the Act are inflicted.

Maize.—The maize crop is the greatest of the crops of the United States. In forage crops as well as in grain crops maize heads the list. In Canada as well as the United States maize is the main silage crop. Within the last thirty years silage has come into general use throughout the United States and Canada, especially in regions where the dairy industry has reached its greatest development. Silage is recognized as a good and cheap feed for farm stock, particularly so for cattle and sheep. The reasons for the popularity of silage are that it is the best and cheapest form in which a succulent feed can be provided for winter use. An acre of corn can be placed in the silo as cheaply as it could be secured by any other method. Crops can be put into the silo during all conditions of weather. A given quantity of, say, corn will produce more milk than the same amount if otherwise cured for feed. There is less waste in feeding silage

than in feeding dry fodder. Good silage properly fed is all consumed, being palatable. Silage, like other succulent foods, has a beneficial effect upon the digestive organs. More stock can be kept on a given area of land when silage is the basis of the ration.

Among dairy farmers who have built silos the general opinion is that the use of silage has increased milk-production per cow and has increased the profits per acre. It is admitted, however, that in certain localities which are well adapted to the growth of lucerne or other hays of good quality the same amount of food nutrients may be produced at less cost in the form of hay as of silage. The experience in America is that any green crop can be successfully made into silage if sufficient care is taken to force out the air from the material. On account of the difficulty, however, of expelling air from plants with a hollow stem, such as timothy, oats, barley, these crops are rarely put into the silo.

From an estimate based upon inquiry made of crop reporters of the Bureau of Crop Estimates, United States Department of Agriculture, the disposition of feed crops in the United States are thus set out: Nearly 39 per cent. of the total value of corn, oats, barley, and hay used on farms is consumed by horses, 17 per cent. by swine, 16 per cent. by milch cows, 12 per cent. by other cattle, 4 per cent. by sheep, 3 per cent. by poultry, 2 per cent. (grain only) by human beings, 2 per cent. for seed, and about 5 per cent. is used for other purposes or is uncertain. The bulk of cultivated crops in these countries represent crops of corn, oats, barley, and hay. There must also be included in the total quantity of products fed to animals a small amount of wheat, potatoes, kaffir, milo, &c., and mill-residues. Pasturage is an important item in the feed-supply, particularly in the western-range districts.

The maize crop of the United States has averaged in the past five years about 2,708,000,000 bushels annually; oats, 1,131,000,000 bushels; barley, 182,000,000 bushels; and cultivated hay, 66,000,000, tons (of 2,000 lb.). The amount of prairie hay and forage crops gathered annually is not estimated, but according to the census report of 1909 it totalled 28,000,000 tons. The average annual consumption of all hay and forage crops may therefore be estimated as about 83,000,000 tons.

It is estimated that these crops were disposed of in the following manner:—

ESTIMATED DISPOSITION OF FEED CROPS ON FARMS OF THE UNITED STATES OF AMERICA.

Object.	Maize.		Oats.		Barley.		Hay.	
	Per Cent.	Bushels.	Per Cent.	Bushels.	Per Cent.	Bushels.	Per Cent.	Tons.
Total used on farms ..	85·6	2,318,000,000	72·0	814,000,000	47·0	86,000,000	83·0	68,890,000
Sold (not used on farms) ..	14·4	390,000,000	28·0	317,000,000	53·0	96,000,000	17·0	14,110,000
	100·0	2,708,000,000	100·0	1,131,000,000	100·0	182,000,000	100·0	83,000,000

The average annual number of horses and mules, cattle, swine, and sheep fed, apart from pastures, in the United States is estimated at about 25,000,000 horses and mules, 21,000,000 milch-cows, 38,000,000 other cattle, 52,000,000 sheep, and 65,000,000 swine.

Root crops, rape, &c., are not grown to any great extent in either the United States or Canada.

Hay.—The most valuable factor in the hay and forage crops according to the census of 1910 was—Timothy and clover mixed, valued at £51,456,000; timothy alone, £37,616,600; lucerne, £18,620,800; wild salt- or prairie-grass, £18,205,200. These four comprise more than three-fourths of the total for hay and forage.

Alfalfa, or Lucerne.—The story: Ahmed, the Bedouin, loved his horse. The beautiful bay mare, by her fleetness of foot and soundness of wind, had many times carried him to safety when beset by tribal foes. Ahmed watched her every move; he anticipated her every whim; he studied for her every need. After browsing near the desert spring, feeding upon the succulent green plant with the triple leaf, the mare (Zadeh) was fleeter of foot and seemed possessed of all the stamina of all her ancestors. Quickly appreciating the food upon which his beloved mare thrived so well, Ahmed called it "alfalfa," meaning "the best forage." Alfalfa is an old, old crop, originating in Asia. It was passed on to the Greeks and Romans. The seed was introduced into America as early as 1793. Having been brought from Lucerne, Switzerland, it was called "lucerne."

No data of a reliable nature is available in regard to the present areas under lucerne in the United States or Canada, but it must undoubtedly be considerable in both countries. According to the United States census for 1910 the acreage under lucerne in that country was 4,707,146, and the yield 11,859,881 tons, which was valued at about £20,000,000. Since that year, in all returns or estimates, it is included under the general heading "hay." There can be little doubt, however, that enormous additions have been made to the acreage under this crop since 1910. As an instance of how the acreage has increased in some States Kansas may be taken as an example, where in 1891 the area under lucerne was 34,384 acres, and in 1914 it was 1,193,641 acres, an increase of 1,159,257 acres in twenty-three years.

At the present time all Departments of Agriculture, be they Federal, Dominion, State, or Provincial, throughout America are alive to the possibilities and the benefits that will accrue through an extension of the area devoted to lucerne-growing. Every channel is being made use of to disseminate information and bring home to farmers and communities the wealth and progress which is assured to the country through the extension of lucerne areas. A lucerne campaign

was started last year by a number of enthusiasts throughout some of the States in the direction of advocating the growing of lucerne on every farm. The plan was to unite all interests in a nation-wide campaign for the general growth of lucerne to be conducted in co-operation with farmers' institutes, bankers, business men, commercial clubs, agricultural associations, live-stock and dairy associations in any community where the people were anxious to improve their conditions agriculturally and were willing to give their time and money for an enthusiastic campaign. It is contended that 10 acres of lucerne on every farm in the United States would give in round numbers 64,000,000 acres of lucerne, that before the next decade had gone into history 100,000,000 acres of lucerne would be grown in the United States, and that if this is carried into effect every one in the States will be infinitely better off than to-day. The fields will be vastly more fertile, and the crop-yields will be bigger and better; the herds will be larger, and the quality of butter-fat will be greatly increased; there will be happier homes and better citizens.

