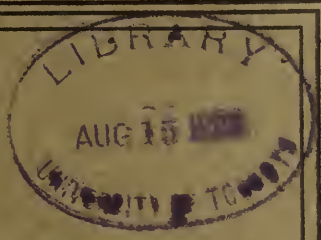

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Vol. X July-August, 1923 No. 4

LEADING TOPICS

DEPARTMENT OF AGRICULTURE
OTTAWA, CANADA

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OTTAWA

MAP OF CANADA SHOWING THE LOCATION OF FARMS, STATIONS AND SUB-STATIONS IN THE EXPERIMENTAL FARMS SYSTEM, THE AGRICULTURAL COLLEGES AND AGRICULTURAL SCHOOLS.

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The AGRICULTURAL GAZETTE
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DOMINION EXPERIMENTAL FARMS

THE VANCOUVER ISLAND EXPERIMENTAL STATION

By E. M. STRAIGHT, B.S.A., Superintendent

THE Experimental Station for Vancouver Island and adjacent islands was established at Sidney, B.C., in 1912. It has an area of 125 acres. All the land except the park area is cleared and in a high state of cultivation. The clearing of land on Vancouver Island, necessitating, as it does, the removal of gigantic trees and stumps, the blasting and removal of rocks, and the draining of almost the entire area, constitutes a problem of considerable magnitude, and forces the holder into some system of intensive agriculture, in order to meet the excessive "overhead." The farm, though too small, is not so small on Vancouver Island as it would be considered elsewhere, for here, as nowhere else in Canada, the average holding is small, and the operations carried on are of an intensive character.

The Station is delightfully situated on the Strait of Georgia, about 17 miles from the city of Victoria, and near the northern end of the Saanich peninsula—the garden of Vancouver Island. The farm is traversed by a branch of the Canadian National Railway, and by the B. C. Electric, with a station on the property. These, with several bus lines, make transportation to and from Victoria easy, but from the northern parts of the island the whole peninsula is difficult of access.

The soil, though typical of the district, is a study in itself, and makes great care necessary in conducting experimental work. A small field may contain many types of soil, varying physically and chemically, and changing from the one to the other without apparent reason—from a black prairie soil to muck, to hardpan, to brick clay, or to sand. This variation makes it difficult to obtain uniform areas sufficiently large to conduct exact experimental work, yet it broadens the scope of the investigation, for the reason that the project may be repeated on various types of soil.

While the cereal, forage crop, livestock and all other divisions are represented on the farm, yet there has been a concentration of effort on three lines of endeavour, namely, Horticulture, Apiculture and Poultry Husbandry.

In the Cereal division one has to learn farming anew in this, the "California of Canada." Many of the spring wheats, when sown here in the fall, yield far better than when spring sown. The same is true of the barleys and possibly of other grains. Investigations along these lines are being conducted. In the Forage Crop division, all the usual roots and grasses have been under test, together with a great variety of semitropical plants, made possible only by the mildness of the climate. The Livestock department is receiving more attention than formerly. A small herd of Jerseys has been purchased, and the breed is living up to its reputation. Though the animals comprising the herd have not yet completed their Record of Performance tests, they promise to be outstanding individuals.

Horticulture

The fruits and vegetables of Vancouver Island are well known over much of Canada. Small fruits, especially, are shipped, and favourably spoken of, over the Prairie Provinces. The industry grows with the years. Through co-operative effort in marketing, and otherwise, the growers look for great expansion, especially in strawberry and Loganberry culture. The Experimental Station has kept pace with the growers in the determination of the value of varieties and systems of growing these and other fruits, and all the various cultural methods in use in the different provinces of Canada, are under test. Among the tree fruits may be found practically all of the pears, cherries, plums, and many of the apples grown on Vancouver Island. The collection is quite complete, and includes varieties from many parts of the world. Thus, a constant object lesson is set up, while the merits or demerits of each variety are carefully recorded. All of the newer insecticides and fungicides are under trial, and reports are made regarding them. In this department the fertilizer needs of soils are determined from the standpoint of fruit culture, while the relative value of sod versus clean cultivation, and clean cultivation versus cover crop, are standard projects.

Islands of the Gulf of Georgia from Dominion Experimental Station, Vancouver Island, B.C. The Olympian range is perceptible in the distance.

Bulb Culture

Vancouver Island is practically the only part of Canada where bulbs can be commercially grown. That these are superior to the foreign grown bulbs has been determined at this Station. That this fact may be more generally known, the Station has furnished bulbs to all the other Dominion Experimental Farms and Stations in Canada, in order that they may be reported upon. Because of disease, often found in the imported bulbs, great extension in this line is anticipated.

Nut Culture

Walnuts, filberts and other types of nuts can be grown on the Island. In order to encourage this interesting branch of horticulture, a considerable area has been given to that phase of the work. Many inquiries are received from different parts of the Island concerning the industry, and it is possible that, in the future, Canada's needs in this respect may be met from Vancouver Island.

Apiculture

The possibilities of apiculture are receiving attention at the Station. Definite problems are being carefully studied. Already it has been demonstrated that bees are the most potent factor in the pollination of fruit trees. Just how much work they are able to perform, and how important other insects may be in this connection are matters that are under investigation. The Island is being mapped from the beekeeping standpoint as rapidly as time will permit, and the various systems of wintering, prevention of swarming, etc., are under test.

Poultry Investigations

Poultry work at the Station, in keeping with the importance of the industry on Vancouver Island, has received much attention. The work is not only comprehensive but exact. White Wyandottes are kept exclusively. The work is well known, and the demands for information, for eggs for incubation, for day-old chicks, and for breeders are constant and almost Dominion wide. In order to indicate the type of work being carried on, a brief outline of some of the lines of investigation is presented.

Nearly all eggs are incubated during the three months, March, April and May. Questions as to when they should be incubated from the standpoint of future layers, breeders or market birds, are distinct problems in themselves, and must be considered as such. The present project considers incubation wholly from the standpoint of incubation, and tabulates results obtained month by month, other factors being equal. It has been found that, so far as the Island is concerned, early hatched chicks not only hatch better, but the viability of the birds in early season is superior to that of the May-hatched chicks. The converse of this is undoubtedly true in many parts of Canada, especially in those sections where layers and males are closely confined all winter.

Chickens are brooded by various methods year by year. Various types of brooders, including electric brooders, have been used, as well as the natural method. All the methods have advantages and disadvantages. Recently, the coal stove brooder has come to be especially well thought of. With this type of brooder the whole colony house is turned into a brooder; heat is plentiful, while the chickens are able to find, in the various parts of the house, just that degree of warmth they require. In a brooder of this type, the air circulates freely and is consequently pure; the chicks are not forced to pile up in the centre to keep warm, and the capacity of the brooder is much greater than with many other types.

Definite figures have been kept as to the cost of rearing young chicks, of which the following is a summary:—

Cost of Rearing 242 Chicks (8 weeks)

66	eggs at 2½c. each	$1 65
39	lbs. oatmeal at 3¼c. per lb.	1 26¾
150	" chick food at 3¼c. per lb.	4 87½
484	" dry mash at 2¼c. per lb.	10 62
84	" wheat at 2c per lb.	1 68
18½	" charcoal at 5c. and 1c.	84½
51	" fine bone at 2½c per lb.	1 27½
28	" grit at 1¼c. per lb.	35
8	" shell at 1¼c. per lb.	10
24½	gals. skim milk at 2c. gal.	49
	Total cost	$23 15½

Number of chicks well developed at end of 8th week, 242.

Total cost of feed consumed, $23.15½.

Feed cost per bird to end of 8th week, 9·5 cents.

The feed consumed by those that did not live to be eight weeks old is charged in the above statement.

The cost of feeding laying stock (Wyandottes) for the year 1922 has been determined, using pens of birds hatched in March, April and May. An everage cost has been obtained from the amounts of feed used month by month, based on prices current on Vancouver Island at that time. It was found that the average number of pounds of grain consumed per

bird was 87·9, and that the total cost of same was $2.45.

The cost of producing one dozen eggs is known only to a few, and is not easy to obtain. For a number of years this phase of the work has been given much attention. A summary follows:—

—	1919	1920	1921	1922
Average production	179·1	200·8	219	188·2
Pounds of grain and mash to 1 doz. eggs	6·29	5·81	4·61	6·1
Cost of all feed per 1 doz. eggs	23.45c.	25·50c.	16·0 c.	16·7c.
Month of highest cost	Nov.	Dec.	Nov.	Oct.
Month of lowest cost	June	Feb.	Apr.	May
Month of highest production	Mar.	Mar.	Mar.	Mar.
Month of lowest production	Nov.	Nov.	Oct.	Nov.

Two types of laying sheds are in use at the Station, namely the Woods and the shed-roof open front. The latter is much preferred on account of its simplicity and economy of construction. It is airy and provides for a maximum of sunlight. During the past six years the birds housed in the shed-roof houses have been immune from colds and roup.

The breeding of layers has been continued. Much emphasis has been placed on the various side issues which converge to form the real breeding problem. The breeder is not satisfied with high production if the eggs are small, if the layers are much below weight, if the hens are off type, or if chicks arising from the high-producing type lack vitality or viability; yet, one or more of these factors is often lost sight of, with the result that a weakness persists, is multiplied, and eventually destroys the model. A mental picture of the ideal Wyandotte is constantly kept in the mind's eye, and though it is not possible at all times to measure up to the standard set, much may be done. Close attention to detail in the breeding work has borne fruit. Almost every year one or more birds of outstanding performance have been produced. Among these are "Lady Victoria" and "Saanich Belle."

A study has been made of the relation existing between weight and production in Wyandottes. Contrary to

Lady Victoria (right) and *Saanich Belle* (left)—two noted Wyandotte hens bred at the Dominion Experimental Station, Vancouver Island, B.C.

the idea often advanced, we have found that the heavier the bird the greater the production. For example: 4½-pound birds have averaged 190·3 eggs in the year; from 4½ to 5-pound, 196·5; from 5 to 5½-pound, 208·8; 5½ to 6-pound, 197; over 6-pound, 210·7. The relation between weight and production is nearly constant. The heavier the bird the better she lays. This is a law so far as averages go, but does not follow when applied to individuals.

Free range for poultry has been recommended, and yet many breeders have secured excellent results in very small houses, with practically no range at all. To determine which system will give the best results is the object of the experiment begun in 1922. It has been found, so far as the work has progressed, that the birds laid better when confined than when on range, but that the cost of feed in confinement was greater than on range. In order to secure further information concerning the incubation of eggs arising from the two pens (confinement versus range), hatching and rearing results have been tabulated. It was found that the number of chicks alive on July 1, hatched from the range pen, was more than double that from the confined pen.

The various commercial feeds used for poultry are being fed in comparison with the home-mixed ration, such as is fed at the Station. The conclusion, as determined by results of one year only, is that while hens laid more eggs on the home ration, the feed cost more than the commercial. The explanation may be found in the fact that concentrated protein substances are offered in many forms, some of which may be much cheaper than beef scrap.

The above projects, undertaken in the poultry department, may be accepted as fair examples of the kind of work attempted in all divisions of labour on the farm—practical but exact—in the hope that in some measure we may solve the problems met by the farmer in his daily task.

PRAIRIE HORTICULTURE

By W. R. LESLIE, B.S.A., Superintendent, Dominion Experimental Station, Morden, Manitoba

PRAIRIE horticulture is older than the earliest settlements of white people on the plains of Western Canada. The Sioux Indians grew corn and squash before the arrival of English-speaking people, and some westerners claim that the large thickets of wild plums, found on Reservations along the Rainy river and elsewhere, have developed from seed carried thither from Minnesota and Wisconsin by the aborigines. These natives eagerly sought garden seeds from early traders, and several decades ago creditable gardens were to be found on the Moose Woods and other reserves.

The horticultural efforts of the early settlers were necessarily limited. Some had no gardens whatever, and depended on neighbours for potatoes and on the storekeeper for canned vegetables, dried prunes, apricots, and apples. Others grew rhubarb, and a few secured roots of the wild black currant and domesticated them in the garden. The majority, however, followed the custom of the natives and depended on the ravines, coulees and stream flats for a supply of fresh fruits. Indians did a good trade in gathering and selling wild raspberries, strawberries, plums, cherries, red and black currants, gooseberries, Pembinas, Saskatoons, and along the northern and eastern boundaries of the prairies, blueberries and cranberries.

A generation ago there were a number of settlers attempting to grow tree fruits. These were brave voyageurs in an uncharted field and successes were rare. Immigrants from Eastern Canada, the British Isles, and the United States were wont to attempt the growing of the varieties of apples, plums and cherries that they had cultivated in their former homes. Thirty years ago a few apple trees bore fruit. The Indian agent on Rainy lake, close to Fort Frances, Ont., near the eastern edge of the prairies, had a Duchess of Oldenburg tree which bore a number of bountiful crops of good fruit. Mr. A. P. Stevenson, founder of Pine Grove Nursery at Morden, Man., was growing crab apples and beginning to harvest standard apples. These men were trail-blazers, and many triumphs in the culture of tree fruits have since been achieved by dwellers on the Canadian plains.

A raspberry plantation in Manitoba. Raspberries, currants and hardy plums may be relied upon to produce bountiful crops in the Prairie Provinces.

Pre-eminent among the successful fruit growers of the Canadian prairies stand A. P. Stevenson and Sons, of Morden, Man. They have introduced a wide range of horticultural trees, shrubs and plants which proved suited to different prairie zones. As an example may be cited their apple crop of 1921, which totalled 300 barrels. This crop was made up chiefly of fifteen varieties of standard apples. Dr. R. Moore of Fort Frances, Ont., has been growing orchard crops for over twenty years, and has many varieties of apples and plums thriving. Thomas Frankland did much valuable work with plums at Stonewall, Man. D. W. Buchanan in his nursery at St. Charles, Man., developed a number of varieties of improved native plums.

Mr. Norman M. Ross, Chief of the Tree Planting Division, has grown, on the Forestry Station at Indian Head, Saskatchewan, fair crops of such apples as Blushed Calville, Hibernal, Wealthy, and Charlamoff, and bountiful crops of such high quality plums as Tokato and Mammoth. The driveway on the Forestry Station would be considered a place of great beauty even in the most favoured fruit-growing sections

of Ontario. The Forestry Nursery Station at Indian Head, Pine Grove Nursery at Morden, and Assiniboine Park at Winnipeg are beautiful prairie oases, and provide inspiration and substantial encouragement to all home-makers privileged to visit these recently developed beauty spots. In 1905 the Forestry Nursery Station was a prairie cow pasture.

In northern Manitoba, at Valley River, W. J. Boughen is growing many kinds of small fruits, plums and crabapples. He is proprietor of the Boughen Nursery and has done a great deal for Northern Manitoba by showing that fruit-growing can be made a profitable enterprise in the Dauphin district.

The Agricultural Colleges of Manitoba, Saskatchewan and Alberta each has a Department of Horticulture. The various phases of horticultural work are taught to student classes, and demonstration and experimental work is conducted on the college farms.

There is at present a distinct tendency for prairie people to become active in horticulture. A score of prominent agricultural men might be mentioned. Among these is Dr. Seager Wheeler, Saskatchewan's "Wheat King," who is doing breeding work with garden crops and fruits, and intends growing tree-fruit seedlings on an extensive scale.

There is one horticultural association on the prairies of considerable age—the Manitoba Horticultural and Forestry Association. This is a flourishing organization and has done a great amount of good. The Winnipeg Garden Show, considered one of the most impressive annual horticultural exhibitions on this continent, is held under its auspices. Besides sponsoring exhibitions, the Association distributes plant premiums and literature, and the leading prairie

The Hungarian grape, hardy in Manitoba, bears fruit of medium size and fair quality.

horticulturists assemble at its annual winter meeting.

Experimental Farms

The Dominion Experimental Farms and Stations in Western Canada have found horticulture to be one of the lines of work most appreciated by the public, and there is ample evidence to prove that the people of the prairies are giving more attention to beautifying their home surroundings, to the planting of fruits and to the growing of vegetables. There are several reasons for this development. Among them may be mentioned the success that has attended the efforts of the men mentioned above. Prairie people, realizing that they are living in the "Last Great West," are more and more preparing to consider it their permanent home. They are frequently hastened to this conclusion by the return of neighbours who had departed for other provinces and countries, only to find they were better satisfied on the Canadian prairies. Moreover, the continually increasing number of varieties suited to western conditions is another favourable factor in developing prairie horticulture.

The Central Experimental Farm at Ottawa has supplied a great deal of horticultural material to Branch Farms and to private individuals. This assistance has included the distribution of seeds, plants and literature. Much of the plant-breeding work of the Central Experimental Farm has for its primary object the developing of hardy strains for the prairies. Among the notable examples are the Saunders' hybrid apples, early varieties of sweet corn, and early maturing tomatoes.

The branch Farms and Stations of the prairies have not, however, done very much plant breeding with horticultural crops, but the Brandon Farm has produced several new varieties of crab apples and small apples. One of the crab apples has been named "Bedford," and appears to be as hardy as "Osman" and "Columbia," two Saunders' hybrids of outstanding hardiness. The service rendered by prairie Branch Farms to horticulture has been chiefly connected with exhibits at summer fairs, demonstration plantings, reports of experimental projects with vegetables, fruits, shelter belts and hedges, and ornamental trees, shrubs and flowers; in distributing small quantities of seeds and plants, and in replying to enquiries. Of these enquiries there has been a marked increase during the last two years.

The Morden Station

The Experimental Station for Southern Manitoba, at Morden, does major work in horticulture. Many projects in general agriculture are carried on, but special attention is paid to horticulture. Over one hundred acres are devoted to horticultural work. The orchard area is eighty acres, of which about forty-five acres are planted to tree fruits and small fruits. The balance of the orchard is to be planted with selected seedlings and material secured by controlled plant breeding.

Most of the seedling apples and plums that have fruited were developed from fruit grown at the Central Experimental Farm, or by A. P. Stevenson & Sons, Morden. A number of these promise to be of value. Two Crusoe seedlings produce large fruit of better quality than any of the many named varieties growing at the Station. Of the 228 seedlings fruiting for the first time in 1922, there are fifteen being propagated for retesting. Ten acres of young apple seedlings were set out in 1916 and of these 327 have already borne fruit. The fact that two seedlings are of outstanding promise, and that more than a dozen others warrant further testing, encourages confidence in the belief that marked advances may be expected when controlled plant

breeding is done for the prairies, on the prairies, by using strains that have proved themselves adapted to prairie conditions. The Morden Station has been equipped with a greenhouse to facilitate breeding work with fruits and vegetables.

In order to accumulate a great variety of strains of horticultural plants as a basis for prairie plant breeding, the Dominion Horticulturist has had supplied to the Morden Station what is probably the largest collection of hardy fruits on the American continent. The collection includes fruits from Russia, Siberia, Manchuria, Peace River, Northern Manitoba, Lake Superior, Northern Minnesota, and many other places.

Trial orchards are being developed for the Central Experimental Farm, for the Fruit Breeding Farm of the University of Minnesota, and for the South Dakota Station. One orchard is completely planted to selected native fruits and nuts. Wild plums are receiving much attention, and 8,000 trees grown from selected fruit were permanently set out in 1922.

Considerable work of value has been accomplished in vegetable culture. The most impressive is probably the success in growing melons of high quality.

A systematized arboretum to embrace all procurable hardy trees and shrubs is to be established. This is a line of work deserving more attention than it has yet received on the prairies.

Apples grown at the Morden Experimental Station, Southern Manitoba. The trees are headed close to the ground.

Conclusions

Experience has shown, (1) that one of the essentials for success with prairie horticulture is a well planted and thriving windbreak or shelter belt; (2) that only hardy varieties of fruits should be selected; (3) that a number of the native prairie fruits have distinct value (some serving as stock for budding and top-working); (4)

the effectiveness of plant breeding as a source of improved varieties; (5) that there is a wide range of herbaceous perennials suitable for planting. (Immigrants from the British Isles have contributed much by introducing varieties of flowers); (6) that beautiful surroundings, productive fruit plantations, and excellent vegetable gardens are possible on the prairies.

Just as the prairie states to the south had to depend on their own efforts in securing hardy fruits, so will prairie Canada. Considerable work is being done on the problem, encouraging successes are being secured, and the number of people interested in horticulture is expanding rapidly.

New varieties will come largely from seedlings raised on our own prairies. Therefore, let all those who are able join in the development by sowing seed and pits of hardy apples, plums, cherries, and pears.

FURTHER CLASSIFICATION OF ELEVATOR SCREENINGS

By GEORGE H. CLARK, Seed Commissioner

ACTING on the recommendation of the Advisory Board under the Feeding Stuffs Act, an arrangement in the interests of live stock feeders has been made whereby grain inspectors' certificates covering shipments of screenings from the terminal elevators at the head of the lakes will serve more adequately to classify this material according to its general character and utility value.

At the instance of the Board of Grain Commissioners a conference was recently held at Fort William, at which representatives of all sections of the grain trade, members of the Grain Inspection Department, and officials responsible for the enforcement of the Feeding Stuffs Act were present to discuss the general practices employed in the handling and disposal of grain screenings.

Concurrently with this discussion the Grain Commissioners, acting as a board of hearing, received evidence in support of a complaint by a Fort William feed manufacturing firm regarding the quality of screenings supplied them by a local elevator. From this evidence it developed that for the protection of holders of warehouse receipts for grain, inspection of all materials removed from the terminal elevators was required, but the designation "elevators screenings" on grain inspectors' certificates had been regarded only as a permit to remove from the elevator waste material cleaned from the grain, and was not intended to designate any specific grade or quality of material.

The Canada Grain Act does not provide for the grading of screenings; but at the request of the Advisory Board under the Feeding Stuffs Act a classification was made some two years ago for "Standard Recleaned Screenings," since which time, on request by the shipper, a certificate bearing this designation has been issued by the grain inspectors covering shipments found to contain not more than three per cent of fine weed seeds, and it has been reliably ascertained that screenings so graded rarely contained in excess of one per cent of the objectionable mustards.

More than sixty thousand tons of Standard Recleaned Screenings have been sold for feed purposes during the past year, and thus far no injurious effects to the health of live stock, resulting from their use, have been reported. Standard Recleaned Screen-

ings from the 1922 wheat crop have been found to contain on the average about 48 per cent of broken and shrunken wheat and 41 per cent of wild buckwheat. The composition will naturally vary with the season and source of origin. Recleaned screenings from wheat grown in northeastern Saskatchewan and Manitoba will normally contain a higher percentage of wild buckwheat and a lower percentage of broken and shrunken wheat than will screenings from wheat grown in the drier areas where wild buckwheat does not thrive so well. Wild buckwheat approximates cultivated buckwheat in feeding value; but its black seed coat imparts a dark appearance to ground screenings, for which reason feeders at first are apt to object to it.

Standard Recleaned Screenings should never be fed to young pigs or calves, but have proved to be a satisfactory and comparatively inexpensive feed for mature stock, particularly pigs, which, however, will promptly refuse to eat it if the mustard seed content is more than about one per cent. This material ought always to be very finely ground, but none of the ordinary steel plate choppers are capable of crushing all of the fine weed seeds which almost invariably are present in small proportions.

In addition to Standard Recleaned Screenings there is separated at the terminal elevators a further screenings product which possesses reasonable uniformity in composition and a feeding value comparable with that of No. 2 feed oats. This product is composed chiefly of wild oats, with a small percentage of cultivated oats, wheat, and other coarse grains, is practically free from fine weed seeds, and is shipped out under the grain inspector's certificate as "Oats Scalpings."

Of the several classes of elevator screenings, Standard Recleaned Screenings and Oats Scalpings only have been given a commercial status ensuring uniformity to the purchaser. When placing orders, therefore, purchasers should always specify Standard Recleaned Screenings or Oats Scalpings, as the case may be; otherwise they are apt to be supplied with material which in general appearance resembles Standard Recleaned Screenings but which actually contains an excess of the fine, black weed seeds, and for which the grain inspector's certificate bears the designation "Elevator Screenings."

THE DAIRY AND COLD STORAGE BRANCH

Origin and Development.—Delegates from the Dairymen's Associations in the several provinces assembled in Ottawa on April 9, 1889, and petitioned the Government to appoint a Dairy Commissioner for the Dominion. The suggestion was favourably received, and the result was that Professor Jas. W. Robertson was appointed to the position on February 1, 1890, and Mr. J. C. Chapais was made Assistant Dairy Commissioner, with headquarters in the province of Quebec. Professor Robertson was at the same time appointed Agriculturist to the Experimental Farms, and continued to hold the dual position until December, 1895, when he was relieved of his duties as Agriculturist and devoted his whole time to the Dairy Branch as Agricultural and Dairy Commissioner.

The work of the branch was developed and expanded until, in 1901, divisions had been created for dairying, live stock, cold storage, extension of markets, fruit, seed, and poultry. When Professor Robertson resigned

on January 1, 1905, a reorganization took place by which the Live Stock and Poultry divisions became the Live Stock Branch, and the Seed division was also raised to the status of a branch, leaving as the Dairy Branch the divisions of Dairying, Fruit, Extension of Markets, and Cold Storage under a Dairy Commissioner (Mr. J. A. Ruddick), whose title was changed a year later to that of Dairy and Cold Storage Commissioner.

On April 1, 1914, the Fruit division was made a separate branch, leaving the Dairy Branch with its present Administrative, Dairying, Extension of Markets, and Cold Storage divisions.

Administrative Division.—This division has, of course, the general direction of all the activities of the branch and the organization of new lines of work. The general progress of the dairying industry, new processes and developments throughout the world, as well as general market conditions for dairy produce, are studied, with a view to their effect on Canadian conditions. The division also keeps in touch with the provincial Departments of Agriculture to preserve the proper correlation and co-operation of the work of the federal and provincial departments in matters connected with dairying.

Dairy Division.—During the early years of the existence of the branch the Dairy division took an active part in establishing the manufacture of cheese in Prince Edward Island, operating a number of factories for several years. Another piece of pioneer work was the establishment of creameries in the Northwest Territories. The creameries were erected by local co-operative societies and operated by the branch until the creation of the provinces of Saskatchewan and Alberta, when the work was turned over to the provincial departments of agriculture. Another line of work was the inauguration of winter creameries, which were operated as dairy stations at several points in Ontario and other provinces. Until this demonstration was undertaken there was no creamery butter manufactured in Canada during the winter months.

In 1902 a campaign was started with the object of improving the quality of Canadian cheese through the control of the temperature in the curing rooms. The Commissioner was authorized to erect and operate for a period of five years, four model curing rooms at different points in Ontario and Quebec for the purpose of demonstrating the value of this improvement.