Ex-Governor Howard, of Fort Atkinson, Wisconsin, whose reputation as a dairy-farmer and as proprietor of the *Howard's Dairyman* newspaper is world-wide, and whose dairy-farm I had an opportunity of visiting and there viewing his fine dairy herd of Guernsey cows, says that "No one more literally abets the growth of two blades of grass where one grew before than he who effectively urges the cultivation of lucerne upon those who are strangers to it, and no one is more truly working for the benefit of agriculture, the basis of all prosperity, than he who proclaims its excellence as the foremost forage."

It is said that lucerne-growing marks the highest development in our modern agriculture, and lucerne is the agricultural wonder of the twentieth century. Lucerne is the most perfect animal-food known to man; it is very productive and cheaply produced. It is the most highly nutritious and palatable of feeds for all classes of farm-animals—dairy cows, beef cattle, sheep, swine, horses, poultry, and also bees, much honey being obtained from lucerne wherever largely grown.

Well-established fields, properly looked after and cultivated after each crop is harvested, at five and six years old yield better crops than those of two or three years old. It is difficult to say how long a life lucerne may have. In Colorado there are fields that have been producing hay for over twenty-five years, and producing just as luxuriant growth apparently as younger fields. In California there are fields considerably over fifty years still producing excellent crops. The annual value of the lucerne crop in California approximates £7,000,000, and the acreage devoted to its cultivation is gradually increasing.

Lucerne more than any other crop is that universally grown in the western States. Many farms are devoted exclusively to lucerne-production, and the hay is fed out in the winter season to range live-stock, or baled and shipped to the cities, the fruitgrowing districts, the mining camps, and the timber camps. In Oregon lucerne yields from 6 to 11 tons per acre in three cuttings. In the stack it commands from £1 12s. to £2 4s. per ton, and when baled £2 8s. to £3 per ton. In some States its value is considerably higher. In Idaho, for supply to eastern States for dairy herds, the price averages £5 4s. per ton.

On my eastern journey through the States, after crossing the Rocky Mountains in Colorado at an altitude of 10,240 ft. above sea-level, and on going down the eastern slope, at an altitude of 8,000 ft. lucerne was being cut and baled. I was assured that a great part of what I saw was to be shipped to Australia to feed the starving stock in that country through drought. Such being the case, it had to be railed some 1,400 miles to San Francisco, and then shipped some 7,000 miles to Sydney; and one can imagine that the price of such food shipped that distance must have been fairly high when it reached its destination in Australia.

The grinding of lucerne hay into meal is becoming an established industry, particularly in the western States. Lucerne-meal is the entire lucerne hay ground, and does not contain an admixture of ground lucerne straw or other foreign material. For chickens, finely ground lucerne-meal is sold at high prices in the eastern States as an egg-compelling nostrum. The meal is also used in the make-up of concentrated feeding-stuffs.

In Argentine nearly all cattle slaughtered in the slaughtering, freezing, and chilling establishments are either raised on lucerne pasture or are brought in from native-grass pastures and finished on lucerne. The lucerne pastures in that country are reckoned the year round to maintain one adult steer upon 2½ acres of land, while in the fattening-period this is increased to 3 or 3½ acres. As a rule no other food is used to supplement the lucerne pastures except in occasional times of drought or invasion of locusts. Some owners, however, are beginning to finish their cattle on corn. Some cattle-growers make it a practice to turn the cattle for a short period on to native-grass pastures, believing that such a change from a lucerne pasture is beneficial. It is said by authorities that lucerne is not grown in Argentina so extensively as it could be. This is, of course, dependent a good deal on the price of cattle. The present satisfactory prices obtained encourages cattle-raisers to convert the suitable lands for grain-growing into lucerne pastures. The rapid growth of the beef-cattle industry during the past fifteen years in the Argentine corresponds with the development of lucerne for grazing purposes. It is contended that the extensive seeding of lucerne pastures by the estancieros (owners or overseers of large grazing farms or estates) is what has made the expansion of the cattle industry possible.

The enormous and successful use of lucerne pasture for fattening cattle in Argentina cannot be overlooked in any consideration which may be given to the advancement of the meat or dairy industries in other countries where lucerne will grow. It must be remembered, however, that the Argentina is situated largely in tropical or sub-tropical latitudes, that pasture is available during the entire year and shelter is rarely needed, except for high-class breeding and show animals. It is said that wonderful fatness and bloom are obtained by the cattle on the grazing-

lands, and only when disease, droughts, or locusts come does the owner or overseer of the farm have much cause to worry.

With the extension of lucerne-growing in the United States and Canada, scientists in both these countries are giving great attention to the testing of many varieties to discover those best suited to the different soils, environment, and climatic conditions to be met with in the different States and provinces, where in some places temperatures have been recorded as high as 110° F. and over, and in others as low as 35° below zero and under.

In a number of the commercial varieties of lucerne many radically different types are met with. Some are found suitable and some are not. In Canada and some of the northern States, on account of the rigorous winters, where extreme freezing and thawing takes place, and where in some winters all except the hardiest plants are winter-killed, those which survive and exhibit traits of special hardiness are being used as a basis of material for further breeding-work, and are either self-fertilized or crossed by hand. Likewise for arid country, where the temperatures are high and the average annual rainfall is less than 10 in., varieties are sought for which show drought-resisting characteristics.

Considerable attention is also given to crossing the true lucerne (*Medicago sativa*) and yellow lucerne (*Medicago falcata*). The results have been that some very promising hybrids have been produced adapted to use both as hay and for grazing. This work can scarcely be over-estimated, and will tend to solve many problems in connection with this great forage plant now exercising the minds of agriculturists.

Recognizing the value of lucerne-production and the need of introducing it prominently in a practical way to the farming community as a crop that should be universally grown, the Government of the Province of Saskatchewan, in Canada, and agricultural societies adopted a novel yet successful and effective scheme to induce farmers to grow this valuable forage crop. The proposal to conduct a province-wide competition in growing lucerne was first made at the Agricultural Societies' Convention at Regina, the capital of Saskatchewan, in 1910. The plan was enthusiastically taken up, and financial assistance was forthcoming from various sources, and the Minister of Agriculture promised such additional funds as might be required to make the contest a success. A committee was named by the Minister of Agriculture to draft regulations and to govern the conduct of the competition. Regulations were in due course drawn up, and a great deal of publicity was given to it by the Press, resulting in preparations for the contest being commenced by scores of farmers all over the province. It is estimated that as a direct result of the publicity given the competition and the articles written upon the subject over five thousand farmers were inspired to commence growing the crop.