The data secured through the operation of these curing rooms showed that the quality of the cheese was greatly improved, and that there was a sufficient saving in the shrinkage of the cheese by being cured at a lower temperature to meet the cost of making the improvements in the curing rooms. Briefly, the demonstration was so conclusive that no cheese factory is now considered to be fully equipped without some means of controlling the temperature in the curing room, and " cool cured " cheese is quoted at a premium on the market.

During the years 1908-9 a thorough investigation was made of the methods followed on the farms in caring for milk intended for the manufacture of cheese. It was found that the practice then in vogue was not only useless, but in many circumstances positively harmful. As a result of the investigation the division was able to recommend an effective treatment which required less labour and apparatus. The presentation of the case was so conclusive that the care of milk for cheesemaking was revolutionized in a single season and the quality of the cheese greatly improved.

At the present time the only dairy station in operation is located at

Finch, Ontario, where a combined butter and cheese factory was built in 1912. The objects aimed at in establishing this station were to provide facilities that would enable the Dairy Branch to—

(*a*) Control and operate a model combined cheese factory, creamery, and milk and cream shipping station;
(*b*) Demonstrate the advantages of a well-conducted factory, equipped to take advantage of the highest market for cheese, butter, milk, or cream;
(*c*) Encourage the production of winter milk;
(*d*) Conduct experiments and investigations relating to the manufacture of butter and cheese;
(*e*) Demonstrate new processes and to try out new appliances;
(*f*) Demonstrate the value of the cool curing of cheese; and
(*g*) Study the economics of dairy factory operation.

Being responsible for the successful operation of this factory conducted on strictly commercial lines, the Dairy Branch is brought into close contact with the problems that confront other manufacturers of cheese and butter throughout the country.

The supply of milk at the Finch Station is nearly four times as great as in 1912, the first year it was operated. The average return to patrons is from ten to fifteen cents per hundred pounds of milk higher than the average received at factories where only cheese is made. A considerable portion of the milk supply is sold to milk distributors in Montreal either as milk or cream. With the necessary equipment to make butter or cheese, or sell milk and cream, on short notice, the management is able to dispose of the products in the highest market prevailing at the time. It is believed that this type of dairy factory is a solution of some of the difficulties which producers have found themselves in during the last year or two in some parts of Ontario.

An important activity of the Dairy division is the promotion of cow-testing whereby, in co-operation with the owner, records are kept of the individual cows in the herd. Records of 50,304 cows were kept in 1922. This work is entirely distinct from the Record of Performance Test carried on by the Live Stock Branch, which is official. The cow-testing promoted by the Dairy division is unofficial, as the owner of the herd weighs the milk and takes the samples for testing. The object is, of course, to show the farmer which are his best and which are his poorest producers so that he can eliminate the poor cows and breed only from those that give the best returns.

A Dominion Educational Butter-scoring Contest was inaugurated in 1919, and has been continued since. The object is to develop uniform methods of manufacture throughout the various buttermaking sections, to standardize the quality, and to establish uniform grades throughout the whole Dominion. This contest has demonstrated that butter of a uniform type and quality can be made in every part of the Dominion.

A new line of work was undertaken in 1920 in the grading of dairy produce for export. The grading has been limited so far to the grading of cheese for sale by auction at Montreal by an Ontario co-operative society, but in accordance with the desire of the producers, the system was, on April, 1923, extended to all dairy produce exported.

A very important service in connection with the grading of dairy produce is carried on by the division with a view of procuring uniformity in the work of grading as carried on by provincial authorities in the different provinces. Conferences of the graders are held from time to time

and classes in the grading of dairy produce are conducted by the Chief of the division at the various dairy conventions and exhibitions held throughout the year.

The holding of conferences with the provincial dairy authorities not only in connection with the grading of dairy produce, but with reference to various other phases of government dairy work, has produced most excellent results, tending to co-ordinate and unify the work throughout the Dominion, to promote standard methods and practice, and to serve as a means of education for all those who participate in these conferences.

An Investigator of Dairy Weights and Measures is located at Montreal who examines complaints of cheese and butter manufacturers as to the weighing of their products at that point.

Extension of Markets Division.—Cargo inspectors were appointed in 1900 to examine all cargoes of perishable produce as loaded on steamers at Montreal and other Canadian ports for export to the United Kingdom. Other cargo inspectors were located at London, Liverpool, Bristol, Manchester, and Glasgow, to examine the cargoes as discharged from the steamers. This service has been continued and improved from time to time. The names of consignors and consignees, the condition of packages and contents at the time of loading and discharge, and the stowage of the cargo, etc., are noted by the inspectors. Recording thermometers are placed in refrigerated chambers, and the record forms part of the detailed report which is forwarded to headquarters at Ottawa from both ends of the voyage on all steamers carrying perishable food products. Copies of these reports may be obtained by any person interested in particular shipments. Much improvement has resulted in the packing, handling and stowage of cargoes, and better ventilation of ordinary cargo space has been provided since this service was inaugurated.

A market reporting service for butter and cheese has been provided during the past four years in the form of a Weekly Market Letter which is sent to every person who asks for it. Paid telegrams are sent twice a week to officials in various districts by whom the information is communicated to salesman in the surrounding territory. Collect telegrams are sent direct to any salesman who makes a request for them. These telegrams give the prices paid on the Montreal and Toronto markets up to a few hours before they are despatched.

A monthly News Letter containing items of general interest concerning the dairy industry throughout the world is sent to every cheese factory and creamery in Canada and to any person who asks to have his name placed on the mailing list.

The enforcement of the Dairy Industry Act, and of the Oleomargarine Act as it refers to the sale and use of oleomargarine, has been entrusted to the Markets division. This work includes investigations into the adulteration of butter by excessive water and by foreign fats, weights or prints of butter, proper marking of butter, adulteration of cheese, proper branding of cheese, sale and use of oleomargarine, weights of fats, weights of prints of butter, proper marking of same, as well as prevention of mixing of butter and oleomargarine. In connection with this work the inspectors of this division have power to confiscate dairy produce in connection with which illegalities have occurred, and they can also prosecute the manufacturer or dealer involved.

Cold Storage Division.—In 1895 the work of organizing the cold storage services was begun by the Dairy Branch. The export butter trade of Canada owing to improvement in other countries and keener competi-

tion from abroad, had shrunk to almost nothing. There was no organization to provide for the carriage of butter in refrigerator cars in Canada or in cold storage space for overseas shipment. No one could get a refrigerator car unless he had a car load to ship and few creameries had any provision for cold storage. The Commissioner was authorized to arrange with the railway companies to run refrigerator cars once a week over stated routes for the carriage of butter in small lots. At the present time cars are run weekly on some 65 different routes from country points to Montreal and other market centres. The Government guarantees two-thirds of the earnings of a minimum car load from starting point to destination plus $8 per car for icing. Inspectors are employed at terminal points to note the quantities in each car, to see that the cars are in proper condition and that they have been fully iced.

Since 1897 the creameries have been encouraged to erect cold storage rooms by the payment of a bonus of $100 for a cold storage erected and equipped according to plans and specifications supplied free by the Branch.

The steamship companies were encouraged to provide refrigerated chambers in 1896 when the Government offered to pay half the cost of installing the machinery on a number of ships. In the course of the next five years there were 34 steamers in the St. Lawrence trade equipped with cold storage space. Before the war all the regular steamships were equipped with cold storage facilities. With these improvements the export of butter increased rapidly until the maximum of 34,000,000 pounds was exported in 1903.

In 1907 an Act was passed authorizing the Minister of Agriculture to enter into contracts for the payment of subsidies to assist in the erection of public cold storage warehouses in places where no cold storage already existed. With this encouragement local cold storage warehouses were established at many points throughout the country thus providing additional market for perishable products of seasonal production to be carried for consumption during the months of scarcity. This policy also had the effect of preventing the concentration of food products in the hands of large companies at central points. Since the inauguration of this law, 34 cold storage warehouses have been assisted, with a total refrigerated space of 4,978,304 cubic feet, on which the total subsidy payable is $722,506.41.

Results.—It is rather difficult to make a definite statement of the results which have followed the various activities of the Dairy and Cold Storage Branch during the last thirty years. Those who are engaged in this kind of work may be accused of over-estimating its value. There is a natural tendency to do so. Perhaps the best way of putting the case would be to state the progress that has been made in lines of work covered by those activities and let the public make their own estimate.

The cheese making industry of Prince Edward Island, which was established under the auspices of this Branch, grew rapidly and has become an important item in the agriculture of that province.

The creamery industry in Alberta, Saskatchewan and Manitoba has continued to develop until the total quantity of creamery butter manufactured in these three provinces during the past year was 34,626,051 pounds.

Winter creameries are now regularly operated in every part of Canada.

No cheese factory is now considered to be complete in equipment without provision for control of temperature

as demonstrated by the cool curing rooms established under the auspices of the Branch in 1902.

The Finch Dairy Station, as a model factory, has been copied in many localities, and will have an important influence on the factory system of Ontario.

Iced cars were not used for the shipment of butter or cheese from country points to the leading markets, as is the case at the present time. The creamery butter industry has been greatly stimulated by this service.

There was no cold storage on steamships sailing out of Montreal until the matter was taken up and promoted by the Dairy and Cold Storage Branch. All steamers in the regular trade with the United Kingdom are now equipped with cold storage facilities.

The cargo inspection services at Canadian and United Kingdom ports, first organized about twenty years ago, have certainly been the means of securing important reforms in the handling of Canadian products in transit between the Canadian shipper and the Old Country merchant. Improved methods of loading on steamships at Montreal have greatly reduced the damage to packages which formerly occurred. More care is exercised in placing perishable products in the best available space on board ship, and such space is now much better ventilated than it formerly was. Twenty years ago there was no cold storage on the docks at any port in the United Kingdom. The butter and cheese was frequently left for many days in the dock sheds before being removed. Armed with the specific information which the cargo inspectors were able to supply, an agitation was begun which was followed by the establishment of cold storage warehouses especially for Canadian produce on the docks at London and Liverpool. The port of Bristol also erected cold storage warehouses at Avonmouth. Butter and cheese can now be discharged direct from ship to coldstore at these ports.

The efforts of the Branch in bringing provincial experts together in grading and other conferences have resulted in remarkable uniformity in the quality and character of butter and cheese made in all parts of Canada.

Since the cow-testing propaganda was started, the annual production of milk in Canada as a whole has been increased by over 1,000 pounds per cow. If we multiply this quantity by the number of cows in Canada we find that the production in one year is three and a half billion pounds more than it would have been if there had been no increase in the individual yield. The value of this increase at the average net value of $1.50 per hundred amounts to over $53,000,000.

The numerous bulletins published, the articles prepared for the agricultural and other press, and the addresses delivered at conventions and public meetings must have stimulated interest in, and added something to, the fund of general knowledge of the subjects treated.

The extensive correspondence carried on, and the personal contact of the experts of the staff with practical dairymen have surely not been without some influence for good.

It would not be correct to take credit for all the improvements that have been cited. Some of them would have come sooner or later without any government assistance or encouragement, but they arrived more quickly and were probably established on a better basis by the help that came from expert direction and suggestion.

COW TESTING REPORT

THE cow testing report for 1922, shows that each year a larger number of dairy farmers are taking advantage of the plan of the Dairy and Cold Storage Branch to obtain records of production of milk and fat from the individual cows in their herds. The following tables give the results of the work in the different provinces as shown by records received by the Branch.

TOTAL NUMBER OF HERDS, COWS, TESTING CENTRES AND TESTS MADE, BY PROVINCES, 1922

Province	Number Herds	Number Cows	Testing Centres	Samples Tested
Alberta	111	1,165	36	5,239
British Columbia	22	100	2	553
Manitoba	82	798	23	2,702
New Brunswick	137	1,061	21	4,879
Nova Scotia	360	2,520	48	13,497
Ontario	783	10,347	92	41,582
Prince Edward Island	164	1,046	15	5,217
Quebec	3,469	33,267	463	129,991
Totals (1922)	5,128	50,304	700	203,660
Totals (1921)	5,194	47,895	711	194,747

NUMBER OF HERDS AND COWS RECORDED FOR EIGHT MONTHS OR OVER, AND THE AVERAGE PRODUCTION BY PROVINCES FOR THE YEAR 1922

—	Number Herds	Number Cows	Average Production		
			Milk	Test	Fat
			Lb.	%	Lb.
Alberta	34	303	7,222	3·66	290·6
British Columbia	10	39	6,614	3·8	251·8
Manitoba	13	111	6,492	3·41	221·5
New Brunswick	36	256	5,345	3·86	206·8
Nova Scotia	158	860	5,342	4·32	230·8
Ontario	118	1,229	7,089	3·49	247·6
Prince Edward Island	51	265	6,875	3·25	261·5
Quebec	230	2,211	5,010	3·9	195·5
Totals and Averages (1922)	650	5,274	5,831	3·8	221·9
Totals and Averages (1921)	580	4,448	5,801	3·69	214·1

NOTE:—The figures for British Columbia represent only the testing work in districts where the Provincial Cow Testing Associations are not in operation.

While during 1922, there were 826 more cows recorded for eight months or over than in 1921, the average production of milk and fat shows an increase during the year, and the average test was increased from 3·69 per cent to 3·8 per cent.

FINCH DAIRY STATION NOTES

A RECORD of the quantity of milk supplied each year from 1913 to 1922, inclusive, by thirty of the original patrons of the Finch Dairy Station, operated by the Dominion Dairy Branch, is presented below. Each of these men has sent his milk regularly to the Station since its inception. The majority have greatly increased their annual output. The record of Patron No. 17 is

particularly noteworthy, showing an increased delivery of 345 per cent during the period. The total production of the thirty original patrons for 1922 shows an increase of 34 per cent as compared with their total for 1913.

RECORD OF INCREASE IN MILK PRODUCTION OF THIRTY ORIGINAL PATRONS

Patron's Number	1913	1916	1918	1920	1922
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
1	56,238	41,250	67,312	71,062	66,252
2	56,642	49,196	48,662	64,728	77,857
3	39,057	24,035	34,739	31,692	34,297
4	57,382	47,255	51,896	39,564	30,647
5	48,330	27,485	23,537	17,660	28,835
6	71,117	52,456	74,436	88,996	113,336
7	51,507	35,063	31,735	27,160	45,933
8	29,631	34,283	44,157	57,741	74,343
9	62,275	28,316	73,605	68,786	84,349
10	105,983	129,003	156,017	140,962	127,856
11	12,743	24,024	30,228	31,809	48,666
12	15,059	15,498	21,933	19,331	31,709
13	53,953	77,552	68,101	67,310	107,263
14	51,594	48,741	50,315	46,144	56,002
15	33,230	33,344	45,088	38,752	36,222
16	103,331	67,402	109,639	99,672	102,329
17	35,475	2,876	22,848	99,864	158,161
18	76,734	69,157	73,255	80,282	130,844
19	56,151	52,142	49,438	57,028	77,560
20	85,806	89,684	87,570	79,029	86,823
21	57,086	55,439	62,975	56,689	87,885
22	49,027	37,171	38,169	35,846	53,071
23	57,654	68,966	71,813	82,957	88,578
24	57,614	60,668	69,198	80,011	102,063
25	22,654	36,710	41,094	38,314	49,954
26	33,021	49,007	40,673	33,112	50,585
27	14,900	22,031	1,311	52,498	74,768
28	42,693	55,367	49,642	47,253	67,336
29	60,592	50,578	61,436	52,043	42,877
30	26,355	28,268	36,430	36,884	51,141
Total	1,523,834	1,412,967	1,637,330	1,743,182	2,187,512

The following table showing the number of months during which milk was supplied each year by the different patrons illustrates the development of winter dairying by patrons of the Station:

1913		1916		1918		1920		1922	
Number of Patrons	Months Sent	Number of Patrons	Months Sent	Number of Patrons	Months Sent	Number of Patrons	Months Sent	Number of Patrons	Months Sent
7	11	6	12	11	12	16	12	22	12
7	10	3	11	3	11	3	11	4	11
6	9	4	10	4	10	3	10	1	10
4	8	5	9	5	9	5	9	3	9
3	7	6	8	4	8	3	8	.....	.....
3	6	2	7	2	7	.....	.....	.....	.....
.....	.....	1	6	1	2	.....	.....	.....	.....
.....	.....	1	3	.....	.....	.....	.....	.....	.....

In the first year of operation, the total quantity of milk received at the Station was 2,069,281 pounds. In 1921, it was 6,586,485 pounds, and in 1922, 8,781,879 pounds.

PART II

Provincial Departments of Agriculture

NUT CULTURE — A NEW AND INTERESTING BRANCH OF HORTICULTURE

By JAMES A. NEILSON, B.S.A., Lecturer in Horticulture, Ontario Agricultural College, Guelph

Status of Nut Culture in the United States and Canada

THE conservation and improvement of our native nut trees and the introduction of suitable varieties from foreign lands have not occupied a prominent place in horticultural activities in North America until just recently, except in the Southern and Western United States, where a great deal of interest has been shown during the last twenty years in this place of horticulture.

In the Southern States the Pecan has been greatly improved and widely planted, and in the Pacific coast region the English or Persian walnut and the almond are extensively grown. As a result of this development large quantities of fine nuts are produced annually and millions of dollars are thereby added to the wealth of the country.

The interest in and the possibilities of nut culture are fortunately not confined to the American South and West. In the northern and eastern States and in Canada there is a growing interest in this useful but much neglected branch of horticulture. An example of this commendable movement is seen in the organization and activities of the Northern Nut Growers Association. This organization was formed in 1909 and is composed of men and women from almost every station in life who are interested in the culture of nut trees and the extension of the use of nuts as articles of human food. At the instigation of members of this Association, the State of Michigan has undertaken an extensive programme of nut tree planting along the state highways, and in other northern states good work has been done to encourage people to plant more and better nut trees.

In Ontario comparatively little has been done to improve and plant our valuable nut trees, and unless something is done to interest the public in this movement, we shall lose a golden opportunity to save for ourselves and posterity the remnant of the fine nut trees which formerly grew so abundantly in some parts of this province.

Realizing that some action should be taken, an attempt was made in the spring of 1921 to draw the attention of the public to the desirability and possibilities of nut culture. This endeavour was conducted along four main lines:

First.—A study of the occurrence and distribution of native and introduced nut trees with special reference to the location of superior species.

Second.—Introduction of new varieties from foreign lands for test purposes.

Third.—Improvement of poor or ordinary trees by top-grafting with scions of superior trees.

Fourth.—Educational work by means of lectures to students, horticultural societies, women's institutes

and other organizations, and also by articles for the press.

Our survey for nut trees was carried on by field trips and by means of a questionnaire, which was sent to officers of Horticultural and Agricultural Societies, Agricultural Representatives, School Inspectors, horticultural and agricultural journals, and the newspapers.

The questionnaire was as follows:—

Q. 1. Are any of the following kinds of trees growing in your locality?

American Black Walnut.
Japanese Walnut.
English Walnut.
Chinese Walnut.
Butternut.
Hickory Nut.
Pecan.
Sweet Chestnut.
Chinese Chestnut.
European Chestnut.
Japanese Chestnut.
Beechnut.
Hazelnut.
Filbert.

Q. 2. Do you know of any individual trees of the above mentioned kinds that are superior because of large size of nuts, good flavour of kernel, thin shells, rapid growth or high yields? Please give exact location of such trees.

Q. 3. Is any one in your section making an effort to grow any native or foreign species of nuts? If so, please give their name and address.

A large number of replies were received which furnished us with some valuable data on the occurrence and distribution of native and introduced nut trees. Moreover, these replies showed that many people were keenly interested in the culture of nut trees and heartily approved of the inquiry.

Description and Distribution of Nut Trees in Ontario

The chief nut trees native to the province of Ontario are the black walnut, the white walnut or butternut, the hickory, of which there are four species, the chestnut, the beech and hazel. Of introduced nut trees there are the Persian, Japanese and Chinese walnuts, European, Japanese and Chinese chestnuts, pecans, filberts, and the Turkish tree hazel.

The Black Walnut, *Juglans nigra.*—The black walnut is one of our finest native trees, and is found growing naturally along the north shore of lake Erie and lake Ontario and around lake St. Clair. It has been planted in many other parts of Ontario, and does well where protected from cold winds. The tree grows to a large size, often attaining a height of 90 feet and a trunk diameter of four feet. When grown in the open, it makes a beautiful symmetrical tree having a large rounded crown with drooping lower branches. Contrary to general belief, the native walnut grows quite rapidly and occasionally bears early. About eighteen years ago I planted several nuts around the buildings and along the roadside on my father's farm. Most of the nuts germinated and some trees have made a rapid growth. The largest tree of the lot measured 37·2 feet tall and had a trunk diameter of 14 inches just above the ground in August last. It began to bear in the sixth year and has borne nuts almost every year since then. The nut is of medium size and of good flavour. Some of the trees from the same planting are almost as large and bear larger and better nuts than the one described.

Trees that produce large, easy-cracking nuts with fine-flavoured kernels have been located in the Northern States and are now being propagated extensively as named varieties. The Thomas, Ohio, Ten Eyck

and Stabler are some of the best varieties which are now available for planting. The Stabler produces a nut which usually has a one-lobed kernel, and when the shell is cracked, this lobe comes out entire in about 70 per cent of the specimens. Several promising trees have also been found in Ontario, and we are hoping that, when our search for good trees is completed, the best native sorts will prove to be as good or better than the best named varieties found in the United States.

The Butternut, *Juglans cinera*.—The butternut or white walnut is much hardier than the black walnut and has a wider distribution in Canada. It is found from New Brunswick westward throughout southern Quebec and Ontario to southern Manitoba. Near Portage la Prairie there is a grove of seventy-seven trees which have grown to a fair size and have borne several crops of good nuts.

The butternut will grow on a variety of soils, but like the walnut, succeeds best on a rich well-drained loam. The tree sometimes attains a height of 70 feet and a trunk diameter of three feet. When growing alone, the trunk often divides into several branches, forming a triangular shaped outline. Like most other trees, the butternut varies greatly in productiveness, some trees yielding up to twenty bushels, while on others the yield is light. Some superior varieties are now being propagated and will be available for planting in a short time.

Japanese Walnuts.—The Japanese walnut is represented in Ontario by two pure types, *Juglans Sieboldiana*, the smooth shelled butternut-shaped type, and *Juglans cordiformis* or the Heartnut, and one hybrid which is a cross between the Sieboldiana and the butternut.

The *Sieboldiana* and the *cordiformis* types are characterized by very rapid growth, early and heavy bearing and marked beauty of form and foliage. These trees are considered by some to be our most beautiful nut trees, and are worthy of much wider planting as ornamental trees alone. They are believed to be hardier than the black walnut, having been grown and fruited in regions where the black walnut does not thrive. As a nut-bearing tree, the heartnut is the most valuable. The nuts are distinctly heart shaped, have a thin shell, crack easily and contain a kernel of good quality. In the best varieties the kernel can often be removed entire from the shell by a light tap of the hammer. Some superior trees of this species have been located in the northern States and are now being propagated as named varieties by nurserymen. Of these the Lancaster, Ritchie and Stranger are considered the best so far discovered. Some very good heartnut trees have been found in Ontario, and plans are being made to propagate them for test purposes. There is an excellent tree on the farm of Mr. A. H. Parker, near Islington, Ontario; another equally good one grows on Mr. Bert Scheer's property east of Aldershot; two very nice trees are found on Mrs. Norah Bullock's place across the road from Scheer's, and two fine trees on Mr. Sylvester Kratz's farm at Jordan Station. One of the trees on Mr. Kratz's place has been planted for twenty-five years, and is approximately two feet in diameter and 35 feet tall, with a spread of fifty-five to sixty feet from tip to tip of branches.

The hybrid between the butternut and the Sieboldiana form grows even more rapidly than either of the pure Japanese species. On the farm of Alfred Smith, Kerman avenue, Grimsby, there is a tree growing under rather unfavourable conditions which is about 30 feet tall and ten inches in diameter at the base at

seven years of age. Mr. J. J. Kelsey of Clinton, Conn., reports one of these hybrids to be 46 feet tall at nine years, and states that trees sometimes bear at three years of age. The hybrid tree appears to be quite hardy, having been grown and fruited at Cap Rouge, near Quebec city. The nuts of the hybrid have a fine flavour, but are not so desirable as the heartnut on account of having a thicker shell which does not crack easily. Its extreme rapidity of growth and the beautiful, almost tropical, foliage, however, make it desirable as an ornamental, to say nothing of the nuts, which are as good as the butternut and are borne in much greater profusion.

The English or Persian Walnut, *Juglans regia*.—The English walnut, or the Persian walnut, as it should be called, is found growing in the Niagara district and to a lesser extent in the lake Erie counties. It is stated on good authority that there are about 100 of these trees growing in the fruit belt between Hamilton and Niagara Falls. There are several quite large trees in the vicinity of St. Catharines, which have borne good crops of nuts. One of these trees produced nuts of sufficient merit to be included in the list of desirable nuts prepared by C. A. Reed, Nut Culturist of the United States department of Agriculture. This variety has been named the "Ontario," and is now being propagated experimentally in the United States.

There is a tree about fifteen years old on the farm of Mr. Peter McDiarmid which produces one of the largest and finest English walnuts I have ever seen. The shell is thin, cracks easily and contains a kernel of excellent flavour. This tree is considered very promising and arrangements are being made to have it propagated. In the vicinity of St. Davids, on the farm of Mr. James Woodruff, there is a fine English walnut tree which produced ten bushels of shelled nuts in one season. This tree is one of the largest of its kind in Ontario. It is about 60 feet tall, has a trunk diameter of three feet at one foot above the ground, and a spread of branches equal to its height. Mr. G. Greeniaus, near Clarkson, has several trees, some of which are bearing well.

The English walnut is not as hardy as the black walnut, and is adapted only to those sections of Ontario where the peach can be grown successfully. At present, this tree cannot be recommended for any part of Ontario except the Niagara district, the Lake Erie counties and possibly the district between Toronto and Hamilton. Even in these districts it should not be planted unless it has been grafted or budded on the hardier black walnut.

Chinese Walnuts, *Juglans regia sinensis*.—The Chinese walnut is being grown experimentally in the northern part of the United States, and has been tried at one place in Canada, *e.g.*, in the grounds of G. H. Corsan, Islington, Ontario. The tree is hardy at the Arnold Arboretum, Jamaica Plains, Mass., and should be sufficiently hardy for southern Ontario. It is believed that the Chinese walnut will prove to be hardier than the English walnut, and it may have an important place amongst nut trees in the northern part of the United States and in southern Canada. The nuts are very large and have a thicker shell than the English walnut, but not nearly so thick or hard as the native black walnut. The kernel generally has a fine flavour, being almost as good as the English walnut.

Several lots of nuts of this species were obtained from North-west China and have been distributed quite widely in Ontario for test purposes. From these nuts, trees are now growing at the Ontario Agricultural College, the Vineland Experiment Station, and at

Port Dalhousie, Thornhill and Cedar Springs. We hope these little trees will prove to be hardy enough for our climatic conditions and will produce nuts that are as good as the Persian walnut.

The Shagbark Hickory, *Carya ovata.*—This species is the most valuable of the four native species for the production of nuts. It occurs from south-western Quebec to south-western Ontario, and is found chiefly along lakes Erie, St. Clair and Ontario and along the St. Lawrence river. It reaches a height of 50 to 90 feet and a trunk diameter of three feet. In the open, it forms a few short heavy limbs which make an outline resembling an inverted cone. The bark is rough and shaggy and peels off in long strips which curl up at the ends, hence the name Shagbark or Shellbark. The husk surrounding the nut is very thick and is composed of four sections. The nut has a hard shell, which may be thin or thick, and contains a kernel that is highly esteemed by many people.

In Norfolk county some excellent trees have been located. One of them grows on the farm of Mr. George Sherk, near Carholme, and yields a large nut with a thin shell and a fine sweet kernel. The shell of this nut can be easily cracked with a light tap of the hammer, and may be cracked with the teeth without much difficulty.

The Bitternut, *Carya cordiformis*, the Mockernut, *Carya alba,* the Pignut, *Carya glabra.*—Of these other species of native hickory, the Bitternut has the widest range of any, being found from Montreal westward to the Georgian Bay and southward to the Great Lakes and the St. Lawrence. When grown alone, the tree is rather spreading and open and makes a pretty shade tree. The nut has a very thin shell which cracks easily, but the kernel is valueless as an article of food because of the bitter flavour. This species makes a good stock for grafting with superior types of the shellbark, and offers interesting possibilities in breeding tree crops. Several natural crosses between the bitternut and the shellbark have been found, and some of these are of excellent quality. Some of these crosses are described elsewhere in this paper.

The Mockernut and the Pignut are found in the Niagara district and the Lake Erie counties. The Mockernut produces a large nut with a very thick shell and sweet kernel. Because of the thick shell it is not usually of much value as a nut tree. A few variations of this species have been found, however, which may prove worth while propagating.

The Pignut produces a nut of variable form and size. The usual shape is oval, but some are found which are pear-shaped, and others again are broader than long. The kernel varies from bitter to sweet in flavour.

The Pecan, *Carya olivaeformis.*—The Pecan of commerce is a native of North America, and is found most abundantly in the southern and south-western United States and Mexico. A few hardy types have been found in the northern States. At Burlington, Iowa, there is a large tree which bears good crops of fine nuts, and at Concord, Conn., another large tree has been located, but on this one the nuts do not ripen.

It may be somewhat surprising to most people to learn that pecan trees grow in Ontario. Mr. C. R. James of Richmond Hill, Ontario, has five trees, some of which have occasionally ripened nuts. In 1919 a fully ripened crop was gathered, but since that time the nuts have failed to mature. The largest of these trees is 35 feet tall and about sixteen inches in diameter at the base, with a spread of 35 feet from tip to tip of branches. To mature a crop of nuts the pecan requires a longer growing season with more heat units than are generally found in Ontario, and for this reason we cannot recommend the planting of

the pure species. There are, however, a few hybrids between the pecan and the bitternut which are promising for northern sections, and it is possible that these natural crosses will prove hardy enough for the warmer parts of Ontario at least. If these trees can be grown and fruited successfully in Ontario, they will form a valuable addition to our nut-bearing flora.

Hybrid Hickories.—A few fine types of hickory of hybrid origin have been located and are now being propagated. The Laney, one of the best of these hybrids, was found in Riverside Cemetery in Rochester, N.Y. It is believed to be a cross between the bitternut and the shagbark, The tree is a large, vigorous, spreading grower, with beautiful foliage, and bears a fairly large nut with a thin shell like the bitternut and a plump sweet kernel like the shagbark.

Another good hybrid has been located near Rochester. It is supposed to be a cross between the kingnut and the shagbark, and is said to possess the characteristic large size of the kingnut with the sweet flavour and thin shell of some of the best shagbarks. This cross has been named the *Carya Dunbarii,* in honour of John Dunbar, Assistant Superintendent of Parks at Rochester, N.Y.

The Fairbanks is another promising hybrid between the bitternut and the pecan. The tree grows rapidly and bears a fine large nut with a thin shell and a sweet kernel. It is found in Iowa in sections where the climatic conditions are more trying than in our best fruit districts.

The Sweet Chestnut, *Castanea dentata.*—The Sweet Chestnut is found growing naturally on sandy ridges in that part of Ontario extending from Toronto to Sarnia and southward to Lake Erie. It has been planted outside its natural range and is doing fairly well. At the Central Experimental Farm, Ottawa, there is a fair sized tree, and near Newcastle and Goderich there are a few fine specimens.

It grows to a large size, sometimes reaching a height of 100 feet and a diameter of five feet at the base. When grown in the open, it forms several heavy branches and makes a broad rounded crown, but when grown in a dense stand it makes a tall straight tree.

The nuts are borne in a spiny burr which contains from one to three nuts. Some very productive trees have been found bearing nuts of large size and fine flavour. The flavour of the native sweet chestnut is superior to all other chestnut species.

The native chestnut is subject to a fatal disease called chestnut bark disease. This disease is not known to occur in Ontario, but there is no assurance that it will not eventually appear and, therefore, the planting of this tree is attended with some risk.

Exotic Species of Chestnuts.—Inasmuch as very few Chinese, Japanese and European chestnuts have been planted in Ontario, little can be said regarding their suitability for our conditions. Dr. Sargeant reports the Chinest chestnut (*Castanea molissima*) as being quite hardy at the Arnold Arboretum. This species produces a large sweet-flavoured nut, and the tree is said to be resistent to chestnut bark disease. The Japanese chestnut (*C. crenata*) is also quite hardy but is very susceptible to blight. A few Japanese chestnut trees are growing near Fonthill and have borne some very good crops. The tree is a small spreading grower, bears early, sometimes at three years, and yields heavily.

The European chestnut (*Castanea sativa*) has been grown successfully at Vineland by Mr. S. H. Rittenhouse. The tree is a low-spreading rapid grower and bears at an early age. The nuts are large, have a

fairly good flavour, and are borne quite abundantly at an early age.

Several Chinese and Japanese chestnut trees and a few hybrids between the two were recently obtained from Mr. Peter Bissett of the Bureau of Plant Industry at Washington. Some of these trees will be planted at the Ontario Agricultural College and the remainder have been sent to the Experimental Stations at Vineland and Ridgetown. It is hoped these trees will be hardy enough for our climatic conditions and will furnish us with material for improving our native species.

Hazels.—The Hazel family is represented in Ontario by two native species, the common hazel (*Corylus americana*) and the beaked hazel (*C. rostrata*). The hazel is without a doubt one of our hardiest nut-bearing plants, being found throughout Canada from the Atlantic to the Pacific, and as far north as Hudson Bay and up to the Peace River district. Dr. N. E. Hansen, Professor of Horticulture, College of Agriculture, Brookings, S.D., has selected some fine strains from Manitoba. These are now being propagated and widely distributed in the northwestern States.

The Filbert (*Corylus avellena*) has been introduced, and some good bushes are now growing and bearing at various points in Ontario. Mr. Graesser, of College Heights, Guelph, has a few bushes which bore well during the past season. Mr. Walter McCall of St. Williams, Ontario, has some fine large Kentish cobnut trees which have been bearing well for several years. Some of these trees are almost 20 feet tall and four inches in diameter. Messrs. H. B. McConnell and Son, of Port Burwell, are also growing the filbert successfully and regard it as a promising nut plant.

From the results obtained in Ontario by the above mentioned parties and at Rochester by Messrs. McGlennon & Vollertson, it would appear that the best hardy varieties of filberts could be grown to advantage in many parts of Ontario where they are not now grown.

The Turkish Tree Hazel (*C. colurna*) is a native of western Asia and southern Europe. In its native land it grows to a height of 60 feet with a wide spread of branches. This tree has been introduced into North America and appears to be quite hardy in northern areas. In Highland Park at Rochester, there is a specimen about 35 feet tall and fifteen inches in diameter at the base, and on the University campus, Toronto, there are a few young trees growing nicely. The nuts are borne abundantly in clusters, similar to the common hazel, are about as large as some of our small fruited hazels, and contain a kernel with a fine flavour. This tree is certainly worthy of a trial as an ornamental, and if a large fruited form could be discovered or produced by crossing with the filbert, it would make an excellent nut tree.

The Beech, *Fagus grandiflora*.—Next to the hazelnut the beech is the hardiest nut-bearing plant grown in Canada, being found abundantly in the Maritime Provinces, Quebec, and throughout Ontario to the west end of lake Superior.

The beech grows slowly and does not bear regularly, and hence has been almost neglected by nut culturists. Where other good faster-growing trees do not thrive, the beech is worthy of planting because of the fine quality of its nuts and beauty of tree.

The Almond, *Prunus amygdalus*.—The hard-shelled almond is grown to a limited extent in southern Ontario. Mr. R. J. Fleming of Watford, Ontario, has a tree which is yielding well, and Mr. Walter McCall of St. Williams, Ontario, has a fine tree which at three years from planting produced one-half bushel of nuts. The growth of this tree is astonishingly rapid, being about five feet per

annum. On suitable soils and in favourable locations the hard-shelled almond should be tried in southern Ontario where the peach can be grown satisfactorily.

Why Nut Trees Should be Planted

Most people who are interested in the welfare of the country realize that trees generally should be planted in much greater numbers, and some believe that it would be desirable to plant trees that serve a three-fold purpose of food, shelter and beauty.

Nut trees yield a valuable food, provide shelter and beautify the landscape, and thus combine beauty with utility. Large quantities of nuts are imported every year from foreign countries, for which a great deal of money has to be sent out of the country. It is believed that a portion of this demand for nuts could be met by growing a greater number of the best types of native and introduced species.

Where Nut Trees Might be Used to Advantage

(1) *As roadside and street trees:* Where the soil and the site are suitable, nut trees should form a part of the scheme of beautifying our highways and streets.

(2) *Trees for the home grounds:* The grounds surrounding many of our homes, both rural and urban, would be more beautiful and productive if planted with some of the best types of native and exotic nut trees.

(3) *Steep hillsides or other places:* Areas not easily or profitably cultivated could be very well devoted to nut trees provided the soil was suitable.

(4) *As park trees:* City and rural parks should certainly have a collection of native nut trees and some of the hardiest and best exotic species.

(5) *As a commercial venture:* In the warmest part of the province of Ontario it might pay to establish, on a small scale, commercial plantations of the best varieties of black walnut, Japanese walnuts, hickories, blight-resistant chestnuts, and filberts.

Kind of Nut Trees to Plant

Nut trees, like fruit trees, are difficult to grow true to type from seed and hence have to be propagated by budding or grafting. While it is quite true that one may get a very good tree by planting nuts from a desirable tree, it is also true that a considerable proportion of the trees so produced will not be any better or as good as their parent. Because of this uncertainty it is much better to plant budded or grafted trees of superior named varieties.

Inasmuch as nut growing is a comparatively recent development, our Ontario nurserymen have not devoted much atention to the propagation of named varieties of nut trees. There is some interest being shown at present, however, and it is hoped that before long there will be a fair supply of the best varieties of native and foreign nut trees available. In the meantime those who desire to secure named varieties of nut trees will have to place their orders with nut nurserymen in the United States.

Should the prospective nut culturist not be able to obtain at a moderate figure budded or grafted stock of improved varieties of nuts then, of course, the only thing to do is to grow seedling trees. As previously stated, some of these may produce very good nuts. If superior trees are found in any lot grown from seed, or if an exceptionally fine native tree is known to exist, such trees are useful as a source of scions for improving trees that are not so desirable. It is a fact, though not generally known, that nut trees may be top-grafted like fruit trees. This task is not as easy to accomplish as is the case in fruit trees, but if proper methods are followed, very good results may be obtained.

THE PROGRESS OF POULTRY KEEPING IN THE PROVINCE OF QUEBEC

By REV. BR. LIGUORI, Chief of the Poultry Division

THREE centuries ago—the exact date being August 26, 1621—the first marriage between Christians in Canada took place in Quebec City, in the church of l'Habitation, built by Champlain. Louis Hébert, first Canadian farmer, and Marie Rollet, his wife, married their daughter Marie Guillemette to Guillaume Couillard. There was a banquet for the occasion at which the whole colony assisted, headed by Champlain. Obviously, this banquet did not include eggs from domestic fowls. The fowls, like the horses, were imported from France several years after this happy event.

Whatever may have been the date of their arrival in Canada, the first roosters and the first hens imported from Sunny France were wintered in rudimentary and dark cabins, made of logs, which also sheltered the horses and the few head of cattle of that time.

Throughout the 17th, the 18th and the 19th centuries, all the live stock of the farm were housed together. Therefore, under the French régime, under the English régime, under the régime of the two Canadas, of Canada under the Union and even under the régime of the Confederation,—as far as the beginning of the present century,—horses, cows, calves, and fowls lived together under the same roof and necessarily breathed this heavy atmosphere—viciated, impure, damp air, particularly injurious to fowls, which fear dampness above all things and require sunshine and pure, dry, sanitary quarters.

The Canada of those days was not noted as a great producer of eggs, especially in winter. At the beginning of the last century, the inexperienced traveller, who asked for fresh eggs in a country hotel in November, December or January, would have been considered as very "smart" indeed.

At the beginning of the present century, the late Victor Fortier, of the Central Experimental Farm, Ottawa, began to recommend the cotton-front poultry house, rightly called by the people "the cold poultry house".

The Oka Agricultural School (which has since become the Oka Agricultural Institute) listened to the advice of Fortier and co-operated with him. Experiments soon showed that this type of construction was both safe and efficient.

In 1909, the Quebec Farmers' Experimental Union, then in its beginning, with the assistance of the Minister of Agriculture, the Hon. Jos. Ed. Caron, launched throughout the province an aggressive compaign in favour of this type of sanitary poultry house. The Union paved the way for the organization of a Poultry Division, which was brought about by the same Minister, and continued the work of its predecessor on behalf of cold poultry houses and poultry-keeping in general,—a work of renovation, affecting the whole practice of poultry-keeping. In this work the present Dominion Poultry Husbandman, Mr. F. C. Elford, has had a large share.

Thus, in less than fifteen years, with the help of the good practical common sense of the population, the cotton front poultry house, which was looked upon as a dangerous innovation at the beginning of the century, was introduced and accepted in all districts of the province. The old methods, which had been followed for three centuries, are now being abandoned, prejudices are being overcome

and, to use a popular expression, the cotton front poultry house is "here to stay." It has successfully passed the test of climate in all sections of the province, even where the winters are most severe. The cotton front poultry house is now found from Hull and Amos to Gaspé Point, and from Mistassini and Magdalen Islands to the frontiers of Vermont.

The Poultry Division

The Poultry Division of the Quebec Department of Agriculture was organized in 1914. Sixteen breeding stations, which were to run for the whole year, were established at that time. In several of these stations, co-operative incubators were placed and gave satisfactory results.

A substantial grant was also given to 39 domestic science schools and to the normal schools of Quebec and Montreal, to enable them to establish modern poultry plants. During the same year, the distribution of eggs to school children was also inaugurated, over 1,000 sittings being distributed.

In co-operation with the Cheesemakers' Co-operative Association, which is now the Quebec Federated Co-operative Association, the Poultry Division endeavoured to organize a co-operative trade in poultry produce, through the publishing of circulars and through practical demonstrations given on the spot by our instructors. The great improvement in quality, and the large increase in the quantity of products placed on the market, show that these efforts were successful.

In addition to the publishing of several circulars and pamphlets, thousands of copies of a complete text-book on poultry-keeping were distributed during the year.

During 1915, thirty-three breeding stations were operated. These stations are generally subsidized during two years only, it being thought advisable to remove them to some other district after two years' work, in order to spread the teachings as much as possible. The superintendents of these stations do not receive any pay from the Department.

The distribution of eggs was also continued in 1915 and 1,568 sittings were disposed of. This feature of the work was extended to the Women's Clubs (Cercles de Fermières) with good results. Thus, in Chicoutimi county, in a single month, twelve modern poultry houses were built at the instigation of farmers' wives. It became necessary to increase the number and the capacity of co-operative incubators to satisfy the demand.

Since 1915, steady progress has been maintained. The improvements are as follows:

1. Sanitary housing for fowls.

2. Winter laying, resulting from the above.

3. Early breeding in the spring to insure winter laying.

4. Breeding of utility breeds, the more common of these being the Rhode Island Red, Plymouth Rock and the Wyandotte.

5. Special poultry exhibitions held by poultry associations, of which there are about fifteen at present.

6. Organization of a provincial poultry association with which all poultry associations in the province are affiliated.

For further information on this subject, the reader is referred to annual reports of the Poultry Division.

No mention has been made of various organizations promoted by the Department of Agriculture. As regards the financial assistance given by the latter, with a view to encouraging the improvement of desirable breeds of fowls, let me conclude by quoting a statement made by the Live Stock Commissioner, Mr. H. S. Arkell, at the meeting of breeders

and fairs' associations, held in Quebec city, on May 7 last:—

"I believe that the Quebec list of breeds and prizes for poultry fairs is now the best that can be found, and it appears to me that this special encouragement given to a few breeds of utility, as is now done in Quebec, is the surest and easiest way to succeed. When the province of Quebec decides to do something in agriculture, she at once sets to work and does it."

The distribution of day-old chicks is now a well-established industry, and the demand is almost unlimited. A co-operative establishment in Quebec city, the Belvedere Farm, hatches and distributes every year from 7,000 to 10,000 day-old chicks, and there are five other co-operative plants having incubators of a capacity of 2,400 eggs.

The Breeding of Turkeys

In order to improve the quality of flocks of turkeys, several hundred breeding birds, specially selected, were distributed by the division. A very great improvement, due to this distribution, is already noticeable in the weight and particularly in the hardiness of the flocks where these turkeys were introduced.

FIELD CROP INSECTS IN MANITOBA

By A. V. MITCHENER, Assistant Professor of Entomology, Manitoba Agricultural College

AMONG the insects most destructive to field crops in Manitoba are grasshoppers, the western wheat-stem saw-fly, and the Hessian-fly. Spring wheat is the crop that is injured to the greatest extent, although other crops are destroyed, especially by grasshoppers. The farmers who first grew wheat had comparatively little trouble from insects, but as time has gone on, insect injury has become more pronounced. The average annual production of spring wheat in Manitoba for the past five years is around forty-five million bushels; consequently, any insect injuring this crop over a widespread area is capable of causing immense loss to the farmers of the Province.

Grasshoppers

Grasshopper outbreaks usually do not extend over a very long period of years. The present outbreak, which is now in its last stages, began almost unnoticed in 1918. The maximum intensity of the outbreak was reached in 1920, and since that time has been on the decline. Several injurious native species were involved. These may be divided into two types, according to their habits. The roadside grasshopper (*Camnula pellucida*) is one type. This made its appearance first, and was found making its way into the edges of the grain fields from roadsides, lanes, headlands, fence rows, etc., where the egg beds were concentrated. The second type includes the lesser migratory grasshopper *(Melanoplus atlanis)*, the two-striped grasshopper *(Melanoplus bivittatus)*, and the red-legged grasshopper *(Melanoplus femur-rubrum)*. The adults of these three species oviposit in cultivated fields; consequently, their attack was scattered through the grain fields and frequently was not noticed as quickly as that of the roadside grasshopper. Wheat, oats, rye, barley, etc., were attacked. The grasshoppers were found most abundant in the older settled areas of the Province, although isolated outbreaks occurred in the newer parts.

The control measures promptly undertaken by the Provincial Government saved the farmers millions of

dollars worth of crop during the outbreak. In 1920, when the grasshoppers were most numerous, it is estimated that over $17,000,000 worth of crop was saved in that year alone. To this amount must be added the value of the crops saved during the other years of the outbreak.

The whole infested area was completely organized by the Provincial Government, and mixing stations were established in towns in the midst of the area infested. At these stations the baits were mixed, and then taken out to the farms by the farmers as required. The Kansas bait was first used, but this ultimately gave

of well mixed bait, mixing machines were devised. The type that met with greatest favour was operated by a gasoline engine, and had a capacity of several tons daily. The drum of the machine remained stationary when the machine was in operation, and the mixing was done by stirring rods which revolved within the drum. These machines were made locally from pieces of old machinery, and played an important part in the campaign against the grasshoppers.

All egg beds and land infested with egg pods should be deeply ploughed to bury the eggs so far down that hatching will not take place. Plough-

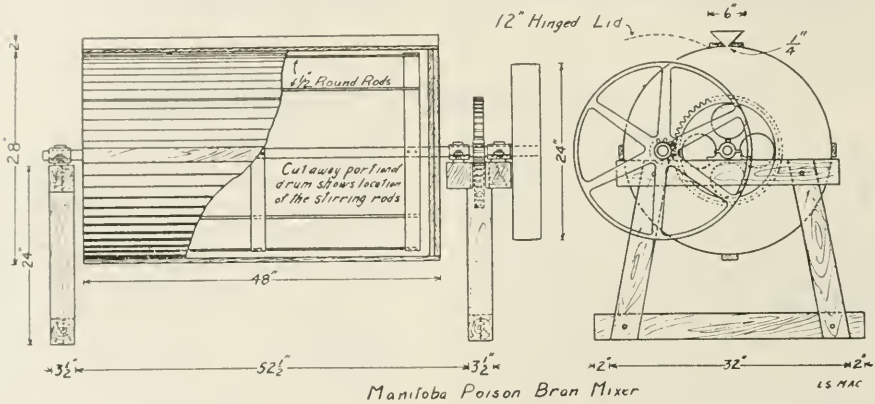

Fig. 1. Line Drawing of the Manitoba Grasshopper Poison Mixer. The left half of the picture shows the broadside view; the right half the end view.

way to a less expensive bait recommended by Mr. Norman Criddle, in charge of the Dominion Entomological Laboratory at Treesbank, Manitoba. In this bait common salt replaced the attractants used in the Kansas mixture. The bait now used in Manitoba contains:—

Bran—50 pounds.
Sawdust—Bulk equal to bran.
Salt—5 to 6 pounds.
White arsenic—5 pounds.
Water—Sufficient to moisten.

Early in the work it was found that hand mixing of baits was too slow to handle the volume needed. To cope with the demand for large quantities

ing should be done in the fall, if possible. If done in the spring, the land should be well packed immediately.

Parasites in the form of bee-flies, etc., are playing an important part in the natural control of grasshoppers at the present time.

Western Wheat-stem Saw-fly

The western wheat-stem saw-fly *(Cephus cinctus)* is also a native insect. Before it began to make its home in wheat, it lived in the native grasses that bore hollow flowering stems large enough to accommodate the larvæ. When this insect first began to invade the crop, it attacked the

grain along the edges of the fields. Now, the grain in the middle of the fields is as badly infested as that at the edges. About 12,000 square miles of the southern and western part of the Province is under attack, and the loss in 1921 was estimated at between three and four million bushels of wheat. Spring wheat, including durum, and spring rye are the only grain crops that have suffered from this insect to date. Fall rye, oats and barley have escaped serious injury.

The western wheat-stem saw-fly has only one brood per year. The adults appear during the latter part of June and early July, and the females lay their eggs near the top joints of the plants which have not yet come into head. These eggs are placed within the cavity of the stem. When the saw-flies are abundant, several eggs may be placed within one stem, and although these eggs may hatch, strange to say, only one mature larva can be found within a stem by the time the grain is ripe. As the larvæ grow, they work downward within the stem, and by the time the grain is ripe, have reached a place about even with the surface of the ground. Upon arriving at this point they chew a V-shaped groove around the inside of the stem. The weakened straw breaks off readily with the wind and the heads are lost. The larvæ winter over in the stubs beneath the surface of the ground. Pupation takes place in late May within the winter quarters, and the adults emerge as stated above.

Fig. 2. An average area in a field of wheat infested with Western Wheat-stem Saw-fly, showing bent and broken stems.

Crop loss is almost entirely confined to those stems that break off before the crop is cut. Samples taken from numerous fields in 1921 and 1922 in various parts of the province showed that the presence of the larva within the stem did not seriously affect the yield and quality of the kernels in the heads. This held true for both Marquis and durum wheat. Farmers who have infested fields are urged to begin cutting early so that

they may be able to finish, if possible, before the crop gets dead ripe, at which time the infested stems fall very badly. This recommendation does not control the insect, but enables the farmer to save at least some of the infested grain.

Co-operative efforts are essential to the successful control of this insect. Just how far the adults will fly, is not known, but it is common knowledge that they will fly across large fields. Experiments have shown that although this insect will emerge through a few inches of soil, very few adults can get up through six inches of earth. Farmers are therefore recommended to plough infested fields in the autumn, burying the stubble six inches deep. We strongly urge the use of the skimmer on the plough. This buries practically all of the stubble deep in the ground. A rotation of crops should be practised, and in the badly infested area no crop should be stubbled in on a field that grew wheat or spring rye the previous year.

The natural parasites of the western wheat-stem saw-fly have not yet been able to attack it in grain, although they do attack it in the native grasses. Whether or not they will ultimately learn to attack it in its comparatively new environment remains to be seen.

The Hessian-fly

The Hessian-fly (*Phytophaga destructor*), unlike the previous insects, is not a native insect. The first outbreak of any importance recorded for western Canada was in 1899. Again, in 1902, another attack was experienced. Little further injury was observed until 1922, when an area north of the main line of the Canadian Pacific Railway and south of the Riding Mountains was found to be lightly infested. While the wheat-stem saw-fly thrives best in dry areas and years, the Hessian-fly does most damage in areas where more moisture is to be found.

In Manitoba, under favourable conditions, there is one full brood and a partial second brood per year. It is the partial second brood that does the damage frequently attributed to hail. The adult is a small two-winged fly whose maggots, unlike the sawfly larvæ, feed upon the outside of the plant. These maggots, by their feeding habits, weaken the stems near the upper joints. The maggots pupate at these feeding points, the pupæ being called "flax-seeds." The weakened condition of the straw allows the stems to crinkle over. Heads bent over in this way are lost when the field is cut.

The usual recommendations with regard to burning stubble, burning straw piles and destroying screenings are suggested. If carried out, these practices will destroy the "flax-seeds" of the partial second generation. The "flax-seeds" of that portion of the first generation which does not produce adults the same season are found around the bases of the plants where the first brood pupates. These can be destroyed only by deep ploughing. Here, also, the skimmer should be used to make sure that the stubbles are all deeply buried.

On occasion, other insects such as cutworms, white grubs, wireworms, aphis, etc., have done some damage to field crops. Of these, probably cutworms of various species have done and may be expected to do the most damage in future. Fortunately the pale western cutworm has not yet done any harm in Manitoba.