For the purpose of the competition the province was divided into four districts, and £315 in prizes were offered in each—£100 for the first prize, £80 for second, £60 for third, £40 for fourth, £20 for fifth, and £15 for sixth. A silver trophy valued at £50 was offered as a grand sweepstake prize for the best field in the province. The size of the fields entered for competition required to be at least 10 acres and to have passed through at least two winters at the time of being judged (June, 1914). Irrigated fields were excluded. Contestants were asked from time to time to furnish to the secretary details concerning the development of their respective fields, in the expectation that this information would be of great value to others unfamiliar with the crop. Boundaries for the districts were arranged. Two years were allowed for men interested to get familiar with the crop and plan for the competition. The fields were required to be sown not later than 1912, or two years prior to the time they were to be judged. On the 18th June, 1914, the awards were placed. The factors given most attention by the judges were—yield and quality of crop; hardiness; freedom from weeds and grass, and freedom from disease and insect-damage.

The good accomplished by this contest has been that five thousand farmers have commenced to grow lucerne in a large or small way, and every other farmer who read the agricultural papers has learned something about how to grow the crop as a direct result of the efforts of the competitors and the publicity given to the competition, and it has been demonstrated that paying crops of lucerne can be grown on all normal soils in every part of the province in seasons of normal rainfall. It is said that the value of the lucerne-growing competition to the Province of Saskatchewan will never be fully appreciated. It has shown that at least one legume crop, a soil-improver and high-quality forage crop, can be grown in a territory where 99 per cent. of the farmers either knew little of its possibilities or thought it unsuited to climatic and soil conditions.

The great problem of increasing production is engaging the attention of the Departments of Agriculture in these countries, and every avenue is studied and searched. New crops and better varieties of existing crops from other parts of the world are being introduced and tested. Plant breeding and selection, improved cultural methods and practices are all part of a mighty scheme being worked out towards increasing production. Every effort is being made to make rural life profitable, healthful, comfortable, and attractive. They are endeavouring to bring to the people of the rural districts some of the finer results of civilization.

Cereals.

In wheat and oat production for 1914 the United States takes premier position for quantity amongst the countries of the world. In barley it is beaten by Russia in Europe. In Canada, whilst the area of the three principal cereals—wheat, oats, and barley—is considerably less than in the United States, when the production is taken at per head of its population it easily beats the United States.

The following are some of the principal wheat-growing countries in the world, showing area under crop in 1914, and estimated yields, also Australia and New Zealand for comparison :—

	Area under Wheat. Acres.	Estimated Yield. Bushels.
United States	53,541,000	891,017,000
Russia in Europe	62,316,000	597,000,000
British India	27,697,000	314,608,000
France	16,049,000	319,667,000
Canada	10,293,000	161,280,000
Australia	9,286,000	106,600,000
New Zealand	167,000	5,559,000

The average yield per acre in the United States for the past ten years was 14·7 bushels. The average yield per acre in Canada for four years up to and including 1912 was 19·11 bushels, and for 1913 and 1914 18·35 bushels.

In oats the average yield per acre in the United States for ten years up to and including 1913 was 29·7 bushels; the average yield per acre in Canada for 1913 and 1914 was 34·95 bushels.

In barley the average yield per acre in the United States up to and including 1913 was 25·1 bushels; the average yield per acre in Canada for 1913 and 1914 was 27·08 bushels.

About two-thirds of the wheat raised in the United States is winter wheat. In Canada, Manitoba raises spring wheat exclusively, whilst Ontario and Alberta raise some of the winter varieties.

In both the United States and Canada hard glutinous varieties of wheat are in the ascendant, and are grown both as spring and winter wheats. The reasons given for the cultivation of these hard wheats are that they are best adapted to high prairie regions, having come from such a region in Russia, where they have long been established, and they give better yields than other wheats in such country and generally command a higher price. Hard wheats have also a higher protein-content, greater percentage of other nutritious constituents, and greater absorption of water by the flour than the starchy wheats. In New Zealand starchy wheats are mostly cultivated. In Canada it is found that for maritime provinces Huron and Marquis are the most suitable; for inland provinces, Marquis and Red Fife; and for dry areas, Red Fife. In central Canada the average time for wheat to mature is from 100 to 118 days. This short time is accounted for by the long hours of sunlight, which during the growing and ripening season average about fifteen hours per day.

Wheat.—There is a great future before Canada in respect to wheat-production. She has vast territory yet to bring under cultivation, and there is no valid reason why she should not yet reach the premier position. Her national development is steadily progressing. The united efforts of farmers' societies and commercial interests are doing much towards agricultural development, backed by the Dominion and Provincial Governments.

In comparing the United States with other nations of the world in producing and importing foodstuffs the *Agricultural Outlook*, published by the United States Department of Agriculture, says, "An investigation into the production, imports, and exports of food products of various countries indicates that England produces about 53 per cent. of her food requirements, and imports (net) about 47 per cent.; Belgium produces 57 per cent. and imports 43 per cent.; Germany produces 88 per cent. and imports 12 per cent.; France produces 92 per cent. and imports 8 per cent.; Austria-Hungary produces 98 per cent. and imports 2 per cent.; Russia produces about 110 per cent. of her requirements and exports an equivalent of about 10 per cent.; Canada produces 23 per cent. more than she consumes; Argentina produces 48 per cent. more than she consumes; the United States produces practically no more than she consumes—*i.e.*, exports and imports of foodstuffs almost balance."

Silos.

Wherever one travels in the States or Canada these great capacious structures are to be seen in evidence at all farm steadings where modern, advanced, and economic methods of farming are practised. Silo-construction has undergone a great change since the first ones were built. All the early silos were built in the ground, while the modern silos are constructed almost entirely above the ground. Besides this, the first silos were comparatively shallow structures, which resulted in a large amount of spoiled silage on account of lack of sufficient pressure. Since about the year 1880 silos have increased rapidly in the United States, until they are now extensively used, especially in those regions devoted to the dairy industry. So useful have they become that many farmers consider them indispensable.

Tractors.

"You should look upon an idle horse in the stable or pasture just as you look upon a herdman asleep in the hay-mow." This old saying came into my mind when visiting a farm in the States where a tractor had lately been introduced to displace horse-labour. All the horses had not been disposed of, however: they were kept to do odd jobs about the farm. The period of my visit was the off season, when there was little cultural work doing. The tractor was in a shed, spick and span, had been overhauled and cleaned, and was ready at a moment's notice to start operations again. In a paddock adjoining were two horses feeding. I drew the attention of the farmer to this, quoting the above proverb. He remarked that it was slowly but surely being realized in America that to keep a horse at the present price of horse-feed and labour

was a luxury, that the horse had to be fed and cared for daily whether it worked or not, whereas the motor cost nothing while idle.