DAIRYING IN SASKATCHEWAN

By PROFESSOR A. E. POTTS, Professor of Dairying, University of Saskatchewan

THE dairy industry in the province of Saskatchewan, still in its infancy, has been showing a steady growth for several years. It has grown in spite of the fact that the dairy cow has not been very popular with the majority of farmers who in many cases came out West with the definite object of getting away from the ties and "chores" that are the necessary adjuncts to a dairy farm. It is much more popular to grow cash grain crops, and on many farms the cow has been and still is conspicuous by her absence. Nature has rebelled, however, and has already shown in many ways that grain crops alone cannot be grown continuously without bringing a load of troubles on the head of the "grain miner." The result has been a gradual change to a more diversified type of farming. This change is being made not from choice but from necessity. The keeping of live stock has increased, and because, in recent years, the dairy cow has proved the most profitable form of live stock to keep, she is rapidly gaining in favour.

An idea of the rapidity of the growth of the industry can be gained by comparing the output of creamery butter in Saskatchewan in the past year (1922) with that produced in twelve months ten years ago. In 1912 the total production was reported as 1,009,604 pounds compared with 8,901,105 pounds in 1922, an increase of 78 per cent in ten years. If we look still further back, we find that ten years previous the production was almost nil. Notwithstanding this rapid growth, the industry is still very small for a province that has 94,000,000 acres of land capable of cultivation, and the possibilities of increase are very great. This very newness has had the effect of placing the industry on a good and solid foundation, since it has been possible to control and direct development along sound lines. The result is that now, although still being far behind in volume of production, Saskatchewan along with the other prairie provinces, leads the Dominion in methods and in the quality and uniformity of the butter produced.

Where an industry has been established for a long time and where the procedure has become set and uniform, it is difficult, when changes are found necessary, to make the required adjustments in equipment and methods. The creameryman starting in the West has not been confronted with this difficulty, and has been able to start with a clear field. It has therefore been much easier under these conditions to start the new creameries operating on a proper basis, and to ensure that they continue to develop on approved lines, making use of all the knowledge that has been already gained in other parts. The results of this are very apparent and striking, and many problems, still very acute and hard to solve in the older provinces, have hardly existed in the West, or, if they have, their solution has been much simpler.

Consider for example the question of the pasteurization of cream for buttermaking. The value of this has been proved beyond dispute, and the practice is by no means universal in the Dominion. It is costly and sometimes difficult to change an old plant over so that it may be equipped to pasteurize cream for churning. This is particularly true with plants where the "make" is small and often not sufficient to carry the necessary increase in overhead charges. Because of this and other minor reasons such as conservatism,

the change is slow and difficult to make. In Saskatchewan this problem does not exist as all creameries are equipped for pasteurization and no raw butter is made. This one factor in itself is a great help to the butter trade since it ensures that only one kind of creamery butter is made, namely "pasteurized." This is the first and a very important step towards uniformity of quality, which is an absolute essential if the product is to be marketed profitably.

Again, wherever butter is made from gathered cream, and this applies to most parts of Canada and the United States, the quality of the cream sent in by the farmers presents an ever-present problem, since the quality of the final product is absolutely dependent on that of the raw material. There is, therefore, a constant endeavour to raise the standard of cream shipments. All creamerymen recognize that cream of a high quality has a greater cash value to them than the lower grade article, and they are all willing and anxious to recognize this extra value by paying more for it, so as to encourage farmers to ship cream of the highest quality.

This sounds very logical and simple but it is a difficult matter to put into practice. If an individual plant starts to pay for cream on the quality basis, the result will simply be a loss in business since the patron who is given the lower grade will immediately send his cream elsewhere. Several attempts have been made by groups of creamerymen to work on a "gentlemen's agreement," but this system has never proved entirely satisfactory, and in some cases the results have been almost disastrous for the operators who have lived up strictly to their agreements.

A solution has already been found for this problem in the West. At the request of the parties concerned, the operators, the producers and the Provincial Governments of Alberta, Saskatchewan and Manitoba have passed legislation requiring that all cream bought for butter making shall be paid for on grade according to fixed standards, and on May 1 of this year, official government graders were located at the butter-making plants in the three provinces to enforce these regulations.

The new system will undoubtedly have far-reaching effects and will do much to stabilize the industry. The producer will ship with more confidence, knowing that his cream is being graded by a third party who is disinterested, and a great source of discontent will thus be removed. The creameryman will know that he can pay more for a good article and less for a poor one without risk of losing his business, and the result of these two factors will be that the grade of cream shipped will undoubtedly improve, with a resulting improvement in the quality of butter manufactured. This in turn will react on the price obtained on the market, which will mean, in short, that the returns will be greater both to the producer and to the manufacturer. It is believed that this increase will more than offset the cost of operating the grading service.

Although this development and progress have been made possible by the newness and relative smallness of the industry, they have not arisen spontaneously, but have been to a very considerable extent the result of careful direction by the various agencies whose business it has been to help and foster dairying.

A factor that has contributed much in gaining these ends has been the establishment of the Provincial Butter Grading System, conducted by the Dairy Branch. The usefulness of this service is proved by the fact that it is taken advantage of to such a great extent by the manufacturers of the province. Although the grad-

ing of butter is quite voluntary, over 90 per cent of the total creamery butter made in Saskatchewan in 1922 was graded by provincial graders. An important point in this connection is that no grade certificates of any kind are given on a sample of butter made from unpasteurized cream, and all samples are carefully checked by the Storch test before certificates are issued. The result, as already mentioned, is that practically no raw creamery butter is made in the province. It should be noted that in the recent Dominion legislation, which made compulsory the grading of all butter for export, it was not possible to insist on all samples being pasteurized since it was considered that this would impose hardship on the many plants in the East which are not yet equipped for the purpose.

In addition to this service, the dairy branch makes its influence felt in the province through the medium of field men—amongst whom are included promoters of cow-testing associations—by assisting the Provincial Dairy Association, and also through the head office, which, in addition to handling its ordinary routine work, acts as a central information bureau, collecting and broadcasting all useful information on dairy topics as soon as it comes to hand.

At the Dairy Department of the Provincial University at Saskatoon the policy has been to work hand in hand with the Dairy Branch at Regina, with the same objects in view, namely, to promote a steady and stable increase in the dairy production of the province. Special attention is given to economy of production, to the emphasizing of the necessity for producing a raw material of high quality, and to teaching the best methods of doing this, to the end that the final products reaching the market will be of the highest grade possible.

The work at the University Dairy Department is divided into three phases—instruction, extension, and experiment.

With regard to the first of these, the Department is well equipped to give instruction, both practical and theoretical, on the care, handling and testing of dairy products, cheesemaking and buttermaking under farm or factory conditions. Up to the present, not much time has been devoted to the training of dairy specialists, although the demand for this is growing. More time is given to instruction of a more general nature.

All students in agriculture take at least one full course in dairying. This course goes into the subject as far as the time available permits, and aims to give the students a general understanding of the field of dairying.

The Department conducts extension work through the medium of correspondence and extension lectures. Large numbers of people are reached annually in this way.

As to experimental work, the problems of greatest interest in the province at this time are chiefly those related to the manufacture of butter, since this is the only form of dairy produce exported to any extent. Cheese is made only in very limited quantity and is therefore of little importance as yet. In view of this situation the Department has been engaged during the last two summers in conducting experimental work on buttermaking problems. These have dealt chiefly with factors affecting the keeping quality in storage.

Perhaps one of the healthiest signs is the strong spirit of co-operation existing between producers and manufacturers. This finds a prac-

tical outlet in the Provincial Dairy Association, an organization serving the interests of both parties conjointly. This is as it should be, since it is obvious that all problems are mutual, and that the welfare of the producer and the manufacturer are entirely interdependent.

The great event of the Association's year is the annual convention. It has been the policy of the directors to promote impromptu discussion rather than to prepare an elaborate programme of set speeches. As a result, these conventions have been very successful, and much useful and practical discussion on present day problems has taken place.

Of the many useful competitions being conducted two may be singled out as being particularly important. A Greater Average Production competition is conducted to encourage the work of cow-testing. Interest in this work is growing very rapidly, and some at least of this increase may be justly credited to this competition. However, the most important work being done by the Association is that in connection with the boys and girls. Boys' and Girls' Judging Competitions are held annually and are very popular. The breeders of the province have been very generous in donating prizes in the form of pure-bred young dairy stock. At the convention held in February of this year, the tangible results of this were shown when three young girls and one boy, who had taken part in the competitions, gave short talks and demonstrated to their elders that they had a clear and sound outlook on the question of dairying, and that they appreciated the value of a good dairy cow.

With an industry in such a healthy condition, with a spirit of co-operation and mutual confidence existing between producer and manufacturer, and with a younger generation showing such keen interest and promise, there is little room for doubt about the future of dairying in Saskatchewan.

ONTARIO'S BETTER LIVE STOCK TRAIN

By L. STEVENSON, Secretary and Supervising Director, Department of Agriculture

THE Ontario Better Live Stock Train of 1923 was organized by the officials of the Live Stock Branch of the Ontario Department of Agriculture, assisted by the officials of the following organizations: Dominion Department of Agriculture, Industrial and Development Council of Meat Packers, Ontario Live Stock Association, the Canadian Pacific Railway, and the Canadian National Railway.

The train was made up of sixteen cars, eleven of which carried live stock for demonstration and sale. A lecture car and staff maintenance cars completed the train.

During March the train made twenty-one all-day stops (9 a.m. to 10 p.m.) and twelve half-day stops. During April, twenty-one all-day stops and four half-day stops were made. The total number of actual farmers visiting the train during the period was 37,600. The number of school children that were conducted through the train by officials and teachers was 6,500. Lecturers, demonstrators and salesmen were continuously on duty in the various cars, and dealt with the varied inquiries of the visitors.

Educational Features

The swine cars were specially fitted to make demonstrations in swine grading possible, and give the farmers throughout the province a

clear idea of the type and conformation required for the different grades of hogs under the new grading regulations. Representative hogs, with the corresponding cured Wiltshire sides, were used in this demonstration. For the convenience of farmers desirous of purchasing young breeding stock of the bacon producing type, a carload of boars and sows from six to eight months of age was included in the train. Many sales were made, and good type young breeding stock left the train for new homes at every stop. The supply of stock was replenished at various points along the line of travel by previous arrangement.

Poultry Keeping

The poultry car was fitted out to demonstrate the most approved methods of selecting, feeding, housing and preparing poultry and poultry products for market. In the exhibit were included live birds showing desirable types for egg production and also those for meat production. Culling demonstrations were given throughout the day, being illustrated with living specimens and skeletons. Models of poultry houses and equipment, and of hatching and brooding devices, occupied a prominent position in the exhibit. Poultry nutrition was illustrated in an attractive way through the use of coloured transparencies, giving rations used in chick rearing and the results. The Canadian Egg Standard was well illustrated by a continuous candling and grading demonstration. Killing and plucking, as done by the expert in charge was a revelation to many, as the loosened feathers were stripped from the bird in the short space of one minute.

Dairying

The dairy cow car contained good grade cows, representing the Holstein, Jersey, Ayrshire and Shorthorn breeds. These animals were selected to show the influence of pure bred bulls, and demonstrate the high degree of excellence that may be obtained by careful breeding. Demonstrations and lectures were given on these cows, with special emphasis on type and conformation as associated with high class cattle. Ayrshire, Holstein, Jersey, and Gurnsey bulls were offered for sale at cost. These bulls were selected for their excellence of type and the production of ancestry. A number of young bulls were sold at the various stops. A dairy lecture was given each afternoon in the lecture car, dealing with feeds, herd improvement, and the rearing of young stock.

Sheep and Wool

In the sheep and wool car, a very attractive exhibit was presented, prepared by the Provincial live stock men, co-operating with the wool growers, the breeders and the woollen mills. Typical fleeces of the principal grades of Canadian wool were shown and used in demonstrating the various grades, classes and purposes for which each was used. The preparation of wool for market was strongly emphasized. Samples of cloth, knitted goods, blankets, and yarn made from Canadian wool by Canadian mills, were shown and described. A number of live sheep were carried and suitably displayed, emphasizing the best breed types and market classes. Lectures were given on breeds, breeding, judging, and the care and management of the flock. Two pens, one showing the progeny of a good type pure bred ram and another showing the progeny of a grade ram, attracted considerable interest through the lesson of superior lambs from the pure bred shire. A full line of shepherd's tools and sheep-fold requirements was shown, and explanations or demonstrations in the use of same were given by the officials in charge.

Beef Cattle

The beef cattle exhibit consisted of a display of steers illustrating market grades and type improvement through the use of pure bred sires. The Ontario Agricultural College supplied a number of animals from a breeding experiment that has been under way during the past two years, so that the farmers of the Province could see for themselves the result of good breeding, coupled with proper care, feeding and management. From the five cars of bulls for sale, many sales were made. Buyers were looking for quality, and appreciated the guarantee and the likelihood of getting a good bull when purchasing from the government. To indicate the type of farmer that the lessons taught by the train was reaching, it can be said that, out of the first fifteen bulls sold, all but one went to farms where the owner had not previously kept a pure bred sire.

The demonstration train attracted and enlightened farmers who hitherto had been disinclined to admit the advantages of pure bred sires and of better live stock.

COW-TESTING RESULTS IN BRITISH COLUMBIA

By G. H. THORNBERY, Assistant in Charge

IT is now eight years since the first three Cow-Testing Associations were organized in the province of British Columbia for the purpose of helping the farmer to increase the average production of his herd through intelligent methods of breeding, feeding and weeding.

The results of this work, as shown in the accompanying table, clearly illustrate what has been accomplished by members of testing associations in different parts of the province. The average herd of 10 cows on test to-day is yielding as much milk and fat as 12 cows were yielding eight years ago. It should be remembered that this is an average, as many herds show a much larger increase.

SUMMARY OF RESULTS OF EIGHT YEARS' COW-TESTING, 1915 to 1922

Average Yield of All Cows Reported

Year	Lbs. Milk	Average per cent Fat	Lbs. Fat
1915	6,517	4·07	265·2
1922	7,073	4·47	316·0
Increase	556	0·4	50·8

When it is remembered that the approximate annual yield of the average cow in this province is 4,500 pounds of milk containing 160 pounds of butter fat, the value of cow-testing work to all dairymen that are taking advantage of it can be readily appreciated. To briefly illustrate:—

To produce one ton of butter in one year, 11 average British Columbia cows would be required, whereas only six average cows in the testing associations would be necessary. This means a direct saving of the maintenance rations of five cows for 365 days, or of 1,825 days' maintenance for one cow, as well as avoiding the labour involved in milking five cows twice a day for 10 months, or a total of 3,000 milkings.

The average dairy farmer with the average cow of the province requires nearly twice as many cows to produce a stated amount of butter in a given time as the dairyman who is a member of a cow-testing association.

Records of production of about 2,000 cows are being kept by the five

associations now in operation. These are situated at Chilliwack, Comox, Langley-Surrey, Kelowna-Vernon, and Richmond-Ladner. Owing to an unfortunate lapse in testing operations in the Richmond district during the early part of 1922, no complete reports have been received from that association for the past year.

The results of the work of the other associations for the year 1922 are here given:—

Chilliwack Cow-Testing Association

Breed	Average Lbs. Milk	Average % Fat	Average Lbs. Fat
Jersey	6,554	5·37	351·8
Ayrshire	7,113	4·39	312·7
Holstein	8,737	3·7	324·0
Guernsey	6,841	4·4	301·6
Shorthorn	8,179	3·76	308·0
Average	7,332	4·38	321·4

Comox Valley Cow-Testing Association

Breed	Average Lbs. Milk	Average % Fat	Average Lbs. Fat
Jersey	5,942	5·29	314·3
Holstein (1)	7,032	4·96	348·8
Ayrshire	4,958	5·01	248·5
Shorthorn	6,287	4·62	290·8
Average	5,942	5,27	313·5

Langley-Surrey Cow-Testing Association

Breed	Average Lbs. Milk	Average % Fat	Average Lbs. Fat
Ayrshire	5,152	4·04	208·2
Shorthorn	6,239	4·14	258·5
Guernsey	8,127	4·45	362·3
Jersey	5,283	5·01	264·6
Holstein	8,340	3·53	295·0
Average	7,639	3·75	287·0

Okanagan Cow-Testing Association

Breed	Average Lbs. Milk	Average % Fat	Average Lbs. Fat
Guernsey	9,329	4·67	464·1
Ayrshire	9,042	4·27	385·4
Shorthorn	5,805	4·49	260·8
Jersey	6,152	5·47	336·7
Holstein	9,510	3·71	346·3
Average	8,724	4·05	353·6

PART III

Agricultural Education and Related Activities

AGRICULTURAL INSTRUCTION IN SECONDARY SCHOOLS

By J. W. GIBSON, M.A., Director of Elementary Agricultural Education, British Columbia

SECONDARY schools may be regarded generally as being intermediate between the public schools and the college or university. They are represented in Canada chiefly by our High Schools and Collegiate Institutes.

From the very beginning these secondary schools have functioned as preparatory schools either for those entering the university or for those about to enter the Normal School in order to complete their training as teachers. Hitherto they have given but little attention to the training of "teen-age" boys and girls whose plans take them neither into the university nor into the teaching profession. It is true that in recent years secondary school courses have been considerably broadened by the introduction of commercial courses, courses in household economics and also in agriculture. Such courses have been long overdue in our Canadian High School and this fact accounts in some measure for the establishing of special schools in which the courses offered have a more definite bearing upon the industrial life of the people. We have now, for example, in many of our cities what have been termed technical schools and also, in a few of the largest cities, certain kinds of trade schools which are more strictly vocational in their character. Similarly, instruction in agriculture below college grade is now being offered in special vocational schools of agriculture here and there in Canada.

There exists in the minds of many people some misconception as to the nature and purpose of high school courses in agriculture. So many people regard the study of agriculture in one light only, viz., as a desirable preparation for intending farmers, fruit-growers, dairymen, etc. Quite naturally they view with a certain amount of suspicion and distrust the teaching of agriculture in the ordinary High School, and are too ready to criticize it as ineffective and superfluous. They do not believe that high school boys will ever become farmers anyway, agriculture or no agriculture. This is the attitude of mind that one finds predominant throughout Canada forty or fifty years ago, and which still persists to a degree.

Nevertheless, the number of level-headed farmers in Canada who believe that a good education is as essential to a good farmer as it is to a good anybody-else has grown apace, and not many will now be found who would support the view recently expressed by a young druggist in a mining town who with great assurance stated that farmers' sons and daughters were getting "too much education". Perhaps they have been getting too much—of a kind—that kind for instance which he and others of his professional (?) stripe have been receiving for the last half century,

and which farmers have largely been called upon to pay for. No, if there is one occupation under the sun which calls for men of highly trained intelligence, skill and personal qualities of a high order it is farming.

But it is a mistake to assume that agricultural instruction is desirable for farmers or intending farmers only. Many of our merchants, bankers and professional men who have, at some time, availed themselves of the opportunity of studying agriculture in secondary schools and colleges can readily testify as to the value of such study, even as part of a good, sound general education. Indeed, it would be difficult to find another field of study that possesses so much of intimate and genuine interest for the masses of the people, whether living in the city or in the country, as does the study of agriculture. It includes all the experimental and biologic sciences and gives them their daily application in the intricate processes of food production. Its study tends to make things which had been accepted as commonplace, uncommon by virtue of the new light shed upon them. Its study well repays the economist, the publicist and the statesman. Teachers above all, and preachers also, should be close students of agriculture. Indeed, our own national prosperity depends in no small degree upon it.

If the study of Agriculture, therefore, in its broadest sense, is to be brought within the reach of the masses of our young people and is to have the free scope which its importance educationally as well as vocationally warrants, it must be given a more prominent place in our present High Schools as these schools are, for years to come, the only ones which can hope to reach the masses of "teen-age" boys and girls throughout the country. It is not too much to hope for, and even to insist upon, that all high schools should have a science and agriculture department. The narrow and erroneous view that the study of agriculture is something that should concern rural schools only has already been effectively answered in practice. Two of the most successful classes in agriculture in the Province of British Columbia are to be found in the High Schools in the cities of Victoria and New Westminster, and no doubt there are other provinces where similar cases could be cited. Indeed there are very good reasons for encouraging the study of agriculture by boys and girls in our city schools. Be that as it may, there can be no doubt as to the wisdom of establishing courses in Agriculture in all high schools that draw students from agricultural districts, and obviously that is the first point of attack.

It will not do to assume either that students in high school who choose agriculture as one of their options do not intend continuing their studies in the University. All the really enlightened and up-to-date universities in Canada have already made Agriculture a subject for matriculation (other universities please take note!). There is ample evidence in western universities at the present time to show that students who were given the opportunity to offer agriculture for matriculation and who have continued their studies in the faculties of Arts and Science or Agriculture are by no means the lame or maimed or halt or blind members of the undergraduate flock. Speaking generally, these students exhibit certain qualities of resourcefulness and breadth of understanding not to be met with in the average high school graduate—and there is a reason.

It is not sufficient either that High School courses in Agriculture should be pre-eminently educational and nothing more. I shall speak now of my own province and say that they are also eminently practical. So many people, many of whom should know better, regard "practical" as the

equivalent of "vocational" when speaking of agricultural instruction. It depends largely on the method of instruction followed as to whether a subject is of any "practical" value no matter what that subject may be. The book method of teaching agriculture has long since been discredited. The pity is that such a method ever existed. The failures of the past, and they have been many, in the teaching of agriculture from a prescribed text-book have helped to delay the real teaching of the subject by at least half a century. It need hardly be mentioned here that the direct method of instruction whereby first-hand knowledge is gained through experiments in laboratory, field and garden and where the project method is followed is the only method that can meet the needs of the situation. A glance at any of the examination papers in agriculture set for high school students would clearly indicate that the instruction given in these schools if successful at all from the standpoint of the promotion of the students must be practical.

The American schools at the present time are making much of the term "vocational agriculture" as the funds provided by the federal government of the United States under the Smith-Hughes Act are for the teaching of "vocational agriculture". It is a matter of common observation that instruction in Agriculture in many of the American schools although professedly "vocational" has really less vocational value and content than that given in most of our Canadian High Schools where the main purpose is not vocational at all.

There are about half a dozen or more special Schools of Agriculture in Canada at the present time. Perhaps they might better be termed junior colleges of agriculture as they aim to do substantially the work of the freshman and sophomore years of the faculty of agriculture. Without doubt these schools are giving excellent courses to their regular students, the young men and women who attend them for about five months in the year, and they also perform a valuable service in providing during the winter months short courses in agriculture for farmers of the district, but they would seem to be hampered by the same limiting factors that our regular agricultural colleges have experienced. The initial outlay in land, improvements, buildings, stock, etc., is excessive, and the maintenance costs for instructors and general upkeep is also high. The great majority of the students attending these schools have to leave home for the five months and have to meet living expenses as if at college. These circumstances do not detract from the value of the work done in these special schools or junior colleges of agriculture, but they do militate against their wide adoption. Many a bright and capable boy who would profit by such a course of training cannot be spared from home for such a long period, and not infrequently the parents can ill afford to spend the necessary money to send him. It would seem, therefore, that valuable as these special schools may be they cannot hope to provide agricultural instruction for the masses of the people. In the richest and most highly developed agricultural districts a limited number of these special schools of agriculture might be established and successfully maintained, but for one such school that might be so established there are already established and at hand a dozen high schools that need to be maintained in any case. Why then should we in Canada not make a better and wider use of these already-established secondary or high schools by adding to the staff of each a specially qualified instructor in agriculture, and offering to the boys and girls attending a thoroughly practical as

well as a broadly educational high school course? Too long and with too great cause has our system of higher schools been stigmatized as out of touch with the life and needs of the people, and especially of the rural people. The wishes of the people who support these schools are daily becoming more articulate, and the demand for a system of secondary schools that have something of real value to offer to the boys and girls of industrial and agricultural communities, other than that too vague and undefined thing called "a good general education," will soon become too insistent to remain unheeded. Special schools of agriculture and trade schools can scarcely meet the situation. Whilst they will claim their hundreds and will do excellent work of a special agricultural and industrial character, our regular high schools will claim their thousands, and with the proper adjustment of their curricula, will combine the cultural and humanistic in education with the industrial and the practical, which to many may also incidentally become the vocational.

It is also to be hoped that in addition to the courses in our High Schools just referred to where agriculture is included as one of the options either for matriculation or for teachers' courses, there will also be established winter term courses for boys and girls of high school age who are not in regular attendance. Such courses might run for four or five months and would be specially organized to suit the needs and the interests of these young people. The local high school and its complete equipment would be made available for the carrying on of these winter term courses and the regular High School staff aided by one or more special instructors, as required, would handle the work. Indeed these courses would soon become a strong feature in the service of the high school in much the same way that summer sessions have been established by our universities. The time has passed when High Schools can be regarded as existing only for those young people who have attained to certain arbitrary standards in connection with the elementary school course. They should be and must be open to all young men and women within certain limits of age and mental ability who wish to, or who can be induced to attend even for a short period during the year. To some extent in all high schools, but more especially in the rural high schools, suitable courses in agriculture and domestic science would be provided for regular students as well as for winter term students and as a result our high schools would become "the people's schools" in a manner and to a degree hitherto unknown.

AGRICULTURE IN HIGH SCHOOLS, ONTARIO

By Dr. J. B. DANDENO, Inspector Elementary Agricultural Classes

THE chief object in view of introducing and establishing classes in Agriculture in High Schools in Ontario is to provide a broader education more intimately associated with the welfare of the individual, his family and his country. This statement is intended to imply that High School education of ten or twenty years ago was narrow, because too directly connected with events, opinions, and dealings of the past, and not enough with matters having to do with the immediate environment of the individual. That sort of education of ten or twenty years ago, had its roots in the middle ages when language by written signs was the ad-

miration and the wonder of the people, and in control of a very few. These few soon realized the tremendous advantage this situation would be to them if it could be continued and consequently centres were established to which those who became skilled in written language were attracted—such centres as Greece and Rome. Oxford and Cambridge in England in early days were similar centres where Greek, (perhaps Latin) constituted the whole curriculum. Of course a knowledge of the written language provided a means of acquiring some acquaintance with the thoughts, habits and ideals of people of earlier times. We have this academic education with us yet, though it has been improved and advanced immensely by the addition of Mathematics, Art and Science. These have been introduced very slowly, only a little at a time,—opposition by those skilled in Greek or Latin being difficult to overcome. It took hundreds of years to secure any recognition for Science as a subject worthy of a place on the curriculum. Mathematics were made use of much earlier, but it was always regarded as of little or no application to the walks of life. It was made as inapplicable as possible. The "savants" could "corner the market" more thoroughly and keep education within the cloister and monastery, only in case the scheme of education was kept as far as possible away from the practical.