I made many inquiries about tractors while in America. Mr. Grisdale, Director of Dominion Experimental Farms, who has opportunities which few others have regarding the value of these, was emphatic in pronouncing against the use of heavy tractors for field-work such as were used extensively throughout Canada some years ago, but says there are great possibilities in regard to the smaller type now being introduced. Others whom I questioned were just as emphatic in respect to heavy tractors. I also had an opportunity of visiting a large establishment in Waterloo, Iowa, where tractors and other farm implements were manufactured. The foundry, machine-shop, and other departments covering 10 acres of ground. I discussed tractors with the manager, who informed me that the heavy tractors for field-work were being discarded, their place being taken by small, powerful, and simply constructed tractors, which it is claimed, are capable of doing everything on the farm that horses can do, and everything that the heavy-duty stationary or portable engine can do, being self-steering while ploughing, and turning within their own length. These light but powerful tractors were being improved and perfected, considerable progress having been made in this direction within the last few years. It is stated that the heavy tractors did great injury by packing the soil to such an extent that the growing crops were visibly injured wherever the wheel-tracks had passed.

As a member of the International Jury of Awards appointed by the President of the Panama Pacific Exhibition, San Francisco, in group "Agricultural implements and farm machinery," I had an opportunity of examining all tractors on exhibition, and considering their merits upon which awards were finally made. The entries were not numerous. For the tractor which received the Grand Prize in that class, "The Caterpillar," it is claimed that its caterpillar or endless track-like attachment admits of its travelling over country where round-wheeled tractors would get bogged, and that in field-work, owing to this same attachment, the large area in contact with the ground distributes the weight and so prevents packing, and gives grip enough to propel the engine and its load without slipping and waste of power.

Motor power is undoubtedly the coming force in farm-work, as it has transformed the work in manufacturing centres. There are difficulties in working the land to be overcome, but they are not insurmountable. To-day the farmer is calling out to anybody who will provide him with better tools for tillage and haulage and labour-saving implements to counteract the dearness of horse and manual labour. The agriculturist knows what he wants, while inventors and manufacturers are lagging behind. The possibilities of the motor plough and tractors are very great, and under fairly favourable circumstances their utility and economy have already been proved. The fact that these tillage machines are already in active service on numerous farms both in America and Great Britain, and other countries as well, and doing excellent work, is perhaps the best testimony to their having come to stay.

Conclusion.

Throughout my report I have not offered any recommendations either in educational matters or departmental practice, believing that these were matters of policy governed largely by financial considerations. But if there is one fact that impresses the visitor to Canada (and in a lesser degree the United States) it is the enormous sum that is spent on the education of the farmer and the farmer-to-be.

Canada, whose prosperity is not more closely bound up in the soil than New Zealand's, is concentrating on the agricultural education of the masses (one might almost say) in a manner that compels the warmest admiration, and is doing so through a variety of channels and in a way that is never opposed to a self-reliant policy. This last fact is to be noted in the encouragement of the co-operative movement and the elimination of the middleman. Money, in fact, is spent on education chiefly among those who are to be the future farmers and farmer's wives of the Dominion; secondly, among those who are the struggling farmers learning their own business as they go along; and, thirdly, among those who, while popularly regarded as successful farmers, have yet to learn and practise the finer points of scientific farming. The County Agent or Farm Demonstrator is the leaven at work in the mass of American farmers, while the agricultural colleges are creating a new type of scientific farmer who takes with him to the farm not an accumulation of theoretical knowledge, but the experience gained in his own actual practice of methods approved by the highest authorities. One is forced to the conclusion that the steady pursuit of agricultural education is bound to give Canada an advantage that will outweigh in time any disadvantages that are suffered through rigorous climate and comparative difficulty of transport. In the matter of agricultural colleges, experimental farms, and the general dissemination of farm knowledge, New Zealand, compared with Canada, has hardly touched the surface.

Reference has been made to the fact that both in the United States and Canada the most important activities of the Federal and Dominion Departments of Agriculture are maintained and controlled by an expert staff at central experimental stations located close to the respective seats of Government. The work is specialized, and yet co-ordination and co-operation are effected by the possibilities of frequent personal contact between the officers at the central station. Investigations of national matters, as distinct from purely local problems, are undertaken at these central stations, and from them at the same time are controlled branch experimental stations throughout the country, and all the various educational propaganda emanate therefrom. This organization is quite the reverse of what obtains in New Zealand, where we have an expert staff located in the City of Wellington, while such experimental stations as we have are managed by good, practical men who, however, have had no specialized scientific training in agriculture,

and no such specialized workers are provided on the staff. While much valuable work has been done by the experimental farms, there can be not the slightest doubt that there would have been an infinitely greater record if, in providing the land, the equipment, and the ordinary staff, provision had also been made to use these to the best advantage by appointing to them, according to the individual needs of the farms, officers of specialized training and talent. To do so in every case would, of course, have involved a considerable expenditure in salaries; but if one of the farms had been staffed on lines which would approximate to the central experimental stations in Canada or the United States, a few trained experimentalists working in co-operation with the central station would meet the requirements of the other provincial or branch farms or experimental areas. It does not by any means amount to the same thing that expert officers are provided so long as these are stationed in Wellington. Agriculture and agricultural research ought not to be so exclusively matters for laboratory investigation. The investigations of experts ought to be brought into vital relationship with the actual affairs and needs of the farm and the field, and the officers concerned should have first-hand facilities for pursuing their investigations, such facilities as can only be obtained at an institution centrally located, but, above all, located on a farm in the country where the officers would be freed from much routine administrative duties.

Such an arrangement seems to me to be very desirable in another respect. We have not in New Zealand as yet any means of affording to young men who have undergone suitable preliminary training an advanced education in agricultural science, the better to equip them for farming and for improving the general system of agriculture in the districts in which they would eventually conduct their farming operations, on the one hand, or to qualify them for State service in agriculture. Such qualified men are not available at the present time, although there are many parts in New Zealand where a trained officer delegated to perform the functions appropriate to a district representative or county agent (already referred to in these pages) would be of tremendous benefit, and would undoubtedly lead to a rapid progress in improved agricultural methods throughout the Dominion. And yet a suitable scheme of training could be easily brought about by the adoption of the previous suggestion. With an expert staff stationed at a central experimental station, the training and education of a sufficient number of capable and enthusiastic young men could be undertaken. In a few years these men would be available for inspection-work, for supervising experimental areas, and as local instructors and demonstrators, and the anomaly of employing for this class of work men of no training and very little aptitude would cease.

At such an institution also short courses of practical instruction for farmers and farmers' sons could be undertaken from time to time, and ways and means for the training of teachers in rural science could be adopted. The great obstacle to bringing the education of the rising generation more into line with its environment and experience is simply that education has not hitherto been related to the actual affairs and daily life of the people. It is conceded that in an agricultural country the youth should be educated to a very large extent through, instead of away from, its environment, without running any risk of making education too exclusively vocational. But in order that this may be brought about it is necessary to educate the teachers first to a knowledge and appreciation of agriculture and rural life. To such an end a central experimental station, in the absence of any other institution devoting itself thereto, might be made to contribute.

With regard to local problems which are continually calling for attention from the Agriculture Department, it may be proper to again refer to the system introduced by Mr. Grisdale, of the Dominion Department, as one worthy of trial in New Zealand. If such a system could be introduced and operated in conjunction with the local agricultural committees which have recently been formed in New Zealand, it is probable that better results would be obtained than have hitherto been possible through the small-plot system of experiments hitherto in vogue. These small-plot experiments have not been unproductive of good—in fact, quite important advances have been made as a direct outcome of these experiments—but the difficulty of getting the experiments carried out according to the specifications of the instructors has always been a serious one, and, on the other hand, the farmers have not been inclined to place unbounded confidence in experimental results derived from small areas. In particular, the harvesting of the crops or the feeding-off of forage crops where the areas have been small have presented so many difficulties that in the majority of cases the experiments have not been carried out to a conclusion which would permit of reasonably exact financial data being obtained. The system outlined as being now in vogue in Canada obviates these difficulties, and can confidently be recommended for trial at any rate. To a very considerable extent these experimental areas could be located in New Zealand at the various institutional farms, mental hospitals, prisons, industrial schools, &c., as has been done in the United States.

Of all the agencies by which the American and Canadian Departments convey knowledge to the communities which they serve, perhaps the most unique, and not the lest effective, is the agriculture train service previously referred to. In this country a considerable sum of money is annually spent on making exhibitions at the larger shows. Such exhibitions are desirable, but they fall far short of the possibilities of instruction and education, simply from the fact that they are staged at shows and are regarded too much in the light of mere display. The people gather to the shows in holiday mood in search of entertainment, and not in a frame of mind to grasp a lesson or even to seek advice. Moreover, the struggling farmer, who is generally most eager for information which would lead to an improvement of his position, is not the individual who is most commonly encountered at our large agricultural shows. The agricultural train, with its equipment designed for instruction as distinct from display, and

with its attendant instructors, gets right to the people requiring instruction and in a mood to absorb and benefit by any information imparted. The large railway companies on the American Continent undertake this agriculture train service purely as a business proposition, fully convinced that the result will be increased traffic in agricultural and pastoral products over their lines. No better testimony to the effectiveness of this kind of instruction is required. I should like to see the present system of exhibition at shows abandoned for a year, and a properly equipped agriculture train service to tap backward districts given a fair trial. I do not think that any other single expedient could do more to popularize the Department and increase its efficiency.

I would like also to emphasize the importance of developing a system of seed associations on lines similar to those adopted by the Iowa and Wisconsin Experimental Associations, to which reference has been made. It cannot be said that any adequate provision for the growing and dissemination of seeds adapted to the requirements of the various districts of New Zealand has been made. On the other hand, the Department has frequently recommended varieties for particular conditions, only to be stultified by the intelligence that the varieties in question were not obtainable or were obtainable in doubtful purity. This should not be so. Every variety produced at the experimental farms or otherwise acquired should be carefully multiplied under prescribed conditions, its purity safeguarded, and its dissemination assured.

In another direction the educational system throughout North America makes a deep impression, and that is in the enormous quantity of so-called literature that is available for the farmer. These farm bulletins are almost entirely free, and are circulated broadcast, while in many cases they are posted to every member of farming associations, farmers' clubs, and so on.

And, finally, the most admirable feature of the whole system is the reduction of all teaching and printing communications to the most simple words. Technical and scientific names are not lost sight of, but they are not employed where the education of the farmer is concerned. Instructions to farmers are couched in the most simple terms available, and this policy is insisted on most rigorously.

The Great Unused National Asset.—Nature has been lavish with her favours to the Dominion of New Zealand. Within its tide-swept shores is to be found scenery of unsurpassed variety and sublime grandeur. It has one of the finest climates in the world, with a rainfall in normal years spread generally over the entire season, and at most times considered sufficient; a soil eminently suitable for agricultural and pastoral pursuits, a good deal of which can be classed as equal to any in the universe for productiveness, and which is prepared to respond to the well-directed labour of the practical farmer. In the majestic everlasting snow-clad mountains, glaciers, vast mountain-bound lakes situated at high altitudes, noble rivers, and lofty waterfalls, Nature has provided New Zealand with an asset, a power, and a wealth beyond estimate, which as yet remains practically untouched, but which can be utilized and bent to the will of man.

Hitherto the Dominion has succeeded in producing apparently sufficient to satisfy her present-day requirements and aspirations without using these vast water assets, but if she is to hold her own in the markets of the world these latent resources of power and wealth must be brought into being and harnessed to the national industry to reduce the cost of production. The waters should no longer be allowed to flow to the sea, as at present, as a waste product of nature, but by gravity be used in irrigating the vast plateaus, plains, and river-basins which may be considered irrigable, and thus bring lands hitherto of little or no value to produce crops profitable not only to the grower but to the Dominion at large.

In traversing the United States and Canada any observant person must note how these national assets are everywhere being taken advantage of and put to profitable use both for power and irrigation, and how the arid and practically desert lands under the benign influence of plenty of water are made to produce and "bloom and blossom like the rose."

Irrigation has become a science, one of the newest of agricultural sciences. Irrigation farming has been practised for many years, but it is only recently that the best methods of applying water, quantity to use and proper time to use it, have received scientific thought and investigation. The agricultural possibilities in regard to the producing of crops when water is available for irrigation purposes are now so universally recognized in both the United States and Canada that where irrigable land is situated for which no gravity water is available, or only available at a very high cost, and which may be situated at a moderate elevation above rivers or lakes, for such conditions the development of a water-supply by pumping is being resorted to and found the best solution. For pumping from these sources the centrifugal pumps and the power-plunger pumps are considered the best adapted. Simple centrifugal pumps specially designed and driven at a sufficiently high rate of speed may be used for lifts considerably over 100 ft. The large sock-pump is not suitable for lifts over 75 ft. For higher lifts compound or multi-stage centrifugal pumps are used. These consist of two or more pumps connected in series; the discharge of the first pump or stage is delivered into the suction of the next pump, and the operation is repeated according to the number of stages. Usually 75 ft. to 125 ft. is allowed to each stage. There is a limit, however, beyond which it is not economically feasible to pump. In Southern California, in the citrus district, lifts above 400 ft. have been profitable, and in British Columbia equally high lifts are considered profitable for good apple-orchards, but in all cases the area irrigated must be considerable, otherwise the cost will be too great.

With regard to the promotion of irrigation farming, it is considered an essential part of the programme that the survey and classification of soils in districts would have to be undertaken by the Government, and also irrigable and non-irrigable lands defined.