These things are mentioned because, to a large extent, our present High School education is influenced by Greek and Latin language and history, and people have so long been led to believe that these things and only these can properly be called education, that a subject such as Agriculture is not regarded as worthy of a place beside these subjects.

The aim is, therefore, to introduce Agriculture to the High School Course of Study, claiming that it has educational value, no less suitable than several other subjects, for the purpose of developing an individual and creating in him a power to think, and to appreciate his environment. Elementary Science has already paved the way to a very great extent, but the High School buildings, ground and equipment have never been provided with any other end in view than that book education—education through printed language, is the only education fostered by the school. But this difficulty is relatively unimportant as compared with the attitude of people, of Boards, and of Teachers.

The aim is not to make Agriculturists by teaching Agriculture, but rather to educate them by means of fundamental things, agricultural things—the raw material of food and clothing.

Is it less educative to handle, experiment with and think about soil than to think about and study over an ablative case in Latin or a battle in ancient Greece? In fact, because of the close connection between the individual and the soil it can be even more educative. This is the aim,—to introduce a subject more closely related to the experience of the individual, whether the individual ever becomes an Agriculturist or not, though there is little doubt that, educated in this broader way he will be more likely to make his living on the farm than if taught Grammar, Literature and Mathematics exclusively. It must not be forgotten that it is during the High School period that aptitudes are developed, habits formed and tastes are acquired. The aim is educative rather than vocational.

Policy Pursued

The policy to be undertaken must be developed with a view towards overcoming the difficulties—especially those outlined in the preceding paragraph. The very first thing to accomplish is to secure teachers, not only with some knowledge of Elem-

entary Agriculture, but also with some sympathy for the subject itself. If we had fairly good teachers we are reasonably sure of success, if an opportunity is given to carry on in a High School.

In order to secure an opportunity to introduce the subject into a High School an inducement is offered to the Board by way of a legislative grant, to repay the Board for expenditure made. The teacher also receives a grant in money depending on the extent to which classes in Agriculture are carried on in the school in which he is teaching.

Provision is made whereby a teacher may prepare himself to teach Agriculture,—(1) by taking the Summer Session now offered at the O.A.C., two sessions of five weeks each being required in order to complete the course; (2) A graduate of the O.A.C. may also qualify himself to teach Agriculture (and other subjects) in a High School by attending the College of Education for one year. To be admitted to the College of Education such graduate must have, in addition to his O.A.C. course, the standing of Honour Matriculation.

Up to the present very few teachers have qualified under either method, and, until a supply of teachers is secured, progress will be slow.

With respect to the course of study in High Schools, a step in advance has recently been made whereby Agriculture may be taken as an option with Elementary Science throughout the Lower and the Middle Schools. But, owing to the lack of teachers and to the general antipathy to the subject itself on behalf of teachers and others, progress has been slow.

The policy is to encourage by a gradual process of education rather than by regulation.

Method of Treatment

In order to teach Agriculture in High Schools it is necessary to have some general understanding with respect to the scope and nature of the work to be carried on under the heading "Agriculture." A common notion, especially among farmers, is that agriculture, and farming are synonymous terms, and they reach the conclusion that if farming is to be taught, there must be a farm on which to work. Some modification of this view is necessary, and the conclusion now reached is that agriculture and farming are two subjects,—agriculture dealing with the sciences directly connected with it and "farming" concerned with the actual operations involved in making a living on a farm. This distinction is recognized as a basis on which to arrange a course of study. This being the case, laboratory, and plot, neighbouring institutions such as a dairy farm, a poultry plant, a fruit orchard and the like, are the bases of accommodation for carrying on such work.

As the work of such a course of study is a part of the regular school work of the High School pupil, it is incorporated into his system at a time when lifelong impressions are made. It becomes a part of the scheme of thought of the pupil and, whether he, or she, finds it advisable or necessary to live in the country, the knowledge gained and the impressions received will have a lasting influence.

In order to secure a suitable type of work for the pupils, no text book is prescribed. The course of study is to be carried on by means of individual laboratory work with instruction by the teacher and by the aid of reference books and other publications. There is always a danger when there is a regularly prescribed text book. The work has a tendency

to be made book work, omitting much that should be taken.

It will thus be seen that Agriculture, as indicated in this method, is not vocational, though it is expected that, as time goes on, courses much stronger in Agriculture can be given. This will not happen, however, until we have in our High Schools some principals and assistant teachers holding the degree of B.S.A. But all of this takes time.

To show one of the changes coming to pass in the High Schools and Collegiate Institutes during the past twenty years, it might be worth while to point out the change of viewpoint of the people with respect to the teaching of Science. In 1893 eight per cent of all the Principals of High Schools and Collegiate Institutes, who were Specialists, were Specialists in Science, and in 1921, twenty-six per cent.

Progress and Development

All educational movements which are worth while, are necessarily slow. Agricultural education is no exception. Looking back over the past twenty-five years and noting the steady and pronounced development in the teaching of science in High Schools, we have a right to feel a certain degree of encouragement. Progress has not been rapid for the reasons previously indicated, but very important changes have been going on underneath the surface as it were, with respect to the attitude of the people concerned, and with respect to the content of the work possible in a High School.

On account of the tremendous breadth of the field covered by the term agriculture, it is not surprising to see that there is a great variety of opinions about the subject and its possible place on any course of study. Some people contend that it is not a suitable subject for a High School pupil, while others contend that Agriculture is really not a subject at all, but a list of subjects. Still others, more particularly men of the city, express the idea that even if agriculture were a subject suitable for a High School course, only those connected with the farm should take that subject, or, to put it in another way—agriculture is only for those brought up on a farm. Even among educationists it is not uncommon to find those who assert that, even assuming Agriculture to be a suitable study for boys and young men, it should be carried on in special schools —agricultural schools. This view has had the strongest backing of all. In fact it has been acted upon in other countries, notably in certain states of our neighbouring country. The chief difficulty in carrying on an agricultural education in such schools is that, for boys of limited means, such a course leads only to the position of hired man on a farm. Boys will not readily be attracted to such a school as will lead only to the farm. This view omits to take into consideration the fact that agricultural education is education. In Ontario we are holding to the view that agricultural education is education, as far as it goes, and that as a subject it is worthy of a place on the regular curriculum of High Schools. It is also suitable for boys whether of country or of city, and even for girls.

To make progress in the establishment of the subject on the High School curriculum, it is necessary to consider all of these views, and this is no easy matter, especially if it is expected that they be consolidated into a workable scheme. This, however, has to be done.

FAMILIES OF GRADUATES IN AGRICULTURE

THE Principal of Macdonald College, Dr. F. C. Harrison, gives the following instances where several members of the same family have completed degree courses at that institution and elsewhere. The most notable example is that of the family of Mr. John Newton—living until recently at Ste. Anne de Bellevue, Que.—where five children, three boys and two girls, each completed B.S.A. courses at the college. Four of them also hold the degree of M.Sc., while three already hold the Ph.D. degree, and the other two are at present taking courses leading to that degree. The records are as follows:—

Newton, Robert
B.S.A., McGill, 1912.
M.Sc., Minnesota, 1921.
Ph.D., Minnesota, 1923.

Newton, William
B.S.A., McGill, 1914.
M.Sc., University of California, Berkeley, Cal., 1921.
Ph.D., California (in course).

Newton, John D.
B.S.A., McGill, 1917.
Ph.D., University of California, 1922.

Newton, Margaret
B.S.A., McGill, 1918.
M.Sc., McGill, 1919.
Ph.D., Minnesota, 1922.

Newton, Dorothy Elizabeth
B.S.A., McGill, 1921.
M.Sc., McGill, 1922.
Ph.D., McGill, (in course).

Both parents formerly took short winter courses at the institution.

Other instances where two or more members of a family have graduated from Macdonald College are:—

Fiske, K. M.,..	1912
Fiske, S. M....	1912
Fiske, H.J.M.,..	1914
Fiske, R.C.M.,..	1917
Hay, G. C.,..	1916
Hay, W. D.,..	1920
Hay, A. L.,..	1921
McOuat, J. E....	1915
McOuat, J. Harold..	1916
Matthews, Victor,..	1913
Matthews, A. E.,..	1920
Matthews, G. D.,..	1921
Ness, A. R....	1912
Ness, J. E.,..	1920
Ness, R. B.,..	1922
Jones, W. N.,..	1920
Jones, A. R....	1921
Reid, R. J. M.,..	1918
Reid, W. J....	1920
Schafheitlin, A. O.,..	1914
Schafheitlin, R.,..	1916
Skinner, S. G.,..	1920
Skinner, C. T.,..	1922
Wood, G. W.,..	1911
Wood, E. G.,..	1917

The Nesses are sons or grandsons of the late Robert Ness, the well-known Ayrshire breeder of Howick, Que.

Many of the above graduates are filling official or teaching positions. According to the records, these are as follows:—

Robert Newton, Associate Professor of Field Husbandry, University of Alberta; William Newton, Department of Agriculture, Victoria, B.C.; Margaret Newton, University of Saskatchewan; G. C. Hay, District Agriculturist, Kamloops, B.C.; A. L. Hay, Agricultural Demonstrator, Cranbrook, B.C.; J. E. McOuat, Lecturer in Nature Study and Elementary Agriculture, Macdonald College; J. Harold McOuat, Principal, High School, New Carlisle, Que.; Victor Matthews, Assistant Superintendent, Experimental Farm, Lethbridge, Alta.; G. D. Matthews, District Agriculturist, Soldier Settlement Board, Quebec, Que.; A. R. Ness, Lecturer in Animal Husbandry, Macdonald College; W. N. Jones, Extension Assistant, University of British Columbia; A. R. Jones, District Poultry Promoter, Charlottetown, P.E.I.; R. J. M. Reid, Fruit Inspector, Dominion Fruit Branch, Quebec; C. T. Skinner, Dominion Fruit Branch, Ottawa; G. W. Wood, Professor of Animal Husbandry, Manitoba Agricultural College; E. G. Wood, Manitoba Agricultural Extension Service.

SCHOLARSHIP FOR EXTENSION SCHOOL STUDENTS IN BRITISH COLUMBIA

ABOUT a year ago an effort was made on the part of Mr. J. L. Pridham, late President of the United Farmers of British Columbia, to establish a scholarship in Agriculture in the University of British Columbia to be known as the United Farmers' Scholarship. For the past winter a scholarship of $50 was offered by Mr. Pridham, personally, in order to get the idea started. It is hoped by Mr. Pridham to establish a Trust Fund in order that the amount of the scholarship may be available every year.

At the time of this discussion, arrangements were made whereby the University through its Extension Service would offer Extension Schools of five days' duration in a number of centres in the Province where the United Farmers' organizations were interested. Boys and girls under nineteen years of age were to be permitted to compete for the scholarship offered by the parent organization.

Extension Schools were held in the following places:—Appledale, 98; Creston, 113; Rock Creek, 44; Duncan, 85; Salmon Arm, 94; Enderby, 83. In all, thirty-two boys and girls wrote the examination, the winner being Kathleen F. E. Miles, Salmon Arm, with a total of 90 marks.

The scholarship may be enjoyed either as a regular student of the University or as a Short Course student. The examination paper was as follows:—

[Candidates were required to answer questions 1, 3, 5, 7, and 9, and any three of questions 2, 4, 6, 8, and 10. Also any two of questions 11, 12, 13, 14 and 15].

1. By what methods can we increase and preserve the moisture in our soils?

2. Give a detailed description of the growing of either corn or roots.

3. Outline a suitable method of caring for and feeding a dairy calf, or a beef calf from birth to three months of age.

4. Describe the conformation of a dairy cow that you would expect to utilize her feed for profitable production. Give brief reasons why the conformation you describe is desirable.

5. Discuss the factors which influence the souring and spoiling of milk.

6. Define a 'High Grade Cream'. What precautions must be taken in order to secure such a cream, and why are the precautions to be observed?

7. Describe briefly the chief factors which influence the quality of vegetables.

8. What causes may be responsible for the failure of fruit trees to produce satisfactory crops? Suggest remedies.

9. A farmer in your district has a flock of pullets that laid an average of 120 eggs in their first year. Describe an economical breeding system for this farmer to follow over a period of three years to increase the egg production of his flock.

10. (*a*) If a farmer has a flock of early, well-matured pullets bred from a good laying strain, how could he feed these pullets during the months of October, November, December, January and February to secure good egg production?

(*b*) How would you proceed to fatten fifty heavyweight cockerels for market?

SPECIAL PROBLEMS

11. Assuming that Nitrate of Soda with 15.5 per cent nitrogen, costs $60 per ton, what is the value of 1 pound of nitrogen in—

(*a*) Sulphate of ammonia,
(*b*) Liquid manure,
(*c*) Raw bone meal.

12. Discuss briefly three (3) important reasons why some dairy farmers succeed while others fail.

13. (*a*) What is meant by 'Milk suitable for Cheese-making'?

(*b*) What is 'Starter'?

(*c*) Why are starters used in cheese-making?

14. Briefly indicate how the following fruits are propagated: (1) Strawberries; (2) Red Raspberries; (3) Loganberries; (4) Black Currants; (5) Gooseberries. Explain how the pruning of the black currant differs from that of the gooseberry.

15. How would you take care of three hundred baby chicks coming from an incubator at one time? Describe how to feed these chicks until they are two months old.

TEACHING MILK FACTS

SOCIETY'S need for a better understanding of the vital place that milk holds in the diet of growing children will receive the broadest recognition at the World's Dairy Congress of 1923. The United States has been making an organized effort to improve the health of its school children by a wiser use of milk and milk products. Some idea of what is being accomplished may be gained from statements made in the last report of the California Dairy Council, one of the most active state organizations engaged in this work.

A few public schools had milk served to the pupils when the Council began its work late in 1919; but the idea prevailed that the children got enough milk at home. The Council's milk survey showed that, of 130,968 children, dwelling in 8 principal cities, 54,233 received no milk at home; while 42,940 received not more than one glass (half-pint) a day. To-day, there is scarcely a city of any size in the State of California that does not have some sort of milk service in the public schools. In San Francisco, 10,500 half-pint bottles are purchased by the children at the school lunches every day. One Berkeley school had milk service in the fall of 1919. To-day, every school in Berkeley has such service.

Last year the people of the State consumed 13,500,000 gallons of milk more than in any previous year. The per capita consumption increased from 17½ gallons in 1921 to 22 gallons in 1922; while the per capita consumption of butter increased from 22 to 22½ pounds in the same period. The health of the rising generation already shows the effects of the use of this better diet.

Two distinct types of agricultural education are being assisted by the Agricultural Instruction Act: (1) Vocational and technical in nature, taught to those who intend either to become farmers or to occupy technical positions; (2) General and social in nature, considered to be indispensable in any well-rounded educational programme in a country whose basic industry is agriculture.

It is with the general type that the public schools are mostly concerned, whereas the agricultural colleges and schools supply instruction that is essentially vocational.—"*The Federal Aid to Agriculture.*"

PART IV

Special Contributions, Reports of Agricultural Organizations, Publications and Notes

THE INFLUENCE OF SOIL FERTILITY ON THE WATER REQUIREMENTS OF CROPS

The Third of a Series of Three Articles by W. H. Snelson, Senior Irrigation Specialist, Irrigation Branch, Dominion Reclamation Service

IT is a proven fact that less water is required to produce a given yield per acre on a fertile soil than on a less fertile soil; therefore, the water requirements for any specified yield per acre will vary as the soil is rich or poor in available plant food.

The food materials needed by plants are obtained from the soil solution by osmosis through the root hairs. The more concentrated or richer this solution is in the food materials being used by the plant, the less the amount of water per pound of dry matter produced that the plant will have to absorb to satisfy its requirements.

Nitrogen is one of the most important food elements used by plants and the one most likely to become exhausted from the soil. It is never very plentiful in an available form as it is very readily leached out by heavy rains or over-irrigation.

Leguminous plants, such as alfalfa, clover and peas, are able through the aid of certain bacteria that live in nodules on the plant roots, to utilize atmospheric nitrogen. Not only are the very large nitrogen requirements of the plants supplied during their period of growth, but also after the crops have been removed the decomposition of their roots in the soil leaves a large amount of nitrogenous matter—the soil thus being richer in nitrogen than it was before growing the leguminous crop.

The value of crop rotations containing legumes in decreasing the amount of water required to produce a given crop yield per acre has been demonstrated very clearly by the irrigation investigations at the Brooks experiment station, and a study of the results obtained by the experiments conducted shows that a farmer in raising the general fertility of his soil by means of these rotations, provides at the same time for an increased production per acre-foot of water applied.

Crop Grown	Yield in Bushels per Acre	Total depth of water in acre-feet per acre required to produce a given yield per acre when grown on soil of:—		
		Excellent Fertility	Medium Fertility	Poor Fertility
Wheat	30	0·98	1·23	2·02
Oats	80	0·98	1·14	1·50
Barley	48	1·12	1·55	2·00
Potatoes	300	1·10	1·56	.....

The preceding table is compiled from results obtained at the Brooks experiment station and gives the amount of water in acre-feet per acre required to produce given yields per acre when the crops were grown on soil of excellent, medium and poor fertility. The depths under the heading " Excellent Fertility " were required when the crops were grown upon land that had grown a leguminous crop the year previous, or that had grown one cultivated crop since being in leguminous crops for several years. The depths under " Poor Fertility " were required when the crops were grown on land that had been in grain for three or four years previous or that had grown no legume in the rotation.

Oats following Clover, Brooks, Alberta, Irrigation Experiment Station.

It required approximately twice as much water to produce a yield of thirty bushels of wheat per acre if grown on soil of poor fertility than if grown on soil of excellent fertility.

Water Cost Reduced by Maintaining Fertility

As an illustration of how fertility reduces water cost, assume that a farmer has forty acres of wheat sown on land that has previously been in alfalfa and where the soil fertility is excellent, and that he also has another forty acres of wheat sown on land that had grown five or six successive crops of grain with no leguminous crop in the rotation and where the soil fertility is poor. To produce a yield of thirty bushels per acre will require the application of twelve acre-inches of water to the fertile field and twenty-four acre-inches of water to the poor field. Assume still further that the ditches have been laid out correctly on each field, that a head of two cubic-feet per second is used for irrigating, and that the irrigators' time is worth thirty-five cents per hour. Then, as the fertile field requires twelve acre-inches per acre and the streams being used will deliver two acre-inches per hour, it will take the irrigator six hours per acre to apply the required amount of water. As the poor field requires twice as much water as the fertile field it will take the irrigator twelve hours per acre to apply the

required amount of water. Therefore, the irrigation, for labour of irrigator only, is costing fourteen cents per bushel on the poor field and seven cents per bushel on the fertile field. The fertile field is, however, capable of producing a maximum yield of fifty bushels per acre with twenty-one inches of water at a cost for irrigators' wages of seven and one-half cents, while the poor field is limited to a yield of thirty bushels per acre at fourteen cents. If wheat were bringing one dollar per bushel and the cost for irrigators' wages were deducted the comparison would be:—Fertile field, 50 bu. x 92½c. (1.00—7½)=$46.25; Poor field, 30 bu. x 86c. (1.00—14)=$25.80.

Building up Soil Fertility on an Irrigated Farm

Soil fertility may be built up and maintained:—

(1) By the introduction of organic matter in the form of decaying roots from leguminous and other crops and in the form of green manure crops.

(2) By increasing the amount of available plant food in the soil through maintenance of conditions favourable to the action of nitrifying bacteria; and,

(3) Through the utilization, and addition to the soil, of the free nitrogen of the air by means of the symbiotic bacteria of leguminous plants.

By Introduction of Organic Matter by Green Manures and Crop Residues.—The most important and least appreciated method of maintaining or increasing the supply of organic matter in the soil is by the use of green manures and crop residues. A ton of clover ploughed under will add nearly three times as much organic matter to the soil as can possibly be recovered in the manure if the clover is fed to livestock. As the most important object achieved by green manuring is the addition of organic matter to the soil, it follows that, other things being equal, the best green manure crop is that which furnishes the largest amount of material which will readily decay in the soil and thus form humus. In general, alfalfa, clover, and peas have been found more valuable for green manuring than other crops because they not only provide organic matter but also leave nitrogen in the soil when they decay. Experiments at Brooks show that clover stubble of two years standing enriches the soil, when ploughed under, more than a three-year stand of grains.

By Maintenance of Conditions Favourable to Nitrification.—By far the larger part of the nitrogen of soils is stored in the form of humus, and thus, through the various processes of fermentation, is gradually made available to plants in the form of nitric acid.

The nitrogenous compounds of organic matter, when incorporated in the soil, are first converted into ammonia by certain bacteria; but no sooner is the ammonia produced than it is converted into nitrous acid by the nitrous ferment. But the process does not end here, for no sooner is the nitrous acid formed than it is converted into nitric acid by still another distinct kind of micro-organism.

In studying the conditions under which the nitric ferment works most vigorously it has been learned that the bacteria cease to develop nitric acid from humus when the temperature falls below about 41° F., that its action is only appreciable at 54° F., while it becomes most vigorous at 98° F., but at 113° F. its activity drops back again. A warm soil favours nitrification. *To keep soils warm they should be well drained and receive early and*

thorough cultivation to prevent the heat losses of evaporation.

The nitrifying bacteria, being aerobic, require free oxygen; this element is also needed to prevent the destruction of the nitrates after they have been formed. The farmer must see to it then that his soils are sufficiently aerated to ensure the production of nitrate on the one hand, and to prevent their destruction on the other.

A well aerated soil favours nitrification; *to keep soils well ventilated they should be well drained, not over-irrigated, and well tilled.*

In excessively dry soils, or those insufficiently drained, and therefore imperfectly supplied with air, nitrification is stopped. The highest fertility and consequently the highest yields are obtained where conditions favour the development of the necessary bacteria. Experiments at the Brooks experiment station show: (*a*) the highest yields occurring on those plots in which an optimum moisture content—about twenty per cent by dry weight of soil—was maintained throughout the growing season; (*b*) the lowest yields occurring on plots that were too dry, and (*c*) less than maximum yields occurring on those plots receiving excessive quantities of water.

The irrigation farmer is well equipped to maintain on his farm the conditions that favour the liberation of nitrogen from the organic matter of the soil and its conversion into available nitrates. By growing deep rooted crops and cultivated crops in some well-planned rotation, he may improve the general tilth and aeration of the soil. By economical and timely irrigation he can maintain the moisture content of the soil at that percentage most favourable to nitrification.

Utilization of Atmospheric Nitrogen by Legumes. — Leguminous plants, such as alfalfa, clover and peas, are able, through the aid of certain bacteria that live in nodules on the plant roots, to utilize the atmospheric nitrogen. Not only are the very large nitrogen requirements of the plants supplied during their period of growth but also after the crops have been removed, the decomposition of their roots leaves a large amount of nitrogenous matter in the soil.

Legumes, in themselves, have no power to abstract nitrogen from the air; this was very clearly illustrated by an experiment at the Brooks station in which alfalfa was grown on two different plots, one inoculated, the other not inoculated. The alfalfa on the inoculated plot grew vigorously; that on the non-inoculated plot produced a very poor and scrawny growth.

The nitrogen-fixing bacteria, once established on the roots of a leguminous plant, cause the formation of small tubercles in which they live, drawing nourishment from the sap of the plant and in return giving to the plant compounds of nitrogen which they are able to produce from the free nitrogen of the soil air.

The following table shows the 1922 yield of grain and cultivated crops following legumes and grasses in five crop rotations in use at the Dominion experiment station at Brooks, Alberta.

Chart Showing Yields Per Acre of Grain and Cultivated Crops Following Leguminous Crops at Dominion Irrigation Experiment Station, Brooks, Alberta, 1922

A	Alfalfa (Seeded)	Alfalfa	Alfalfa	1849 Alfalfa	4547 Alfalfa 4 to 6 tons per acre	5756 Potatoes 406 bush.	5554 Wheat 65 bush.	5352 Flax 30 bush.
B	6766 Alsike Clover (Seeded)	6564 Alsike Clover	6362 Alsike Clover 2 tons hay	6160 Alsike Clover 3 bush. seed per acre	5958 Corn 17 tons per acre. Greenweight	7372 Oats 134 bush.	7170 Wheat 58 bush.	6968 Oats 109 bush
C	Grass (Seeded)	Grass	Grass 1·5 tons hay	Potatoes 265 bush.	Barley 50 bush.	Wheat 42 bush.		
D	Red Clover (Seeded)	Red Clover 5 bush. seed or 2 tons hay	Oats 120 bush.	Barley 63 bush.				
E	Peas 57 bush.	Wheat 56 bush.	Oats 100 bush.	Barley 44 bush.				

Wheat Yields

The maximum yield of wheat, sixty-five bushels per acre, was obtained in rotation "A" where the soil fertility was very high due to the three-year stand of alfalfa preceding the potato crop. The next highest yield, fifty-eight bushels per acre, was obtained in rotation "B" where the fertility received by the soil from a two-years growth of alsike clover had been depleted to some extent by the production of one crop of corn and one crop of oats before the wheat crop. The next highest yield, fifty-six bushels per acre, was obtained in rotation "E" where the wheat crop followed one crop of peas. The lowest yield of wheat, forty-two bushels per acre, was obtained in rotation "C" where the crop followed two years in grass, one in potatoes and one in barley.

The wheat in rotation "E" occupied the same land in 1922 that it did in 1918 when the land was broken from sod. The maximum yield per acre from this rotation was forty-one bushels in 1918 and fifty-six bushels in 1922, showing that by growing peas one year in four the soil fertility has not only been maintained but increased.

Oat Yields

The maximum yield of oats, 134 bushels per acre, was produced in rotation "B" where the crop had the advantage of the fertility built into the soil by three years of alsike clover—the last year of which was as green manure—and further elaborated by the cultivation treatment applied to the immediately preceding corn crop.

In rotation "E" 100 bushels of oats were produced per acre as a result of the fertility furnished by the crop of peas two years previous.

Barley Yields

The maximum yield of barley, sixty-three bushels per acre, was produced in rotation "D" where the land had grown a crop of oats since being in red clover for two seasons. The barley for rotation "C" occupied the same position in relation to the basic soil building crop of the rotation as it did in rotation "D," but yielded only fifty bushels per acre. The grass, not being a legume, did not leave the soil as fertile as the clover. The barley in rotation "E" occupied land two crops removed from a legume of one year's duration only and yielded but forty-four bushels per acre.

Potato Yields

Potatoes following a two-year stand of alfalfa yielded 406 bushels per acre as compared with potatoes which followed a two-year stand of grass and yielded but 263 bushels per acre. This is a striking illustration of the soil fertility building value of a leguminous crop when compared with that of a non-leguminous crop.

Economic Value of Legumes

There is ample evidence in the foregoing data to show the value of legumes in maintaining soil fertility and making possible the continuous production of large crop yields at a minimum water cost in acre-inches per pound of crop produced.

Summary

It is impossible in this series of articles to touch on all the factors which have an influence on the success or failure of irrigation farming and only those factors have been dealt with that are associated with crop production under irrigation. There still remain the problems of how best to market the commodities raised on the farm, whether to feed beef cattle or to sell the products through the dairy herd, or to market the produce direct.

It must be remembered that while all reasonable efforts should be made to produce large crops, this must be accomplished by the practice of those principles of thrift that are essential in any steady occupation. A large portion of the profits in irrigation farming lie in the side lines or by-products. Statistics show that in the production of the common field crops the farmer is making not much more than day-labourer's wages but that the larger part of the profits lie in the manufacturing of the forage and grain crops into meat, butter and eggs by means of livestock and in so arranging the farming programme that the farmer and his family can be engaged in profitable occupations during spare time intervals. Farming under irrigation will be more profitable to the man who has a small holding and can get along without outside labour, than to the farmer who has a large area and who must rely on one or more hired men to assist him.

CANADA'S RECORD AT LEADING AGRICULTURAL SHOWS IN 1922

THE high place secured by Canada's agricultural and horticultural products at shows held in Great Britain and the United States, in 1922, is indicated by the following summary:

ONTARIO

Fruit

At the Imperial Fruit Show, held in London, England, apples from Ontario secured eleven first prizes; nine second prizes and one third prize. In addition to this, a splendid display of commercial apples and pears was made. Seventy cases of choice pears and apples, and six hundred baskets of "Wealthy" apples, the only dessert apples ready at that time, made a most imposing exhibit and attracted a great deal of attention.

Horses, Cattle, Sheep

At the exhibit of Ontario dairy cattle at the National Dairy Show held at St. Paul, Minn., Ontario cattle won two championships, two 1st prizes, three 2nd prizes, and five 3rd prizes, besides securing several other awards in "string" classes. In the

Dairy Herd Class, Ontario stood second in the exhibits.

At Chicago, where the International Live Stock Show has become the greatest world's show of its kind, Ontario achieved great distinction in Clydesdale horses, carrying off the Reserve Championship, two 1st prizes, three 2nd prizes and several 3rd and 4th prizes, all classes being very strongly contested.

The outstanding achievement was the awarding of the champion carlot at the show to Ontario, and the carrying off by an Ontario breeder of the grand championship wether under two years, and the grand championship of the show by the same exhibitor. This was the first time in the history of the show that the top prizes were all won by one man.

The province was represented in the following classes: Southdowns, Oxfords, Lincolns, Leicesters and Shropshires, and the exhibits won in all classes eight championships, thirty-two first prizes, twenty-five second prizes, and several third prizes.

In the Shorthorn and Angus classes of general cattle, Ontario again stood high, and the fact that Ontario breeders were chosen as judges at this show attests to the character of the stock that is being raised in this province.

Cheese and Butter

At the London show, one thing was brought out very clearly, and that was the need for establishing grades and uniformity in order to compete in the British market. For example: in butter, Australia scored 100 points against 97 for Ontario, and won first, second and third prizes in the salted, as well as the unsalted classes.

The same thing was true in cheese; South Africa wining first prize, and Ontario coming second, with another entry being highly commended.

This competition with producers from other countries opens up to our farmers a vision of what world trade means, and what must be done in order to compete.

SASKATCHEWAN

At the International Grain and Hay Show, Chicago, Ill., 1922, Saskatchewan growers won eleven prizes for wheat out of 26, thus maintaining the province's reputation for the production of the finest hard spring wheat. Many successes were also secured in other sections. The complete list is as follows:—

Threshed wheat, Sweepstakes, 1st and 5th (Hard Red Spring); 6th, 12th, 13th, 18th, 19th, 21st, 25th (Reserve), 7th (Hard Red Winter). Threshed oats, 11th, 18th, 26th, 29th, 34th; threshed barley (two-rowed), 8th; threshed rye, 12th; threshed clover, 9th; threshed peas, 1st.

In connection with the above, it may be stated that Saskatchewan growers have won the wheat championship nine times in eleven years, not exhibiting one year and taking second the other.

ALBERTA

Once more Alberta upheld its reputation at the International Hay and Grain Show in Chicago, in 1922, when grain from this province secured no less than three grand championships, one being in oats, another in peas and another in rye. In wheat, Alberta exhibits gained 2nd, 8th, 10th and 11th places. In oats, exhibits from Alberta secured 1st and grand championship, as well as 12 other prizes from 2nd to 24th. In barley, Alberta exhibits secured 1st and 5th places. In peas, Alberta exhibits secured 1st and grand champion, also 2nd, 3rd and 4th. In rye, Alberta was given 1st and grand champion, and in alfalfa won second place.

Live Stock Winning

At the International Live Stock Show, Chicago, 1922, Alberta stock won the following places:—

Galloways, 1st and grand championship; Shorthorns, a 4th and a 7th prize; Herefords, 2nd, 9th and 11th places; Grades, 1st and 4th, and Shorthorn special.

The livestock exhibit was prepared by the University of Alberta.

The grain exhibit at Chicago was made up by exhibitors from all over the province, and was in charge of the field crops commissioner of the Department of Agriculture.

NOVA SCOTIA

The winnings of the province of Nova Scotia at the Imperial Fruit Show, 1922, were as follows:—

British Empire Section—

Dessert apples, best 20 boxes, 1st prize.

Culinary apples, best 20 boxes, 1st prize.

The prize consisted of a gold medal and £50 cash in each class.

In the Overseas Section, Nova Scotia took third place, being preceded by Ontario and British Columbia.

The combined winnings in the two sections were: two firsts; three seconds; five thirds, and £183 cash.

NEW BRUNSWICK

New Brunswick fruit growers did not exhibit at the Imperial Fruit Show, 1922. It might be mentioned, however, that at the show held in 1921, New Brunswick apples achieved a notable success. In that year, her exhibits of McIntosh and Fameuse —two of Canada's most famous varieties of apples—obtained first prize with gold medals and two special prizes of £5. Third prize medals were secured for Golden Russets.

BRITISH COLUMBIA

At the Imperial Fruit Show, 1922, British Columbia suffered from the fact that the Okanagan and Kootenay growers were practically unrepresented, although, in 1921, they were very successful.

A special prize of £20 was awarded to Creston for the best British Columbia exhibit in the British Empire section. The variety was Cox's Orange.

In the Overseas section, Creston and Kelowna each won a first with Cox's Orange and Spitzenberg, respectively. Creston won a third with Fameuse apples, and a first and third in "any other variety," besides a first for pears. Two special prizes in this section were awarded to Creston for the best British Columbia apple exhibit.

At the Portland, Oregon, International Live Stock Exposition of 1922, British Columbia live stock winnings were as follows:

In the classes for Clydesdale horses the winnings were, Senior and Grand Champion; Junior Champion and Reserve Grand Champion. Also seven firsts and a number of second and third prizes.

In the classes for Dorset sheep the winnings comprised two championships, and 14 first and five second prizes.

FIRST SHIPMENTS OF STORE CATTLE TO GREAT BRITAIN

THE first shipments of store cattle to Great Britain, since the removal of the embargo on April 1, 1923, arrived at Manchester and Glasgow respectively on April 5. The steamship *Manchester Division*, owned by the Manchester Liners, Limited, was the first to reach port. Her consignment consisted of 423 head of Shorthorns, Angus and Herefords, shipped by Messrs. Rogers and Maybee, of Toronto, for Mr. T. Woodward, M. T. Chapman, and Messrs. Coller and Black. Mr. A. H. Carley, Veterinary Inspector of the Health of Animals Branch of the Dominion Department of Agriculture, accompanied the shipment. His certificate of health was confirmed by the port inspectors. The price obtained ranged from £22 to £32 per head, or 9½d. to 11d. per lb. Forty animals were purchased for immediate slaughter, and the remainder were distributed.

The Glasgow shipment, via the Donaldson liner *Concordia,* was a few hours later in arriving. It consisted of 221 head, made by the Harris Abattoir Company, of Toronto, the United Grain Growers' Association and Mr. Munro, Montreal. The majority of the animals were Shorthorns but there were also some Hereford and Polled Angus crosses. A clean bill of health was given. The animals were fats rather than stores, and nearly 100 were purchased by butchers. The average price per head was £32, or 61s. per cwt., live weight. Mr. Duncan Marshall, Dominion Commissioner of Agriculture, was present on arrival of the shipment.

EXPERIMENTAL SHIPMENT OF CATTLE AND CHILLED BEEF

THE Dominion Department of Agriculture recently made an experimental shipment of cattle to Great Britain, with a view to comparing the shipment of chilled beef, store cattle and fat cattle.

For the purposes of the experiment, 180 head of steers, fed during the past winter on the Experimental Farms and Stations at Lethbridge, Indian Head, Rosthern, Brandon, Ottawa, Lennoxville and Kentville, were selected and assembled at Montreal. Fifty of these were chosen, slaughtered, and the carcases chilled and shipped to Liverpool in the refrigerator chambers of the *S.S. Coracero*, which sailed June 1. This shipment will be sold by a responsible wholesale meat firm as Canadian chilled beef.

Of the remaining 130 head, all of which were shipped alive on the *S.S. Irishman,* sailing for Liverpool May 28, eighty were to be sold as stocker cattle, twenty-five were to be slaughtered as fat cattle and sold as fresh Canadian beef, while the remaining twenty-five were to be sold either as stocker or fat cattle, according to the price to be obtained.

This shipment is in charge of Mr. Victor Matthews, Assistant to the Superintendent at Lethbridge, Alta., while the selling arrangements are in the hands of Mr. P. D. Chapman, of Fakenham, Norfolk. Mr. Duncan Marshall is supervising the selling arrangements in connection with the whole experiment, and it is hoped that some valuable data will be obtained.

CANADIAN CATTLE MARKING ORDER

THE Minister of Agriculture and Fisheries for Great Britain, by virtue and in exercise of the power conferred by section 9 of the Importation of Animals Act, 1922 (Session 2), hereby orders as follows:

Marking of Canadian Cattle

1. (1) Canadian cattle, except as hereinafter provided, shall, as a condition of landing in Great Britain, be marked before shipment by securely affixing to the right ear of each animal a tag of a pattern approved by the Minister of Agriculture and Fisheries with the letter "C" and a serial number stamped therein, and also, in the case of any cattle shipped from a port in the Dominion of Canada after the first day of September, 1923, by branding the animal on the left hindquarter with the letter "C." or tattooing that letter on the left ear, unless the animal is already branded with a brand registered by the government of a province of the Dominion of Canada: Provided that this provision shall not apply to cattle to be landed at an imported animals wharf for immediate slaughter.

(2) For the purposes of this article the expression "Canadian cattle" means cattle born and reared in the Dominion of Canada.

Short Title and Commencement

2. This order may be cited as the Canadian Cattle (Marking) Order of 1922, and shall come into operation on the date on which the Importation of Animals Act, 1922 (Session 2), comes into operation.

GIFT OF SHIRE HORSES TO CANADA

THE Minister of Agriculture, Hon. W. R. Motherwell, stated in the House of Commons recently that the five Shire horses, donated to Canada by the Shire Horse Association of Great Britain, would be located at the Dominion Experimental Station, Lacombe, Alberta. The sixth, "Snelston Topper," donated by Mrs. Stanton of Snelston Hall, Ashbourne, will be assigned to the Dominion Experimental Station at Lennoxville, Que. This disposition, the Minister stated, was in conformity with the wishes of the donors that the animals should be located in districts where some attention had already been given to the breed.

The horses reached Canada recently in charge of the Dominion Animal Husbandman, Mr. G. B. Rothwell. Those destined for Alberta will be exhibited at various western shows this summer.

With the horses came a consignment of Ayrshire cattle, a number of sheep, and a few swine, purchased for use at the Central Experimental Farm, Ottawa, and at various Stations.

DAIRYING IN AUSTRALIA AND NEW ZEALAND

THE Dominion Dairy Commissioner, Mr. J. A. Ruddick, returned at the end of April from a trip to Australia and New Zealand, where, under instructions from the Minister of Agriculture, Hon. W. R. Motherwell, he investigated dairy conditions for the information of Canadian dairymen. Mr. Ruddick was accompanied by Mr. W. A. Wilson, of Regina, Sask.

Mr. Ruddick and Mr. Wilson were cordially received in both countries by government officials, factory managers and others connected with the dairying industry, every opportunity being afforded them for gathering information. Mr. Ruddick's former connection with the dairy industry in New Zealand, as dairy commissioner from 1898 to 1900, greatly facilitated his investigations in that country. He reports, as regards New Zealand, that great progress has been made of late years in the country generally and in dairying in particular. In Australia, much advance has been made in methods and organization since the war. In both countries large factories are the rule. The output of some creameries runs from 800 to 1,000 boxes of butter a day, while, in New Zealand, a cheese factory that does not make four or five hundred tons in a year would be considered small. Both countries are devoting their energies to the improvement of quality, regardless of all other considerations, and in Mr. Ruddick's opinion, Canada will meet very keen competition from these countries in the future. The information secured will be made available to dairymen in Canada as soon as practicable.

A PARASITE OF THE CORN BORER

THE United States Bureau of Entomology, through the courtesy of Dr. L. O. Howard, Chief of the Bureau, and Mr. W. R. Walton, Entomologist in charge of Cereal and Forage Insect Investigations, is furnishing the Entomological Branch of the Dominion Department of Agriculture, with a supply of the imported corn borer parasite known as *Hebrobracon brevicornis*. This parasite, which has been imported by the United States Government from Europe, has been reared in large numbers in Massachusetts and has been liberated in districts infested with the corn borer.

For the purpose of breeding and colonizing this parasite in districts in southern Ontario heavily infested with the European corn borer, the Entomological Branch is establishing a temporary laboratory at St. Thomas. It is to be hoped that the experiment will successfully establish the parasite in that province, and thus assist in the control of this important pest of corn and other crops. The St. Thomas laboratory will be in charge of Mr. A. B. Baird, who has had considerable experience in parasite work.

THE EUROPEAN CORN BORER

Quarantined Area Extended

ON February 26, 1923, an Order in Council was passed which quarantined the following territory in the Province of Ontario on account of the European Corn Borer:

The counties of Essex, Kent, Lambton, Elgin, Middlesex, Norfolk, Oxford, Haldimand, Welland, Lincoln, Wentworth, Brant, Halton, Waterloo, Perth, Huron (with the exception of Ashfield, Wawanosh East, Wawanosh West and Howick townships), Peel (with the exception of Caledon township); as well as, Culross township in Bruce county; Guelph in Wellington county; Etobicoke, Scarboro and York in York county; Pickering, Whitby East and Whitby West in Ontario county; Darlington and Clarke in Durham county and Brighton township in Northumberland county. On account of the severity of the infestation in Elgin and Middlesex counties they have been placed under double quarantine.

The products affected by the regulations are corn fodder, corn stalks, including broom corn whether used for packing or other purposes, green sweet corn, roasting ears, corn on the cob or corn cobs. The movement of these products from the quarantined area to points outside is prohibited.

The cities of Toronto and Hamilton are now included in the quarantined territory, consequently the markets in these cities will be open to all growers of sweet corn with the exception of those situated in the counties of Elgin and Middlesex. It is pointed out however, that quarantined products must not be shipped from Toronto or Hamilton to any point outside the quarantined territory.

United States Quarantine No. 41 prohibiting the importation, without inspection, of various cutflowers and vegetables from Ontario on account of the European Corn Borer, is still in force. The Dominion Department of Agriculture will co-operate with growers again this season in making all reasonable inspections and furnishing the necessary certificates for proposed shipments.

INSECT PESTS OF CANADA AND THE UNITED STATES

AS a result of an international conference on insects of importance both to the Northwestern States and the prairie Provinces of Canada, recently held at Winnipeg, Manitoba, plans were perfected for conducting experimental work in the control of these insects. The experiments are to be carried on in such a way as to render the results comparable in all the districts involved. For the purpose of plotting the occurrence of the principal insect pests of common importance to Canada and the United States, a base map of all the international territory affected has been prepared.

The principal pests discussed at the Conference were grasshoppers, the western wheat-stem sawfly, the pale western cutworm, and the Hessian fly. The Bureau of Entomology of the United States Department of Agriculture was represented at the conference, as well as the Dominion Entomological Branch.

IMPERIAL FRUIT SHOW, 1923

THE Imperial Fruit Show, 1923, will be held in Bellevue Gardens, Manchester, England, from October 26 to November 3, inclusive.

The previous two shows were financed by the London Daily Mail, but arrangements have now been made for the complete financing and direction of the Show by a committee representing the fruit industry in Great Britain. The regulations in connection with the Show have been modified to some extent, and practically all of the changes are of advantage to Canadian exhibitors.

INTERNATIONAL CONGRESS OF REFRIGERATION

AT the Third International Congress of Refrigeration, held in Chicago in 1913, the year 1916 was fixed for the holding of the Fourth Congress and St. Petersburg designated as the place of meeting. The War intervened and, with the resumption of peace, plans were made to hold the Congress in London in June, 1924.

The British Government is officially subscribing to the international movement, and will be the official host at the next Congress. It is expected that representatives of forty countries will be present.

INTERNATIONAL FARM CONGRESS

THE Seventeenth Annual Convention of the International Farm Congress will be held at Kansas City, Missouri, October 10, 11 and 12, 1923.

The convention will devote its attention to the economic problems of agriculture, but the programme will include the discussion of the best farming practices, agricultural education, reclamation, dry-farming, natural resources, transportation, and highways.

International factors bearing upon the agricultural industry will be considered, and for this reason it is expected that those countries having trade relations in farm products with America will send representatives.

WORLD'S DAIRY CONGRESS

IN order to fully present the milk industry of the United States, the World's Dairy Congress will be held in three cities. It will open at Washington, D.C., on October 2. There the delegates will be officially welcomed and will have an opportunity to inspect the Government's laboratories, experiment stations and statistical and economic bureaus. The sessions held there on October 2 and 3 will consider questions of the broadest import.

The work of the National Dairy Council in promoting national health by educating the public as to the food value of milk and its products will be demonstrated for the delegates at Philadelphia, Pa., on October 4, under the auspices of the National and Inter-State Dairy Councils.

From October 5 to 10, the Congress will meet at Syracuse, N.Y., in co-operation with the seventeenth National Dairy Exposition. Mornings will be devoted to Congress sessions; afternoons to the inspection of Exposition displays and evenings to group meetings. The Exposition annually presents a cross-section of the milk industries of the United States and Canada, with displays of the best bred dairy cattle, the newest machinery and equipment and the latest methods of production, manufacture, distribution and use of dairy products, as well as public health activities of the Government and private organizations.

An international banquet will be held on the evening of October 10. When the Exposition closes on October 13, the delegates will be given an opportunity to take part in sight-seeing excursions.

WINNERS OF SPECIAL PRIZES AT MACDONALD COLLEGE

THE challenge cup given by Sir Edward D. Stern to the Macdonald College student (Faculty of Agriculture, McGill University) taking the highest marks in live stock judging in the fourth year, *i.e.*, judging all classes of live stock in the final examinations, was this year won by Edgar Wendell Holden, of Frelighsburg, Que.

The prize offered by the Minister of Agriculture for the Province of Quebec to the fourth-year student standing highest in the horticultural option was awarded to Wilfrid Henri Perron, of St. Philippe de Chester, Que.

A special prize, given by three members of the staff, for the student taking the highest standing in plant pathology, was won by Thomas Clifford Vanterpool, of St. Michael, Barbados, B.W.I.

NEWS ITEMS AND NOTES

In a recent address, the Deputy Minister of Agriculture, Dr. Grisdale, drew attention to the notable strides in dairying made in the Prairie Provinces, where only a few years ago cereals, and to some extent live stock, were the only products of consequence. On the British market, the only Canadian butter that is in demand, he said, comes from the Prairie Provinces. He spoke of the change that has taken place in the attitude towards the cream-gathering creamery. Not many years ago it was condemned as a wrong method. To-day all of the fine butter made in Saskatchewan and Alberta is produced from gathered cream. The success of this system is in a large measure due to the cream grading policy of these provinces and the thorough system of pasteurization employed.

At 11 exhibitions across Canada at which Alberta creamery butter was exhibited during 1922, a total of 229 prizes were won by that Province out of 436 prizes awarded. Of these there were 54 first prizes out of 100 awarded, 74 seconds out of 123 awarded, 83 thirds out of 157 awarded, 8 fourths out of 17 awarded, 5 fifths out of 17 awarded, 2 sixths out of 7 awarded, 2 sevenths out of 7 awarded, 1 eighth out of 4 awarded. In total number of points won during the year, Alberta stood first among seven of the provinces, having taken 1,526 points out of a total of 2,808.

Every confidence is felt by the Ottawa authorities that the new grading regulations for export butter and cheese adopted by the Dominion, which came into force on April 1, will have a marked beneficial effect on Canada's export trade in dairy products.

Government grading of cream as received at the creamery was put into effect on May

l in the provinces of Manitoba, Saskatchewan and Alberta. The adoption of compulsory cream grade standards is in response to the urgent request of creamerymen and producers.

The grades are: "Table Cream," "Special Grade," "First Grade," "Second Grade," "Off Grade." A premium of not less than two cents per pound butter-fat is to be paid for Table and Special cream over first grade, and a premium of not less than three cents per pound butter-fat for first grade over second grade.

The official graders, in addition to grading the cream, also check the weights and butter-fat tests of the farmers' shipments. The cost of the service is borne by the creameries.

"Large factories attract a superior class of men to the ranks of the cheese makers," states the Dominion Dairy Commissioner, Mr. J. A. Ruddick. "The overhead costs decrease rapidly as output increases, and the larger the output the easier it is to provide capable management. It is right at this point of management that so many of our factories fail. I do not know of any other industry of equal importance and extent in which there is so little management. The small factory cannot afford to pay for it.

"Importers in the United Kingdom make a strong point of the advantage of having such large quantities of cheese of uniform character and quality under a single factory brand. Since the New Zealand cheese has begun to loom so large in the market, shipments of cheese from Canada, consisting frequently of ten or a dozen factory marks in a lot of 500, have been more criticized on this score."

"I firmly believe," states Mr. Ruddick, "that grading will help very materially to remove many of the defects in the quality of both cheese and butter. It has been demonstrated wherever it has been applied, not only to dairy produce but to other commodities, that it is a stronger influence in that direction than all other agencies put together."

Many prairie farmers this year are trying plots of corn for the first time, and much interest is being shown in this crop.

The new dairy building provided by the Province of Ontario at the Agricultural College, Guelph, is being fully equipped for experimental work. Not only will scientific investigation be undertaken in connection with cheese and butter making, but attention will be given to powdered milk and ice-cream production, as these industries are growing in importance and proving remunerative to Ontario dairymen.

Canadian agriculture is stated by Dr. Grisdale to have a valuable asset in the quality of its farm seeds. Potato seed from the Maritime Provinces has won for itself a very enviable reputation in the United States, which produces early potatoes. Prince Edward Island seed is especially favoured in this regard. In 1919 small shipments were made to some of the eastern states and did so well that the demand increased by leaps and bounds until, last year, Prince Edward Island alone sent one hundred cars of potato seed over the border. New Brunswick and Nova Scotia also marketed large quantities in the States of New Jersey, Maryland, Georgia, the Carolinas, and Rhode Island. In grains our Northern grown Marquis wheat and Prince Edward Island oats are very highly regarded in other countries for seeding purposes. Whereas a few years ago much of the United States seeding supplies of timothy, alfalfa and other varieties of clover came principally from Europe, Canada, by reason of the quality of her seed and of the satisfactory seed laws, is finding an excellent outlet in the American Republic.

A recent development in connection with Canada's export seed trade is the shipment to Argentina of 500 bushels of Registered Marquis Wheat. This wheat was the product of Saskatchewan members of the Canadian Seed Growers' Association, and the shipment was the first of its kind to go to South America in commercial quantity. The results will be observed by the representatives of the Commercial Intelligence Service of the Department of Trade and Commerce, and should the performance of the seed prove to be satisfactory, extended purchases from Canada may be looked for.

As a result of the campaign instituted by the British Columbia Fruit Growers' Association, a co-operative selling agency has been formed to control the output of the principal tree-fruit districts of the Province. The central selling agency is known as the "Co-operative Growers of British Columbia, Limited."

Two items of interest appear in the estimates of the Ontario Department of Agriculture. One is an appropriation for a radio broadcasting station at the Ontario Agricultural College. The Minister, Hon. Mr. Doherty, explained that the installation would not be proceeded with until a sufficient number of farmers were equipped to receive broadcasted information on farm topics.

The second, is an appropriation of $20,000 for the erection of a model centralized cheese factory to demonstrate the benefits to be derived from factory consolidation.

The Ontario Live Stock Improvement Train is reported to have had an attendance of about 700 at each stop. Some 30 bulls and 120 hogs were sold for breeding purposes.

The Ontario Department of Agriculture is providing a motor truck to tour certain rural districts and demonstrate water supply systems, plumbing equipment, and installation methods. The exhibits include an air pressure water system and kitchen and bathroom fixtures for the farm dwelling. One day is spent in each locality visited, lectures and demonstrations being given in the afternoon.

Last year 2,590 birds were entered in the Laying Contests conducted by the Dominion Experimental Farms. The total production was 391,805 eggs, an average of 151 eggs per bird. These eggs were produced under every conceivable weather condition, and laid by a great variety of breeds.

These contests were conducted in every province in the Dominion. In average production British Columbia led with 181·2 eggs per bird; Ontario was second with 173·5 eggs, and at the Canadian Contest, conducted at Ottawa, third with 167·1 eggs. In the British Columbia contest there were 290 birds, in the Ontario 280, and in the Canadian 600.

Registration of hens producing 200 eggs and over in 52 weeks, can be secured only through the laying contests, of which particulars are obtainable from the Dominion Poultry Husbandman, Ottawa, or the Superintendents of the Experimental Farms at Agassiz, B.C.; Lethbridge, Alta.; Indian Head, Sask.; Brandon, Man.; Lennoxville, and St. Anne-de-la-Pocatiere, Que.; Fredericton. N.B.; Nappan, N.S.; and Charlottetown, P.E.I. The registration of poultry is conducted by the Canadian National Live Stock Records, through the Canadian National Poultry Record Association.

The College of Agriculture of the University of British Columbia received accurate reports from 536 farms in connection with its Farm Survey Work in 1922. In all, 1,017 farms were visited. A number of farmers who did not keep records last year are expected to do so this year, and at a later date, a report will be published.

The report on the Poultry Farm Survey, made in 1921, has already been issued. The cost of these surveys is met from the Agricultural Instruction grant.

Since the war there has been a rapid development in poultry farming in certain districts of British Columbia. Many returned soldiers have taken up poultry farming under the Soldier Settlement Board. Moreover, many of the older established poultrymen have materially increased their flocks, and a considerable number of other settlers have gone into poultry farming in a specialized way.