One cannot but be struck in both the United States and Canada with the good work being done by agricultural, co-operative, and other associations and institutes, and the community interest displayed by all sections in agricultural matters. Dr. Creelman, the President of the Ontario Agricultural College, Guelph, who visited the Dominion in September, 1914, in reporting on his visit to the Minister of Agriculture for the Province of Ontario, said, *inter alia*, "The people in Australia and New Zealand were not so progressive, or perhaps were more dependent upon the Government aid, and more inclined to blame any one but themselves when things went wrong." Whether this summing-up is just or not is not for me to say, but the fact remains that if a disaster or a pest overtakes any farming community in the United States or Canada the farmers themselves, the bankers, the business men, and all are out to investigate and endeavour to prevent a recurrence. Besides this there is a great spirit of inquiry abroad in regard to agricultural matters. They believe that "agricultural progress has been made by men who were not satisfied with what was good enough for their grandfathers." The farmers like to get together and have a "talk"—that is, some one of them speaks on a subject, and then those who are conversant with it join in the discussion which follows and exchange experiences, the consensus of opinion being in the direction that "No man knows all that there is to be known about farming; let us all get together and learn from each other." What seems wanting in New Zealand is an organized rural life in which farmers are willing to work together for the common good of the community in such matters, instead of working as isolated unorganized units.

The cultivation of Indian corn, or maize, originally merely the primitive food grain of the aborigines of tropical and semi-tropical regions of the Western Hemisphere, has within a few centuries extended to all continents. Its exceptional productiveness in both corn and fodder, and the many uses made of its grain, stalk, pith, leaves, and cob, have won for it the fame of being America's most valuable contribution to agriculture. In the United States the annual acreage under maize is more extensive than the total surface under all other cereals. In Canada also a considerable acreage is grown annually. The value of the luxuriant foliage of the plant has been so universally recognized that its cultivation for fodder has extended into countries where the seasons of warm sunshine are too short for the grain to mature, hence maize is grown for forage to a greater or less extent in many countries of northern Europe, ever as far north as Scotland.

To see this plant grown so extensively in the United States and Canada on different soils and under varied climatic conditions, &c., impresses one that the possibilities of this plant have not received the attention they deserve in New Zealand. In the North Island as well as in some parts of the South Island successful grain crops on small areas are being produced, but so far very few tests have been made in the direction of ascertaining early-maturing and heavy-yielding varieties suitable for different localities where the season of warm sunshine is sufficiently long to mature the grain. It is, however, in regard to its use as a soiling and silage crop, particularly in districts where dairying is the main industry, that its value should be advocated and brought under the notice of farmers. For this purpose it is well known that it can be grown successfully in most parts of the North Island, and also in the South Island at least as far south as Balclutha. For soiling purposes it comes in at a time, and is an excellent stand-by, in dry seasons when pastures are beginning to suffer towards the end of January, February, and beginning of March. If not required for soiling purposes it is readily made into ensilage, and can be so converted either in a silo or in the stack.

Success in the growing of maize depends to a great extent on the selection of proper varieties to suit the conditions in different localities. This can only be ascertained by tests of varieties over a number of years, by selection of specially adapted types, or by developing types having the necessary characteristics suitable to the requirements of the locality. In well-arranged rotations of crops, so strongly advocated in the improvement of agricultural practice in Canada, maize takes its place in the rotation immediately after grass and clover.

Naturally, in both the United States and Canada much attention is given to wheat-growing; particularly is this the case in regard to Canada, wheat and its product (flour) being the primary export. In America in former years the variation of wheat giving the largest yield was the first consideration of the farmer, little attention being paid to the question of quality in flour-production. Now, however, the quality as well as the quantity of flour that can be obtained from the grain are the factors which govern the price. In Canada the spring wheats, as a rule, are harder than the winter varities, contain a higher percentage of protein, are more valuable from a nutritive point of view, and generally sell at a higher price. The requirements of the chief wheat-importing countries of Europe also have a bearing on better prices being given for hard spring varieties, as the wheat produced in these countries is of a soft and starchy character, therefore these importations are in the direction of securing wheats of a hard and flinty character containing a relatively high percentage of protein. Over thirty years ago the New Zealand and Australian Land Company (Limited) introduced some four or five varieties of these hard wheats from America, and grew them for about four years on their Pareora Estate in Canterbury, and Totara Estate in Otago. Whilst undoubtedly they were wheats of high milling-quality, they did not yield within 15 bushels per acre of the old-established wheats then and still grown—viz., Velvet Chaff and Red Chaff. Millers were not prepared to pay a higher price for these than Velvet Chaff, although admitting their excellent quality, so the company discontinued growing them. Red Turkey, one of the present favourite hard wheats grown in the United States, has been tried in variety tests of wheat conducted throughout the South Island for three years. The results have been disappointing, the yield being on the average quite 20 bushels below ordinary varieties, and compared with these the sample of the grain was thin and shrivelled in appearance, and only saleable as second-grade wheat, although its weight per measured bushel

was high, belying its appearance. I had an opportunity of seeing samples of this wheat exhibited by different States at the Panama Pacific Exhibition, and also saw it in considerable bulk being made into flour in the Palace of Food Products at the Exhibition by the Sperry Flour Company, who have many flour-mills throughout the States, and had a large mill erected and worked during the Exhibition season within the Palace of Food Products. The sample of Red Turkey wheat they were milling had the same thin shrivelled appearance as that grown in New Zealand, although in weight per bushel it was heavy.

Attached to the Sperry Flour Company's exhibit was a laboratory equipped with the most up-to-date appliances for chemically testing wheats and flours, and also for baking-tests. The company's chief chemist, Mr. B. Ingels, expressed a desire to test the New Zealand wheats on exhibition for comparison with the American wheats in regard to quality of flour for bread-baking. The following is his report and analysis:—

"Attached herewith please find tabulation of the results of our tests on eight New Zealand wheats, which you submitted, as compared with four wheats which we use in our mill here. We have arranged these tests according to our ideas of the value of these wheats for milling purposes. More especially are they arranged as regards their value for breadmaking purposes rather than their value for making high yields. This is on account of it being more difficult and more important to get wheat of high breadmaking characteristics than it is to get wheat of high yielding-value. We also made complete chemical analysis of these samples, and the results as tabulated take into consideration the chemical tests and are arranged accordingly. Trusting that this information may be of value to you, &c."

TABULATION OF TESTS OF NEW ZEALAND WHEATS.

Variety.	Percentage Absorption.	Percentage Wet Gluten.	Colour of Gluten.	Quality of Gluten.	Volume of Loaf.	Colour of Loaf.	Texture of Loaf.
American-grown.							
Kansas Turkey Red..	61	34·9	Very good ..	Very good ..	2175	Good ..	Very very good.
Idaho Turkey Red ..	60	28·5	Slightly yellow	Slightly soft..	2125	Very good ..	Fair.
Washington Blue-stem	58	26·7	Good ..	Very good ..	2100	Very good ..	Very very good.
Californian Blue-stem	58	22·5	Slightly yellow	Very good ..	2025	Very good ..	Very very good.
New-Zealand-grown.							
Velvet Ear	58	25·0	Good ..	Good ..	1925	Very very good	Very good.
Bob's	58	23·5	Good ..	Good ..	2050	Very good ..	Good.
Pearl	57	22·0	Good ..	Slightly soft..	1900	Very very good	Very good.
Marshall's	55	21·2	Slightly yellow	Good ..	2000	Good ..	Fair.
Red-chaff	52	21·8	Good ..	Good ..	1950	Very good ..	Fair.
Purple-straw ..	55	24·2	Slightly yellow	Good ..	1875	Very good ..	Fair.
White-straw ..	53	23·9	Slightly yellow	Good ..	1850	Good ..	Poor.
Bordier	55	21·7	Slightly yellow	Soft and sticky	1800	Good ..	Poor.