The Twelfth International Egg-Laying Contest is now being held under the auspices of the Poultry Division, Provincial Department of Agriculture, at the Exhibition Grounds, Victoria, B.C., and is to continue from October 2, 1922, to October 1, 1923.

The degree of Bachelor of Veterinary Science was conferred on May 1, 1923, at a special Convention of the University of Toronto, on thirty-three graduates of the Ontario Veterinary College. Eleven were from Ontario, two from Quebec, two from Nova Scotia, five from Manitoba, two from Saskatchewan, one from British Columbia; seven were resident in the United States, while Newfoundland, Dominica, B.W.I., and Bermuda was each represented by one.

By means of the Federal grant for Agricultural Instruction, the provinces have improved their extension services, developed agricultural education, erected institutions that are doing good work, and have increased the facilities for research. The activities thus promoted include those that get closest to the people on the farm, and are therefore of greatest benefit to the rank and file of the producers.

Short courses in agriculture for men and in domestic science for women have been an important feature of extension work assisted by the Agricultural Instruction grant. Held either under local auspices or offered by the schools and colleges of agriculture, their aim has been to give instruction on improved methods and practices. Every branch of farming has been dealt with, from stock-judging to motor mechanics for men and from general housekeeping to the domestic arts for women, often accompanied by demonstration.

In the province of Nova Scotia and the other Eastern Provinces almost half of the cost of educational and demonstrational work in agriculture has been provided out of the Federal grant.

A competition has been instituted among the boys on the farms of Carleton and Russell counties, Ontario, under the R. B. Whyte Bequest, for the purpose of promoting a better understanding of the suitability of varieties for the district and the more general planting of apple tree on the farms.

The competition is open to boys under eighteen years of age living on farms in the two counties named. Each boy entering the contest will receive six apple trees of early summer or late winter varieties. The contest will extend over three years, and prizes will be awarded annually as well as at its conclusion.

In the 1923 graduating class in Agriculture at Macdonald College, the name appears of John Hume Grisdale, with first class honours in Animal Husbandry. Mr. Grisdale, who is now in his twenty-first year, is a son of Dr. J. H. Grisdale, Deputy Minister of Agriculture.

APPOINTMENTS AND STAFF CHANGES

Mr. R. H. Helmer, Superintendent of the Dominion Experimental Station, Summerland, B.C., has resigned his position to take effect at the end of August. It is understood that Mr. Helmer will direct farming operations on the large holdings in the Nicola district, acquired by Major Goldman, ex-member of the Imperial parliament.

The United States Department of Agriculture announces the appointment of M. A. Jull, B.S.A., M.Sc., Ph.D., as Senior Poultryman in charge of Investigations on the staff of the Division of Animal Husbandry of the Bureau of Animal Industry. Mr. Jull is a graduate of the Ontario Agricultural College, whence he went to the West Virginia Experimental Station, thence served with the British Columbia Department of Agriculture and then at Macdonald College, where he has been head of the Poultry Department for the past eleven years. While at Macdonald he was also engaged by the Vermont College of Agriculture in teaching and extension work. He obtained his M.Sc. from McGill University and his Ph.D. from the University of Wisconsin. His work at Washington will consist almost entirely of investigations relative to fundamental problems of the poultry industry.

ASSOCIATIONS AND SOCIETIES

Union of Quebec Co-operative Societies

An important amalgamation of co-operative societies for the disposal of farm products and the purchase of supplies has recently been effected in the province of Quebec. Under the provisions of an Act passed by the Legislature in 1922, three societies, the Farmers' Central Co-operative, the Comptoir Co-operatif of Montreal, and the Co-operative Society of Seed Producers, Ste-Rosalie, have been united in one association, known as the Co-operative Fédérée de Quebec.

The following are the officers:—

Bureau of Direction.—President, Arsène Denis, Joliette; Vice-President, R. B. Décary, Dorval; Secretary, Jos. N. Bernier, St. Jean Port-Joli.

Business Executive.—President, J. Arthur Paquet; Secretary, Ph. Gingras.

Branches, etc., are located at Ste-Rosalie Junction; Trois-Rivieres; Quebec; Princeville (abattoirs); 1461 rue Papineau, Montreal (dairy produce); Export Warehouse, 63 rue William, Montreal.

The following are the principal products and supplies dealt in:—Butter, cheese, eggs, honey, maple sugar and syrup, seed grain and grass seeds, live stock and meat products, flour and feed, fertilizers, coal, fencing, motor car supplies, galvanized sheet iron, roofing and building paper.

The business address of the association is 114 St. Paul St. East, Montreal, P.Q.

Canadian Silver Fox Breeders' Association.—At the annual meeting held at Summerside, P.E.I., on March 6, a number of changes were made in the rules with a view to a higher standard for fox registration. It was decided that the premises of breeders of registered stock should be subject to a yearly inspection by the Live Stock Branch in-

spector; the inspection to have relation to sanitation, the keeping of records, and the re-inspection of all registered animals. Animals that on re-inspection do not conform to the standard are to be eliminated.

Alberta Swine Breeders' Association.—President, W. J. Hoover, Bittern Lake; Secretary-Treasurer, W. J. Stark, Edmonton.

Royal Agricultural Winter Fair—President W. E. Dryden, Brooklin, Ont.; Vice-President, E. M. Carroll, Toronto; Secretary, A. P. Westervelt, 146 King St. West, Toronto.

New Brunswick Fruit Growers' Association.—President, W. B. Gilman, Fredericton; Vice-President, A. R. Gorham, Grey's Mills; Secretary-Treasurer, A. G. Turney, Fredericton.

Canadian Co-operative Wool Growers Limited.—President, Lieut.-Col. Robt. McEwen, London, Ont.; 1st Vice-President, J. W. Renton, Calgary; Secretary, G. O'Neil, 128 Simcoe St., Toronto.

Manitoba Poultry Breeders' Association.—President, Prof. M. C. Herner, Manitoba Agricultural College, Winnipeg; Secretary, W. J. Currie, Brandon.

Canadian Council of Agriculture.—President, W. A. Amos, Palmerston, Ont.; Vice-President, C. H. Burnell, Oakville, Man.; Secretary, J. W. Ward, 404 Bank of Hamilton Bldg., Winnipeg, Man.

Canadian Goat Society.—President, W. H. Cottrell, Vancouver, B.C.; Vice-President, C. E. Dickerman, McKay; Secretary-Treasurer, Geo. Pilmer, Department of Agriculture, Victoria, B.C.

Western Stock Growers' Association.—President, D. E. Riley, High River, Alta.; Secretary, Miss Ruth Rogers, Calgary, Alta.

Western Canada Live Stock Union.—President, G. H. Hutton, B.S.A., Calgary, Alta.; Secretary-Treasurer, E. L. Richardson, Victoria Park, Calgary; Provincial Vice-Presidents: Geo. Gordon, Oak Lake, Man.; F. H. Auld, Regina, Sask.; G. F. Herbert, Medicine Hat, Alta.; W. T. McDonald, Victoria, B.C.

United Farm Women of Manitoba.—President, Mrs. Jas. Elliott, Cardale; Vice-President, Mrs. S. E. Gee, Virden; Secretary, Miss Mabel E. Finch, 306 Bank of Hamilton Bldg., Winnipeg.

Ontario Honey Producers' Co-operative Ltd.—President, W. Krouse, Guelph; Vice-President, Wm. A. Weir, Toronto; Secretary-Treasurer, Prof. F. E. Millen, O.A.C., Guelph (pro. tem.)

Alberta Cattle Breeders' Association.—President, J. G. Clark, Clark Manor; 1st Vice-President, W. H. Wallace, Viking; Secretary-Treasurer, W. J. Stark, Edmonton.

Alberta Sheep Breeders' Association.—President, Geo. Ball, West Salisbury; 1s; Vice-President, W. J. Hoover, Bittern Lake; Secretary-Treasurer, W. J. Stark, Edmonton

Associate Growers of British Columbia; Ltd.—President, A. T. Howe, Vernon, General Manager, A. N. Pratt; Sales Manager, B. McDonald; Secretary, K. E. Kinnaird.

The address of the Association is Vernon, B.C.

Berry Growers' Co-operative Union of B.C.—President, J. B. Miller, Mission; Manager, A. Dobberer, Salmon Arm.

Canadian Society of Technical Agriculturists.—Officers for 1923-24: President, H. Barton, Macdonald College, Que.; Vice-Presidents, E. A. Howes, University of Alberta, Edmonton; Jules Simard, Dominion Seed Branch, Quebec; Honorary-Secretary, L. H. Newman, Dominion Cerealist, Ottawa; General Secretary, Fred H. Grindley, Box 625, Ottawa.

NEW PUBLICATIONS

DOMINION DEPARTMENT OF AGRICULTURE

Experimental Station, Lennoxville, Que., 1922.—Report of the Superintendent, J. A. McClary. Dominion Experimental Farms.

Experimental Station, Lethbridge, Alta., 1922.—Report of the Superintendent, W. H. Fairfield, M.S. Dominion Experimental Farms.

Root Maggots and Their Control.—By R. C. Treherne, Chief, Division of Field Crop and Garden Insects, Entomological Branch.—Pamphlet No. 32.—New Series.

Annual Review of the Live Stock Market and Meat Trade Situation, 1922.—Comments on supply and demand. Comparative statistical tables. By P. E. Light, B.S.A., and D. M. Johnson, B.S.A., Markets Intelligence

and Stock Yards Service Division, Live Stock Branch.—Pamphlet No. 34.—New Series.

ONTARIO

Agricultural and Experimental Union, 1922.—Forty-fourth Annual Report.

Sweet Clover.—Bulletin 296. Ontario Agricultural College.

Grafting Fruit Trees.—By Jas. A. Neilson, B.S.A., M.S. Bulletin 294. Ontario Agricultural College.

Agricultural Societies, 1922.—Appendix to Annual Report. Results of competitions in standing field crops and prize-winning grain at winter fairs. The Canadian National and Central Canada Exhibitions.

BRITISH COLUMBIA

Care of Milk and Cream.—Dairy Circular No. 6. Department of Agriculture.

Bee Culture in British Columbia.—Bulletin No. 92. By W. J. Sheppard, Provincial Apiarist; A. W. Finlay and J. F. Roberts, Assistants. Department of Agriculture.

The Okanagan Valley.—Agricultural Department Circular No. 40. By William J. Bonavia, Secretary, Agricultural Department.

Poultry Farm Survey, 1921.—A Report on Sixty-five Commercial Poultry Farms in the Lower Fraser Valley and Vancouver Island. Issued by the Department of Poultry Husbandry, College of Agriculture, University of British Columbia, Vancouver. Agricultural Department Circular No. 41.

NOVA SCOTIA

The European Apple Sucker.—Bulletin No. 10. By W. H. Brittain, Provincial Entomologist.

Annual Report of the Secretary for Agriculture, 1922.

MISCELLANEOUS

Western Canada Live Stock Union, 1922.—Proceedings of the Tenth Annual Convention.

The Trench Silo.—By G. H. Hutton, Superintendent of Agriculture and Animal Industry. Canadian Pacific Railway Company. Department of Natural Resources.

Sanitation.—Sewage treatment for isolated houses and small institutions where municipal sewage system is not available. By B. Evan Parry, M.R.A.I.C., Supervising Architect. Publication No. 1. Issued by the Department of Health, Ottawa.

Report on the Grain Trade of Canada.—For the Crop Year ended August 31 and to the close of Navigation, 1922. Issued by the Dominion Bureau of Statistics, Internal Trade Branch, Ottawa.

Holstein-Friesian Herd Book.—Volume XXVI. Containing a record of all Holstein-Friesian cattle approved and admitted for registry since the publication of the twenty-fifth volume of this book, under the by-laws and regulations of the Holstein-Friesian Association of Canada. W. A. Clemons, Secretary and Editor.

Canadian National Record for Sheep.—Volume II. Compiled and edited in the office of the Canadian National Live Stock Records, Ottawa, and published by the Canadian Sheep Breeders' Association, 1922.

The Clydesdale Stud Book of Canada.—Volume XXX. Compiled and edited in the office of the Canadian National Live Stock Records, Ottawa, and published by the Clydesdale Horse Association of Canada, 1922.

THE LIBRARY

LIST OF PRINCIPAL ACCESSIONS TO THE DEPARTMENTAL LIBRARY, INTERNATIONAL INSTITUTE BRANCH, DEPARTMENT OF AGRICULTURE.

Supplying Britain's meat, by G. E. Putnam. London, Harrap, 1923. 169 p. il.

The potato: its culture, uses, history and classification, by William Stuart. Montreal, J. B. Lippincott co., 1923. 518 P. il.

The story of the maize plant. by P. Weatherwax. Chicago, University of Chicago press, 1923. 247 p. il.

Les bles cultives. Paris, Denaiffe & Colle. 151 p. il.

Plantes nuisibles a l'agriculture, par G. Fron. Paris, Librairie J. B. Bailliere et fils, 1917. 346 p. il.

Social and economic conditions in the Dominion of Canada. Philadelphia, American academy of political and social science, 1923. 367 p.

Marketing live stock, by H. W. Vaughan. Chicago, American institute of agriculture, 1922. 36 p.

Marketing grain, by W. J. Spillman. Chicago, American institute of agriculture, 1922. 60 p. il.

Marketing dairy products, by C. W. Larson. Chicago, American institute of agriculture, 1922. 36 p.

How the city consumer influences marketing, by C. S. Duncan. Chicago, American institute of agriculture, 1922. 12 p.

Why we have a marketing problem, by Sydney Anderson. Chicago, American institute of agriculture, 1922. 16 p.

Costs and income in land utilization, by R. T. Ely. Ann Arbor, Mich., Edwards bros., 1922. 163 p.

Characteristics and classification of land, by R. T. Ely. Ann Arbor, Edwards bros., 1922. 150 p.

Land policies, by R. T. Ely. Ann Arbor, Mich. Edwards bros., 1922. 172 p.

Effects of the war upon French economic life, ed. by Charles Gide. Oxford University press, 1923. 197 p.

Die deutsche volkswirtschaft in produktion und verbrauch, by Dr. K. Leibig. Washington, Carnegie endowment for international peace, 1922. 230 p.

Ireland. Commission of inquiry into the resources and industries of Ireland. Minutes of evidence. Dublin, 1920. 2 parts.

Economic conditions of agriculture at home and abroad, by Dr. A. G. Ruston. (Journal of the farmers' club, April, 1923).

Enseignement agricole; lois, decrets, arrêtes, circulaires et instructions. Paris, Imprimerie nationale, 1921. 246 p.

Comparison of tariff acts. Washington, 1922. 379 p.

Graphic methods for presenting facts, by W. C. Brinton. New York, The engineering magazine co. 1914. 371 p. il.

The productivity of hill farming, by J. P. Howell. Toronto, Oxford University press, 1922. 25 p.

Agriculture and the guild system, by M. Fordham. London, P. S. King & son, ltd. 1923. 24 p.

Chicago wheat prices for eighty-one years; daily, monthly and yearly fluctuations and their causes, by J. E. Boyle. Ithaca, Cornell University, 1922. 71 p.

The value of economic study in agricultural education and farm management, by A. W. Ashby. Aberystwyth, Eng. Agricultural society of the University College of Wales. 12 p.

Food production in war, by T. H. Middleton. Oxford, Clarendon press, 1923. 383 p.

The federal farm loan act, 1923. Washington, 1923. 32 p.

Social aspects of the food surplus in the United States, by B. Ostrolenk, Menasha, Wis. 1922. 92 p.

The country newspaper, by M. Van Marter Atwood. Chicago, A. C. McClurg & co. 1923. 137 p.

The county agent and the farm bureau, by M. C. Burritt. New York, Harcourt, Brace & co. 1922. 269 p. il.

Hardy border flowers, by H. H. Thomas. Toronto, Cassell, n.d. 144 p. il.

Engineering on the farm; a treatise on the application of engineering principles to agriculture, by J. T. Stewart. New York, Rand, McNally & co. 1923. 538 p. il.

Farm science; a foundation textbook on agriculture, by W. J. Spillman. New York World book co. 1919. 344 p. il.

Lindlahr vegetarian cook book and A.B.C. of natural dietetics, by Mrs. Anna Lindlahr and

Henry Lindlahr. Chicago, Lindlahr pub. co. 1922. 535 p.

The fern lover's companion; a guide for the Northeastern States and Canada, by G. H. Tilton. Boston, Little, Brown & co. 1923. 210 p. il.

The new air world; the science of meteorology simplified, by W. L. Moore. Boston, Little Brown & co. 1922. 326 p. il.

Railroad freight transportation, by L. F. Lorree. New York, D. Appleton & co. 1922 771 p.

The early herdsmen, by K. E. Dopp. New York, Rand McNally & co. 1923. 231 p.

A handbook of the community church movement in the U.S.A., by D. R. Piper. Excelsior Springs, Mo. The community churchman co. 83 p.

A laboratory handbook of bio-chemistry, by P. C. Raiment and G. L. Peskett. London, Edward Arnnold & co. 1922. 102 p. il.

Building a community, by S. Z. Batten. Philadelphia, The Judson press, 1922. 167 p.

Bibliography of the woods of the world with emphasis on tropical woods, by S. J. Record. New Haven, Yale university, 1923. 40 p. mimeo.

Hogs, by A. J. Lovejoy *with supplementary chapters on feeding*, by J. M. Evvard. Chicago, Frost pub. co. 1919. 212 p. il.

The calf club manual. Brattleboro, Vermont, The Holstein-Friesian Association of America, 1922. unpaged.

Conference on scientific and industrial research; arranged by the Canadian manufacturers' association, Ottawa, Feb. 20, 21 and 22, 1923. Toronto, The Canadian manufacturers' association, 1923. 166 p.

The letters of Agricola on the principles of vegetation and tillage, by John Young. Halifax, King's Printer, 1922. 368 p.

Poultry keeping on the farm, by Edward Brown. London, Benn bros. 1923. 54 p.

Animal nutrition, by E. T. Halnan. London, Benn bros. 1923. 52 p.

Insect pests and fungous diseases of farm crops, by A. Roebuck. London, Benn bros. 1923. 55 p.

Farm costing and accounts, by C. S. Orwin. London, Benn bros. 1923. 31 p.

The fishes of Illinois, by S. A. Forbes and R. E. Richardson. Springfield, State printer, 1920. 357 p. il.

Ancient man; the beginning of civilizations, by H. W. Van Loon. New York, Boni and Liveright, inc. 1922. 208 p. il.

The ornithology of Illinois. Springfield, State printer, 2 vols. 1889.

Report to the Board of agriculture for Scotland on the financial results on 65 farms for the period 1919 to 1921 and on the cost of production of 1920 crops and of milk. Edinburgh, Board of agriculture for Scotland, 1922. 30 p.

The settlement horizon, by R. A. Woods. New York, Russell Sage Foundation, 1922. 499 p.

Elements d'economie rurale non-technique, par Em. Vieberg. Brussels, 1922. 575 p.

Speculation and the Chicago board of trade, by J. E. Boyle. New York, Macmillan 1920. 277 p.

Quebec. Comite permanent de l'agriculture, de l'immigration et de la colonisation. Rapport sur l'opportunite de creer un credit agricole. Quebec, 1922. 239 p.

Cost of marketing grain; a history of certain carloads of grain from the farmer to the terminal buyer, by J. E. Boyle. 24 p.

The packing industry: a series of lectures given under the joint auspices of the School of commerce & administration of the University of Chicago & the Institute of American meat packers. Chicago, 1923.

Pruning, by W. J. Allen. Sydney, N.S.W., Dept. of agriculture, 1921. 191 p.

The pruning book, by R. B. Gilman. Philadelphia, Henry Disston & sons, 1921. 105 p. il.

British Basidiomycetes; a handbook to the larger British fungi, by C. Rea. Cambridge, University press, 1922. 799 p.

A bibliographic enumeration of Bornean plants, by E. D. Merrill. Singapore, Fraser & Neave, ltd. 1921. 637 p.

Botanical features of the Algerian Sahara, by W. A. Cannon. Washington, 1913. 81 p.

Culture des plantes medicinales, Paris, Publications agricoles de la Compagnie d'Orleans, 1922. 110 p. il.

New essentials of biology, by G. W. Hunter. New York, American book co. 1923. 453 p. il.

A real country teacher, by J. Field. Chicago, A. Flanagan co. 1922. 119 p.

Climatic changes; their nature and causes, by E. Huntington, Research associate in geography, Yale university, New Haven, Yale university press, 1922. 329 p.

Elementary geology, by A. P. Coleman, Toronto, J. M. Dent & sons, 1922. 365 p.

The parliamentarian, by C. W. Trow. New York, The Gregg pub. co. 1920. 163 p.

History of agriculture in Wisconsin, by Joseph Schafer. Madison, State historical society of Wisconsin, 1922. 212 p. il.

The beginnings of agriculture in America, by L. Carrier. New York, McGraw-Hill book co. 1923. 323 p.

Rural Michigan, by L. A. Chase. Toronto, Macmillan co. 1922. 492 p. il.

From Newton to Einstein, by B. Harrow. New York, D. Van Nostrand co. 1920. 116 p.

Vade-mecum du forestier. Besancon, Imprimerie Jacques et Demonstrond, 1921. 192 p.

Mechanical devices in the home, by E. Allan. Peoria, Ill., The Manual Arts press, 1922. 251 p. il.

Constructing concrete porches, by A. A. Houghton. New York, Norman W. Henley publishing co. 1912. 62 p.

Trade and industry of Finland.Helsingfors, Finland, J. Simelius' Heirs printing co. 746 p.

Newfoundland, compiled by H. M. Mosdell. St. John's, 1920. 94 p. il.

L'Algerie et ses produits.Algiers, Syndicat commercial algerien, 1922. 209 p.

Syllabus of Japan, by K. S. Latourette. New York Japan society, inc. 1923. 44 p.

Tropical agriculture in Australia. Melbourne, Commonwealth immigration office, 1921. 32 p.

Humane horse-training, by P. F. Thorn. London, Hutchinson & co. 1922. 287 p.

Feeds and feeding; a handbook for the student and stockman, by W. A. Henry rewritten by F. B. Morrison; 18th ed. Madison, Henry-Morrison co. 1923. 770 p.

Dogs as home companions, by A. F. Hochwalt. Cincinnati, Sportman's digest, 1922. 129 p.

Breeders calendar and year book, 13th ed. 1923. New York, Field pub. corp. 1923. 151 p.

Outdoor opportunities. Kansas City, Mo., Outdoor enterprise publishing co. 1922. 256 p. il.

Poultry, by A. W. Richardson. New York, Harper, 1922. 152 p.

Line breeding for pigeon fancier, by E. R. B. Chapman. Chicago, American pigeon keeper. Chicago, American pigeon keeper, 1922. 32 p.

Harness repairing, by L. M. Roehl. Milwaukee, Wis., Bruce publishing co. 53 p.

Starting right with bees, by H. G. Rowe. Medina, O., A. I. Root co. 1922. 128 p. il.

Remarks on canning, by Sir F. A. Nicholson. Madras, 1921. 146 p.

A manual of American and European mammals. New York, Funk & Wagnalls co. 35 p.

Heredity in poultry, by R. C. Punnett. Toronto, Macmillan and co. 1923. 304 p.

The book of wild flowers for young people, by F. S. Mathews. New York, G. P. Putnam's sons, 1923. 397 p. il.

Fur facts, by A. M. Ahern. St. Louis, Mo., Funsten bros & co. 1922. 304 p.

Progressive agricultural programs, written and compiled by Mignon Quaw. Franklin, O., Eldridge entertainment house, 1922. 135 p.

Many roads to health, by M. K. Moriarty New York, Child health organization of America, 1922. 63 p. il.

Manuel du laitier-cremier, by A. Corvez. Paris, Librairie J. B. Bailliere et fils, 1923. 307 p. il.

Elementary agriculture, by H. J. Waters. New York, Ginn & co. 1923. 349 p.

The school book of forestry, by C. L. Pack. Washington, The American tree association, 1922. 159 p. il.

Trees as good citizens, by C. L. Pack. Washington, The American tree association, 1922. 257 p. il.

Manual in agriculture: making things, by F. L. Bennett. Pierre, S.D., J. F. Olander co. 1922. 155 p.

Principles of marketing, by F. E. Clark. Toronto, Macmillan, 1922. 570 p.

Soil conditions & plant growth, by E. J. Russell. Toronto, Longmans, 1921. 406 p.

PART V

The International Institute of Agriculture

FOREIGN AGRICULTURAL INTELLIGENCE

All communications in regard to this section should be addressed to T. K. Doherty, International Institute Commissioner, Department of Agriculture, West Block, Ottawa.

VISIT OF THEIR MAJESTIES KING GEORGE V. AND QUEEN MARY TO THE PALACE OF THE INTERNATIONAL INSTITUTE OF AGRICULTURE, ROME, ITALY

On the 8th of May, 1923, Their Majesties King George V and Queen Mary, accompanied by Their Majesties the King and Queen of Italy, visited the Palace of the International Institute of Agriculture at Rome, Italy.

Their Majesties were received by the President of the Institute, the Honourable Senator Edoardo Pantano, and by the members of the Permanent Committee, including Sir Thomas Elliott, Bart., K.C.B., ex-Secretary for Agriculture for England and Delegate of Great Britain and the Dominions on the Permanent Committee of the Institute.

To the President's address of welcome His Majesty George V made the following reply:—

"I thank you, Mr. President, on behalf of the Queen and for myself, for your eloquent address, and I thank you gentlemen, Delegates of the Institute, for the cordial reception you have given us.

"Agriculture has a vital and universal importance, for it not only provides the immediate necessities of life, but it affords a firm foundation of social and political stability, and at the same time assures to the sober and industrious dwellers on the land a life under the most healthy and natural conditions.

"The welfare and prosperity of the agricultural communities are therefore the objects of the special solicitude of the Governments and peoples of all the countries. I personally follow with the closest attention the vicissitudes of agriculture, not only in the British Empire, but in the whole world.

"I am well aware that, aside from the ordinary uncertainties of agriculture, there are to-day special difficulties to be met on account of the instability of prices following the great war. My sympathies go out to my comrades of the farm in the efforts they are making and in the anxieties they are experiencing. But I do not despair. I have confidence that their traditional patience, courage and enterprise will triumph over the present crisis.

"After the ravages of the war, the way that leads to peace and prosperity is rough and tortuous, and perhaps the easiest and most direct way is to be found in that international co-operation so well followed for eighteen years by the International Institute of Agriculture. One of the chief functions of the Institute is to furnish the agriculturists of all countries with the most recent information, either practical or the result of scientific research. The necessity of this organization is from year to year more generally recognized throughout the British Empire, and the fact that both Governments and agriculturists have through it adopted the most modern methods promises well for the future of agriculture. There is evident in this beautiful land of Italy the same spirit of progress that exists in other countries. In this sphere, as in others, the work of the International Institute of Agriculture has a special value, and the Queen and I are happy to have this opportunity of inspecting it.