With regard to the foregoing tests it is well to know that two of our best New Zealand varieties of wheat—viz., Velvet Chaff and Solid Straw Tuscan—were not represented; also that the New Zealand wheats grown in 1913–14 were not up to the average quality owing to unsuitable weather experienced during the growing and ripening period.

Velvet Ear, which heads the New Zealand varieties in the test, is a variety much grown in Southern Otago, and usually sown as a spring wheat. It somewhat resembles Velvet Chaff, a winter variety, but the heads differ. In Velvet Ear the head tapers towards the point, whereas in Velvet Chaff the head is square or larger at the point.

Most hard wheat in America is produced in regions of less than 35 in. of rainfall and where early summers are subject to drought. When hard wheats are grown under more humid climatic conditions the berry becomes much softer in texture, and this softening tends to develop a large percentage of soft yellow kernels known as "yellow berries." This mixture of hard and soft kernels is difficult to mill properly, hence wheat of this kind never commands a high price. In many of the States soft wheats are grown, and flour produced from these sells at a premium.

From observations it is apparent that if millers and bakers in New Zealand are satisfied with the quality of the wheat now grown and flour produced therefrom, and are not prepared to differentiate sufficiently in price between hard wheats with a higher percentage of protein but low in yield of grain per acre and soft starchy wheats with a high yield of grain per acre, farmers are not likely to alter but will continue to grow the wheats that pay them the best.

No better plan has been devised for discovering the most suitable cereals to grow in any locality than that of the variety test, and no grower of wheat or other cereal should long remain in doubt as to whether he can increase his production or not when he has at hand so simple a method as that of securing a number of varieties considered suitable of each, whether of wheat, oats, or barley, &c., and growing them in small plots of about one-fortieth acre each, a test which should be continued for at least five years. In this way the farmer will discover for himself which variety or strain is best adapted to the soils of his farm, climatic conditions, and environment.

There is ample room and abundance of opportunity for increasing our average yield and production of cereals in the Dominion. More attention should be given to soil-improvement and better cultural methods, the selection and propagation of meritorious types of grain, and breeding for hardiness and increased yield of superior quality by artificial fertilization of individual

plants which may possess in one or more respects the valuable and necessary characteristics aimed at.

For some years past, and at the present time, indications are in the direction that cereal-growing, particularly wheat, is not looked upon by New Zealand farmers as a paying proposition, and even the somewhat increased price for wheat since the war began does not attract farmers in the way one would expect. No doubt this can be attributed mainly to the enhanced prices obtained for some years past, and now, for wool, frozen meat, and dairy-produce, and the difficulty the farmer has in securing the assistance of skilled labour nowadays to help in harvesting and other farm-work, together with the high wages which have to be paid for labour, which in most cases is not skilled and therefore dear at any price. Moreover, the farmer is likely to produce that which is easiest and pays him best. It seems obvious, therefore, that there will be little or no surplus of wheat for export in the future if similar conditions continue to prevail, and that on the other hand New Zealand may be importing wheat to meet her requirements.

Whilst it would not be wise to neglect entirely the importance of cereal-growing and investigations that may tend to increase the production per acre and a higher quality of grain, yet the best energies of agriculturists and farmers in the Dominion should be directed towards the frozen-meat and dairy industries, which are the backbone of the country, with a view of increasing these and providing for an assured annual production.

New Zealand's primary exports are derived from its agricultural and pastoral industries, principally the products from farm-animals. The important bearing which these have on the prosperity of the Dominion is best understood by examining the exports for year ending 31st December, 1915, where the value of these and other exports can be compared, as follows:—

	£
Pastoral produce: Wool, frozen meat, tallow, skins, hides, pelts, butter, cheese, and other pastoral products	26,486,706
Agricultural produce: Wheat, oats, barley, peas, potatoes, seeds (grass and clover), and other agricultural produce	610,020
Phormium-fibre	571,621
Produce of the mines, forests, fisheries, manufactures, &c. ...	3,369,785
Total value of exports for year ending 31st December, 1915	£31,038,132

No doubt the values of the agricultural and pastoral produce exported last year, and particularly wool, are somewhat inflated on account of the war. There has been, however, a steady and continuous increase of animal-products exported for many years past, with a relative advance in values, and as these represent the fundamental industries and revenue-producing factors of the Dominion I made it a point in my travels through the United States and Canada to take particular notice of any phase of agriculture or other element likely to be of benefit to the further promotion of these.

It must be evident to all interested in both the frozen-meat and dairy industries how very dependent these are for success upon favourable seasons and abundance of suitable animal-food. A dry season in any district under present farming conditions means a great decrease in exports, and invariably disaster and ruin to many farmers. Too much dependence is put upon pastures which burn up when there is a lack of moistures and drying winds set in. At present little or no attention is given to testing, discovering, or growing reliable forage crops to supplement the pastures in such seasons. Turnips and rape are not now reliable crops. Every other year both these crops are subject to the ravages of insect pests which make them almost valueless, and turnips are periodically subject to fungus diseases, and when dry seasons occur there is little or no crop.

Farm-animals depend upon the plant kingdom for their food. Therefore if we are to increase our primary exports of animal-products we must of necessity increase our plant-food. This can be done by making use of and growing those plants in our pastures and as forage which are of a more reliable character and will produce abundantly under almost all weather-conditions, thus ensuring that a larger number of cattle, sheep, &c., can be reared and carried on the lands of the Dominion, avoiding fluctuations as far as possible, and guaranteeing an annual increase for many years to come in the production of animal-products for export. To effect this reform there is no surer way than to grow lucerne. Lucerne is undoubtedly the "king of forage plants," and those countries which have early recognized its value are annually reaping an assured harvest of wealth from its abundant production. Nothing that I saw in the whole of my travels through the United States and Canada impressed me so much as the possibilities there are for the Dominion of New Zealand should farmers be induced to grow lucerne. There are few parts of the world so well adapted to grow lucerne to perfection as New Zealand. It has been proved that it can be grown in the driest seasons in the most unlikely soils without the assistance of irrigation, and where irrigation is necessary there is abundance of water in most places now running to waste which can be utilized for that purpose when the Dominion is prepared to give its attention to irrigation projects.

In New Zealand lucerne is no innovation. It was grown successfully over forty years ago on down land with a clay subsoil on the New Zealand and Australian Land Company's Levels Estate in South Canterbury, and on Clydevale Estate in Otago. That was in the early days when the squatter reigned, and with the vast areas of land then at his command, and abundance of other feed available at the time for the number of stock carried, lucerne was considered too much of a luxury and only used particularly as a feed for stud animals. Lucerne has also been an established crop for many years in the Marlborough Province, where it has now become one of the staple crops. Further, for the last six years the Department of Agriculture, in order

to bring to the notice of farmers the value of this forage plant as an addition to the economy of the farm, offered annually to supply free to a limited number lucerne-seed, lime, and inoculated soil sufficient to test 1 acre of land on their farms. This offer has been taken advantage of by farmers in both Islands, particularly in the South Island, to its utmost limit, quite five hundred farmers participating in tests during the time mentioned. These tests have been carried out on quite a variety of soils, in most cases successfully. From reports of these tests conducted in the South Island, compiled by the District Field Inspectors, I am in a position to say that where failures have occurred they have been shown to have resulted in most cases through ignorance on the part of the farmer in not understanding the habit of the plant he was dealing with, and neglecting to follow the directions given in regard to sowing and keeping the area free from weeds during the early growth of the lucerne-plant and until it was fairly established.

It was recognized that lucerne could be grown successfully on good to medium soils, if not wet and sour, so long as the drainage was good and the water-level not less than 5 ft. below the surface (the further away the better, even 50 ft.) and the soil in good heart and properly cultivated. Early attention was then given to the testing of poor and comparatively unprofitable soils on the shingle plains of Canterbury, on land that was considered too poor to grow grass even in fairly good years; on sand areas deemed worthless for growing vegetation; and on the high plateaus of the Mackenzie Country and in Central Otago, now almost denuded of native vegetation through overstocking, unseasonable fires, and so on. All these classes of land were tackled and successful results obtained, indicating that such areas now contributing but little to the wealth of the country can be brought to grow several crops of lucerne in the driest of years without irrigation. Reports of results of lucerne grown on some of these areas—viz., School for the Deaf, Sumner; Te Oranga Home, Burwood; and the Industrial School, Burnham—will appear in the *Agricultural Journal*.

The lucerne tests conducted by farmers demonstrated that in very few instances was the application of lime or inoculated soil necessary to secure a good stand; that the majority of soils were in a condition capable of growing the plant if the advice in regard to cultural methods given by the Department of Agriculture were strictly adhered to. It is advocated, however, that farmers would do well before sowing an extensive area in lucerne to first test an acre divided into four plots as follows: No. 1, lime; No. 2, inoculated soil; No. 3, no lime or inoculated soil; No. 4, lime and inoculated soil. No encouragement was given to apply stable or artificial manures either before sowing, with the seed, or after the plant was established as a top-dressing. In some few instances farmers did top-dress with disastrous results, checking the growth of the plant and bringing the grasses and weeds into competition with the lucerne, which soon got choked out.

Notwithstanding the action of the Department of Agriculture in making these free demonstration tests as widely distributed as possible throughout the Dominion to bring them under the notice of farmers, it has to be admitted that the effect to date has not been what it should, farmers being either too apathetic or too content with their present methods and income to bother with this fodder plant, of the value of which as a fodder they appear to know nothing and are under the impression that it is difficult to grow. It is quite evident that had the farmers in the Oamaru and other districts now suffering from the long-continued spell of dry weather taken the precaution to have established stands of lucerne on their farms they would not be in the position they now find themselves in to-day of being obliged to appeal to the Government for assistance for their stock. As proof of this it may be well to mention one instance out of many —that at the Government School for the Deaf, situated at Sumner (an area which, equally with Oamaru, has experienced a long dry spell). With less than one-half acre of a lucerne stand grown on poor soil (almost pure sand) six cows have been kept in perfect condition since the beginning of October last, there being no grass or other feed for them, all being burnt up. Six crops have been cut from this less than half-an-acre area during the present season, the first four cuts averaging 3 ft. in height, or a total growth of 17 ft. high if the six cuts were extended their length one above the other. About one-quarter acre was sown to lucerne two years ago, and the other quarter-acre was sown about fifteen months ago. No irrigation or manures were applied to give the above results. These results indicate that the problem of our non-producing dry land areas will be solved through lucerne-growing.

The growing of lucerne requires a little higher order of system than many of our most successful farmers employ in their work. It requires explicit attention in all details during its early growth and until it is fairly established. *Lucerne can do best only when it is in exclusive possession of the land, with no other plant growing there. Weeds and grass are its enemies; lucerne fails immediately the land is allowed to get weedy. When established lucerne is hardy, when young it is delicate.* In some tests in New Zealand as many as three crops have been obtained within one year from date of sowing.

In this report I have endeavoured to show what is being done in the direction of the extension of lucerne-growing in some parts of the United States and Canada, and how strongly the matter is being taken up and advocated, even in Saskatchewan, where agricultural societies, bankers, and other commercial institutions, backed by the Provincial Government, conducted a province-wide competition in growing lucerne, offering substantial money prizes with the object of introducing it prominently in a practical way to the farming community as a crop that should be universally grown. A matter of vital importance to the Dominion and to its advancement is that farmers should be in a position to secure without any doubt pure and viable seeds to sow. In Canada this is recognized, as the sale of seed is there regulated by law. Under present conditions it may safely be said that New Zealand is often used as the dumping-ground for bad seeds. It is a noteworthy fact that exceedingly bad lines of seed are met with as soon as a scarcity of any

particular kind of seed arises. Lines of seed, particularly of white clover, have been imported into New Zealand and placed upon the market which are totally unfit (by reason of their feeble germination-capacity and high percentage of extraneous seeds) for use in New Zealand agriculture. It may be said, in fact, that the spread of weeds in New Zealand is affected to a very large extent by the demand for cheap seed, which means the utilization of those imported lines which, in their country, were difficult or impossible to sell. The difficulty of selling such lines in their native countries is undoubtedly due to the seed legislation governing the sale of seeds in these lands, and the possiblity of selling such lines in New Zealand arises equally from the absence of such legislation in this country.

It is conceded that few countries are so well adapted for high-class seed production as New Zealand. This fact was brought prominently into notice at the Panama Pacific International Exhibition, San Francisco, where the seeds (other than wheat) grown in New Zealand and exhibited there not only secured the highest awards in the different classes, but also received high commendation from the International Jury of Awards, being described by them as being unequalled by any other country.

In conclusion, I may say that I cannot speak too highly of the extreme courtesy extended to me by all persons with whom I came in contact both in the United States and Canada, and the readiness with which information on all points was given by the heads of departments and experts.

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