"I shall always closely follow the progress of the Institute, having faith that, with the generous assistance of His Majesty the King of Italy and with the co-operation of the adhering States, it will continue to render great services to the most essential and the most ancient of all occupations."—(*Translated from the French.*)

SCIENCE AND PRACTICE OF AGRICULTURE

GENERAL INFORMATION

The Radio-Telephone as a Means of Distributing Weather Forecasts, Crop Reports, and General Agricultural News.—I. *Journal of the Ministry of Agriculture*, London, Aug., 1922, p. 444.—II. *The Dakota Farmer*, March 1, 1923, p. 231.

In England, in France and in the United States the wireless telephone has already, to a more or less extent, been brought to the assistance of agriculture. The feasibility of using wireless telephoning in this connection has been amply proven, and the results have been satisfactory.

The British Air Ministry issues daily by means of radio broadcasting a number of weather reports of considerable use to the farmers, and a pamphlet giving particulars concerning these messages has been distributed. Special forecasts are also issued during the harvest season.

The National Meteorological Office of France broadcasts weather bulletins from the station on the Eiffel tower twice daily. Every commune is to have a receiving station in the parish school, police station, or at the home of some chosen person, where the messages will be received and posted. The messages are communicated in the district by the ringing of a bell—no ringing if there is no change of weather, three strokes to announce rain, six to announce frost, ten to announce storms or hail. In England, where the farm houses are more isolated than in France, it is proposed that the messages be received at suitably chosen towns, and redistributed from them to villages and to farms in possession of the cheap wireless receivers already at the disposal of the general community.

The United States Department of Agriculture has organized and developed a comprehensive radio programme that covers the entire country. This service includes market reports, weather information and general agricultural news. At the present time the radio crop and market news service of the Bureau of Agricultural Economics is handled by four high-powered radio-telegraph stations of the Navy Department, five strong radio-telegraph and one radio-telephone station of the Post Office Department, and 78 radio-telephone stations belonging to colleges, state agricultural departments, electrical companies, newspapers, stockyards, and other interested concerns.

In July 1922 there were 98 stations in 35 States broadcasting daily weather forecasts and warnings by radio-telephone. Weekly reports on the effect of weather on crops and highways, and other information issued by the Weather Bureau are also disseminated by the station.

An international weather information service and crop reporting service is also being built up. A daily radiogram is sent to the French Meteorological Service and broadcast from the Eiffel tower all over Europe. The Weather Bureau receives radio reports from European countries in exchange. Crop reports are exchanged with the International Institute of Agriculture at Rome and with the Egyptian Government.

Another service consists of a number of short speeches on various agricultural topics which are broadcast from the Naval Radio Station at Arlington, Va. Educational talks on all subjects pertaining to farming are broadcast by private stations.

The United States Department of Agriculture does not operate any wireless equipment, but the radio distribution work is carried on through stations operated by other Government Departments, by corporations, and by private individuals.

The prices being paid for cash grain as well as for grain for future delivery in the Exchange Room of the Chamber of Commerce of Minneapolis, are now being broadcast throughout the Northwest of the United States by radio. The following quotation from "The Co-operative Manager and Farmer," February, 1923, shows how this is done:—

"The Minneapolis Chamber of Commerce quotations are being broadcast through the courtesy of the Northwestern National Bank, one of the subscribers above mentioned. The time schedule of these quotations is as follows: At 9 : 40 a.m. the "opening" prices of grain and flax for "future delivery." At 10 : 30 and at 11 : 30 a.m. the "going" prices of grain and flax for "future delivery." At 1 : 30 p.m. the "official closing prices" of cash grain and flax, also grain and flax for future delivery. This schedule applies to every business day, including Saturday.

"A Western Union "ticker" or type recording telegraph instrument has been placed in the transmitting room of the Oak Grove station by the Chamber of Commerce Quotations Committee. This instrument is connected directly with the so-called piano grain ticker transmitter located in the Exchange Room of the Chamber of Commerce of Minneapolis. The operator of this piano grain ticker transmitter delivers to the Oak Grove station the grain prices above mentioned, and these prices appear in type upon the "tape" which is constantly issuing from the ticker in the Oak Grove station. The operator at the Oak Grove station immediately broadcasts these prices over the Northwest by radiophone."

The Chicago Board of Trade also broadcasts market and crop news from a powerful

sending station. In an article in the "Price Current-Grain Reporter," May 9, 1923, describing this service the author says:—

"It has always been a difficult problem for the farmer to choose what he considers the most opportune time to ship his grain. Usually he is not in a position to study the daily price changes, and certainly not on the very day the changes are taking place. By the new method the farmer is closely linked with his market. He may have, hot off the wires, the latest news that is likely to affect prices of grain and produce; he may have the freshest statistical information from Government and other crop reporting sources; he may have price quotations almost while they are being posted.

"Indeed, all the facilities of the vast crop-reporting system of the Chicago Board of Trade are now placed at the disposal of the farmer free of charge. And these facilities are one of the marvels of modern commerce."

Books on Radio in the Library of the Institute Branch.—To any reader who desires to build for himself a radio telephone set or otherwise acquire one and operate it, the Branch gladly extends the privilege of borrowing a number of the books mentioned hereunder, in so far as they are available at the time of request. In case the particular books asked for are loaned, others equally as good will, if possible, be substituted.

The Complete Amateur Radio Book, by M. J. Grainger. McClelland & Stewart, Toronto, 1922. 159 pp. illustrated.

Radio Phone Receiving, by E. Hausman. D. Van Nostrand Company, New York, 1922. 180 pp. illustrated.

Practical Wireless Telegraphy, by E. E. Bucher. 336 pp. illustrated. Wireless Press, New York, 1921. A complete text-book.

Radio For Beginners, by J. R. Cameron. The Technical Book Company, New York, 1922. 160 pp. illustrated.

Radio for the Amateur, by A. H. Packer. The Goodheart-Wilcox Company, Chicago, 1922. 207 pp. illustrated.

1011.—**Influence of the Weight and Size of Seeds on Yield.**—Desprez, F., in *Journal d'Agriculture pratique*, Year 86, No. 7, pp. 141-143. Paris, Feb. 18, 1922.

It has always been admitted that the largest and heaviest seeds gave the best cultural results.

Varro, Columella, Pliny and in more recent times Olivier de Serres, P. Joigneaux, Schribaux, etc., have recommended this mechanical selection for obtaining the most vigorous plants and the greatest yield. Some agriculturists however, have attributed but slight importance to these characters of the seed. Thus, the Belgian agriculturist De Caluwe published a pamphlet in 1908 in which he set out the results of experiments carried out at the "Jardin d'Essais" at Ghent with oats and barleys which were unfavourable to large seeds. Further, basing his conclusions on tests made by Janneson, of the Glasterberry Station in Scotland, by Th. Remy, of the Agricultural College of Bonn-Poppeledorf in Germany, and others he came to the conclusion that the results of practical and carefully arranged experiments tended to negative the superiority of large heavy seeds.

The writer refers to some experiments made by him since 1896 at the Agricultural Experimental Station of Cappelle (Nord) with 5 varieties of wheat sown on 5 plots of an area of 50 acres each; one half of each plot was sown with large seed and the other with small. The superiority of the large seeds, so far as the yield of grain calculated by weight was concerned, was evident and in some cases very marked. The difference was greatest in the case of a yellow bearded wheat for which the large seed gave a yield of 70 bushels per acre and the small seeds a yield of 57 bushels, a difference of 13 bushels per acre. For the other varieties, the difference, though less marked, was still considerable. The specific gravity of the grain (weight of 1 hl. expressed in kg.) was the same for two varieties and for the other three, that of the large grain was slightly greater than that of the small grain. There was no appreciable difference in the weight of the straw.

In 1922 fresh experiments were undertaken at the Cappelle Station with oats and barley so as to have them under conditions identical with those of De Caluwe.

CROPS AND CULTIVATION

1012.—**Critical Period of Wheat as Regards Rain.**—Azzi, G., in *Nuovi Annali del Ministero per l'Agricoltura*, Year I, No. 2, pp. 299-307. Rome, Dec. 31, 1921.

In the development of cereals critical periods are encountered during which the plant feels most acutely the unfavourable effects of its environment, such as drought.

In the case of wheat the greatest need of moisture is felt; (1) during germination and the initial growth of the young plants; (2) during growth; (3) during the period of earing. The critical period for the formation of ears was previously determined by the writer by means of the formula of correlation and by making use of statistical, meteorological and phenological data ascertained for the Province of Girgenti. It follows that the period of about twenty days required to form ears is of capital importance; if, during this period the total amount of atmospheric precipitation is less than the minimum compatible with the normal development of the plant, the harvest will be poor, even if

rain falls during the remainder of the growth period. Wheat can give good crops even with a total rainfall of less than 12 inches; but as the minimum is approached the influence of the distribution of the rainfall prevails and becomes decisive during the critical period.

In this connection the writer has investigated experimentally 4 varieties of wheat: *Apulia* (Rietta X Spelta), *Cervaro*, *Carlotta Strampelli* (Rietta X Massy) and *Spelta*. The experiment was carried out at the Botanical Garden of the University of Rome during the agricultural year 1920-21. The plants were grown in pots; copiously watered from sowing on December 29 up to April 12, and from the 7th day after forming ears up to maturity; during the interval, on the other hand, the plants were given a variable number of waterings: 0—1—2—5. The best selected varieties, of high specific productivity, *Spelta* and *Carlotta*, suffered most from the absence or slightness of the watering, the two other varieties were less exacting.

The harmful effect of insufficiency of water during the critical period is shown by:—the total production of grain expressed in weight—the average weight of the grains—the length of the stalks—the length of ears—the weight of straw—etc. There was also a delay in earing and reaching maturity, more noticeable for the selected varieties, especially *Carlotta Strampelli*. The length of the ears did not diminish correlatively with the length of the stalk; on the contrary, in the variety *Apulia*, in spite of want of moisture they maintained an almost invariable length. This capacity of decreasing the length of stalk while maintaining the length of ear unchanged, may be interpreted as a character of adaptation to drought.

With the varieties *Spelta* and *Carlotta*, not even as many as 5 waterings *made in the conditions of the experiment* were sufficient for them to reach the production of the two other varieties.

Production therefore depends on two factors; specific productivity and resistance to the unfavourable conditions of environment. In the 4 varieties studied, these two factors were more pronounced in the *more hardy* varieties. The variety *Cervaro* especially seems to unite in the best proportions the characters of specific productivity and resistance to drought; it is well suited to a dry climate.

Adaptation to drought may arise:—(1) by advancing or retarding the formation of ears so as to alter the critical period; (2) if the roots are deep; (3) if the structure of the plant is such as to enable it to economize moisture. This last is true resistance to drought, and the real object of these experiments.

1022.—**Soil Fatigue.**—D'HUBERT, A., in *Journal d'Agriculture pratique*, Year 86, No. 7, pp. 136-138. Paris, Feb. 18, 1922.

The writer defines the fertility of a good soil as its capacity to produce vegetable matter, independently of its chemical composition. Decrease of fertility has been attributed to several causes:—

(1) The most simple hypothesis is the soil's exhaustion in nutritive matter. Recent research has shown that this is not adequate, for the composition of soil solutions is, if not constant, at least almost invariable.

(2) Another explanation of soil fatigue is furnished by Russell and his collaborators who bring in *antagonism between the germs in the soil*, in which the injurious germs get the better of the useful germs. The former class is represented mainly by protozoa, which by phagocytosis would destroy the latter, represented chiefly by *Azotobacter*. The exhaustion of the fertility of the soil would be due to the rapid increase of the protozoa. This is perfectly correct when it is a matter of crops *in vitro*, but, in nature, protozoa and *Azotobacters* play a secondary part relatively to other living agents. Moreover this hypothesis does not explain why a particular crop e.g. lucerne, cannot be grown again on the same ground except after a certain period of repose.

(3) *The injurious effect exercised by the organic residues* left by the plant in the soil is another suggested explanation. These residues may be either dead roots, or pellioles coming from the desquamation of the live roots. In this order of ideas, Prianichnikow and Peritourine have proved experimentally that the introduction of fragments of roots into a pot of screened soil reduces the yield. The writer has repeated this experiment under conditions permitting a more rigorous comparison. As soil is too complex a medium for it to be possible to study in it each of the factors which regulate vegetation, he preferred to make use of a sterilized nutritive liquid, in which he grew maize, following the method suggested by Mazé. Three series of experiments were made:—one series grown in a liquid which had not yet borne any crop, one series in a liquid which had already borne a crop of maize, one series in a fresh liquid, but into which fragments of roots had been introduced.

The average lengths of stalk and roots showed marked increases from the 1st to the 2nd and from the 2nd to the 3rd series; they were respectively 2·4 and 1·6 inches, 5·3 and 7·1 inches, 4·9 and 7·9 inches. It is therefore possible to conclude that, at least in the case of young plants, the presence of the dead roots of a plant is very favourable to and does not hinder growth.

(4) There remains a fourth hypothesis, closely connected with the last, namely that the plant *elaborates waste products injurious* to itself, which check the development of plants of the same species, behaving like toxins. Although this hypothesis is still slightly inconsistent, it alone can explain several facts.

It is supported by Whitney, who quotes the following commonly observed fact: beneath the trees on a lawn there is no vegetation, and the grass disappears. This lack of vegetation is not due to shade for it would then be observed only under the north part of the tree, where the shade is more persistent; but this is not the case, the lack of vegetation being uniform under the crown of the tree. This lack of vegetation is also not due to exhaustion of the soil by the roots of the tree, either in nutritive matter or in moisture, for, whatever amount of manure and water is given, the soil does not recover its fertility. This is therefore in all probability due to the excretion, by the leaves, of injurious substances which the rain carries down to the ground below. It must also be remembered that acid soils are infertile; now acidity in itself, is not injurious; in fact cultures in liquid media require an acid reaction; nor can it be stated that acidity is injurious as checking the process of nitrification; in fact the plant assimilates ammoniacal nitrogen as well as nitric nitrogen; it follows that acidity is merely an indication of the presence of injurious substances.

Applications.—This hypothesis has led to a practical application for ascertaining the nutritive value of a soil. The method recommended by Whitney consists of rapid comparative experiments of growth, made so as to shield the soil against the action of oxygen which would destroy the vegetable toxins, which are highly liable to oxidization. With this object, the soil tests are made in metal pots steeped in melted paraffin; the experiment lasts only 2 or 3 weeks; the weights of the crops are then taken. By adding manures to the soil it can be ascertained which is the more suitable. The soil Bureau of the United States has used this method for more than 10 years; it is not absolute, but, in practice, its results agree with those given by cultures in the field and chemical analyses do not always give such satisfactory results. It is desirable that further research should be made regarding the nature of the supposed toxic substances and the right means of destroying them. Up to the present time the use of carbon disulphide, toluen, calcium sulphide and heat have been tried empirically; but a strict scientific study is required.

922.—Influence of Irrigation on the Composition of the Soil.—Greaves, J. E., in *Journal of the American Society of Agronomy*, Vol. 14, No. 5, pp. 207-212, bibliography of 7 works. Geneva, N.Y., May, 1922.

Water has a double action on the soil. It assists or hinders the normal development of the processes in the soil, and its most manifest influence is over the process of nitrification, of which the maximum is attained when the soil contains 60 per cent of its water-holding capacity. Above or below this concentration, there is a decrease; and nitrification ceases when the quantity of water reaches or exceeds 90 per cent. As regards nitrification, therefore, an excess of water is more detrimental than an insufficiency. Under good moisture conditions, from 50 to 100 lb. of nitric acid may be produced in an acre of soil during a season; it is a well-known fact that this acid is of great assistance in the liberation of phosphorus and potassium. The moisture content acts similarly, but in a less degree, on ammonification, the maximum production of which is also reached when the soil contains 60 per cent of its total water-holding capacity. All the other processes which take place in the soil are also dependent on its water content; for instance, the production of carbonic acid gas; it also plays an important part in the solution of tricalcium phosphate. Finally, it influences the production of lactic, acetic, butyric, sulphuric, and other acids, which help to dissolve potassium, etc.

The other fundamental action of irrigation water is that it brings or carries away plant food; it impoverishes or enriches the soil. To gain an idea of the enormous quantity of substances that water may carry off from the soil, it is only necessary to consider the constituents of river water. The substances in solution such as for instance, sodium chloride are not generally of any importance in agriculture, but useful substances, such as potassium, nitrogen and phosphorus, are not lacking. The writer describes certain analyses on this question. Some irrigation drain waters are still richer; certain of them contain as much as 133 pounds per acre-foot.

When irrigation is carried out properly, the water, as it evaporates, deposits the substances it contains, as in the case of the Nile. Thus, in Utah, the waters used for irrigation contain 0·79 to 59·0 parts of potassium per million, or an average of 5 parts which may be used by the soil. Irrigation waters contain besides potassium, nitrogen and other useful soluble substances;

they are therefore capable of improving the soil. The great point is to irrigate *in moderation* in order not to *wash out* the soil. Irrigation may transform the desert into a garden or render the most productive fields barren, according as it is well or ill done.

924.—The Sowing of Seeds and Scattering of Chemical Fertilizers Simultaneously in Parallel and Close Lines.—BANDRY, A., in *Comptes Rendus des seances de l'Academie d'agriculture de France*, Vol. 8, No. 20, pp. 574-580. Paris, 1922.

Low crop yield is due less to the insufficiency of chemical fertilizers used than to their imperfect utilization by the crops. It was decided to place within immediate reach of the young plants the mineral nutriment needed by them from the earliest stages of their growth. For 15 consecutive years the author studied the application to extensive cultures of the simultaneous scattering of chemical fertilizer and seed grain in close parallel lines. The results obtained are as follows:

(1) The maximum profit in practice from crops, both of cereals and pulse, has always been obtained by using quantities of chemical fertilizers varying from 270 to 360 lb. per acre.

(2) With more than 360 lb. of chemical fertilizer the value of the increase in weight of the crops did not correspond with that of the increase in weight of the chemical fertilizers used.

(3) The yield per acre of useful dry matter from the crops obtained by using 180 to 360 lbs. of chemical fertilizers spread in lines has been at least equal and often superior to that obtained on the same soil by using 540 to 900 lbs. of the same fertilizers distributed in the usual way.

(4) Chemical fertilizers sown in lines at a depth of 1 to $1\frac{1}{4}$ inches in close proximity to the seed have a beneficial effect on the young plants.

The author concludes that this method of rational utilization of chemical fertilizers is so effective that it has become possible to reduce the quantities hitherto judged necessary to ensure the maximum practical profit from crops by 50 to 60 per cent.

925.—Thirty Years of Field Experiments With Crop Rotation, Manure and Fertilizers.—MILLER, M. F., and HUDELSON, S. R., in *Missouri Agricultural Experiment Station Bulletin*, No. 182, pp. 1-43. Columbia, Missouri, April, 1921.

The authors proposed to ascertain the effects of crop rotation and continuous cropping upon unmanured and manured soil respectively. They realized that experiments over a long period are necessary in order to reduce to a minimum the influence of seasonal variation and to secure reliable results from the various rotations.

The data here reported include the results of 30 years experiments (1888-1918) with different systems of crops, manures, and fertilizers, designed to ascertain not only the effect upon crop yields, but also upon the soil.

The soil of the experiment field was a silt loam of a dark brownish grey colour, the surface drainage was generally good and the soil fairly uniform in fertility. The field was divided into 39 tenth-acre plots at first, though these were afterwards reduced to one-thirteenth acre and subsequently to one-fourteenth acre. The plots were planted with continuous crops and rotations of maize, oats, wheat, clover and timothy.

These crops were grown at the same time on untreated plots, on plots given manure, plots given chemical fertilizers such as nitrate of soda, muriate of potash and superphosphate, as well as on plots receiving both manure and fertilizers.

The applications of manure were much larger than is usual on the average farm (7-9 tons per acre); hence the effects upon the soil and crops were intensified, but weed growth was encouraged so that the grass and clover crops sown with the crops were smothered, and lodging was induced in wheat and oats.

The fertilizer treatment was based on the quantitative chemical analyses of the crops, the different elements being added in the same proportions that they were removed in maximum crops. The plot on which wheat was continually grown received sufficient nitrogen, phosphorus and potassium to equal the amounts contained in a 40 bushel wheat crop and the accompanying straw.

From the experimental data collected by the authors it appears that:

(1) *on untreated soil*, rotation gave very superior results to continuous cropping. In the case of maize, the yield is increased by lengthening the period between the crops, as is shown by the following figures:

20·9	bushels	with	continuous	cropping.	
32·6	"	"	3 years'	rotation.	
38·5	"	"	4	"	"
41·5	"	"	6	"	"

In the case of the other crops, the maximum yield is obtained from 4 years' rotation.

In the opinion of the authors, the low yield obtained by continuous cropping is due to several factors among which are insect enemies, weeds and disease, which are all favoured by growing the same crop on the same field year after year.

(2) *On soil treated with manure* so as to maintain its fertility, rotation gave better results than continuous cropping, although the differences in the yields of the various crops were not so great as in the case of the experiments carried out on unmanured soil.

The use of manure greatly increased the yield of continuous crops, especially in the cases of maize, wheat and oats, the average increase recorded being as follows:

Maize	14·0 bushels	per annum	per acre
Oats	10·4	"	"
Wheat	8·6	"	"
Clover	827 lbs.	"	"
Timothy	2,325	"	"

The above figures show the high value of manure on wheat, maize and timothy, the effect on continuous clover not being so good.

In the course of the long experiment period, it was found that a three-year rotation on an unmanured soil gives lower yields than are obtained from continuous crops on manured ground, whereas with a long rotation (4-6 years), better results are obtained than from continuous crops grown on manured soil. Judging from the soil analysis, it is evident however that manure is more effective than rotation in maintaining the fertility of the soil. In fact, although by means of careful rotation it is possible to some extent, to relieve soil exhaustion all the elements required cannot be supplied by this means. A combination of rotation and manure is best.

(3) *On soils treated with chemical fertilizers* the yield of the crops was kept up as well as when manure was used. On comparing the different results obtained it is seen that maize does better with manure, but wheat and oats are better with fertilizer. In general, this relative response of the different crops to manure and fertilizer agrees with the results of numerous other experiments made at the Missouri Experiment Station and at the Rothamsted Experiment Station in England, and the Pennsylvania Experiment Station.

Chemical fertilizers, especially phosphates, are particularly to be recommended for wheat.

In the case of plots receiving fertilizers only, even in the one cropped continuously with wheat the soil was not appreciably more compact than that of similarly cropped plots without treatment, contrary to the generally received opinion that large quantities of sodium nitrate tend to deteriorate the soil texture.

(4) *On soil treated with half-manure and half fertilizer*, better results were obtained than with chemical fertilizers alone; therefore mixed fertilizers are the best to employ as they also maintain the soil fertility. To determine the effect exerted on the soil by different methods of cropping, the authors had recourse to chemical analysis. At the end of 25 years samples were removed from the different plots and the nitrogen content was taken as an indicator of the amount of organic matter in the soil. Maize was found to be the most exhaustive crop as regards the nitrogen, after which come oats and wheat. Timothy appears to exhaust the soil least. As a rule, rotations are less exhaustive of soil nitrogen than any single crop. This may be due to nitrogen fixation by bacterial agency.

Chemical fertilizers, even when used in large quantities, did not keep up the soil nitrogen. Evidently most of the nitrogen not immediately used by the crop was removed by leaching, or denitrification. Manure on the other hand proved very effective in maintaining the nitrogen supply.

This long series of experiments proved that, in general, *crop rotation gives better results than continuous crops*. Among the rotations used the four-year rotation of maize, oats, wheat and clover gave somewhat better results than the others. In order to obtain good crops the soil must also be manured. As a rule, farmyard-manure and chemical fertilizers proved of about the same value from the point of view of crop yield, but farmyard manure was more effective in maintaining the fertility of the soil.

The application of a mixed fertilizer has proved to be the best method to maintain heavy crop yields without exhaustion of the land.

1145.—**The Value of Tetraphosphate as a Fertilizer.**—HUDIG, J., and NEIGER, C., in *Verslagen van Landbowkundige Onderzoekingen der Rykslandbouwproefstations*, No. XXV, pp. 140-159. Gravenhage, 1921.

The authors describe the circumstances which led to the starting of the tetraphosphate industry, the methods of manufacture and the success or non-success of this wartime fertilizer up to the present day. The fertilizer does not require sulphuric acid in its preparation and any quality of phosphates can be used, even such as are not suitable for the manufacture of superphosphates.

After referring to the reports of Menozzi and Belluci, the authors describe the investigations they have made respecting the value of tetraphosphate. The first experiment was made with oats grown in pure sand, in pots; these were given, as fertilizers, chloride of potash and magnesium sulphate; one set of these cultures were given nitrogen fertilizer in the form of nitrate of soda and the other nitrate of ammonium. The eight pots of each of these two sets received respectively as phosphatic manure; phosphate soluble in water—phosphate only slightly soluble—insoluble phosphate—low grade crude phosphate—high grade crude phosphate—the same high grade crude phosphate, heated to 700°C. and rapidly cooled—tetraphosphate—no phosphate at all. These experiments have shown that in a slightly acid medium, tetraphosphate and

the two other crude phosphates are of value. The favourable results obtained with tetraphosphate on rice plantations may probably be attributed to the acidity of the soil. The fact that Menozzi obtained unfavourable results was probably due to the fact that the soil used in his experiments contained a sufficiency of phosphates, or to its alkaline reaction. The cultures failed when grown in an alkaline medium with crude phosphate.

A second study was made by the authors by carrying out comparative field experiments with 17 per cent superphosphate, 18 per cent French, Somme phosphate and tetraphosphate containing 26 per cent of phosphoric acid. These trials showed that:

(1) in alluvial soils tetraphosphate and Somme phosphate were equivalent, although in sands of the "Anna-Paulownapolder" tetraphosphate was superior to French phosphate.

(2) in "roodoorngrond" super and tetraphosphate gave an increase of 13 per cent in yield.

(3) In the 22 cultures in sandy soil which responded to tetraphosphate, 6 gave a better yield with the tetraphosphate than with Somme phosphate; of these 6 cultures, three gave higher yields with tetraphosphate than when super was used; in the remaining three cases the two fertilizers proved to be equally effective.

These results were obtained with cultures of red clover, lupins, peas, and oats. On the other hand with cereals and potatoes, 4 instances were recorded in which tetraphosphate was inferior to crude phosphate.

The authors summarize their work as follows:

(1) In sandy soils which had received a manure with an alkaline reaction tetraphosphate did not give such good results as ground, crude phosphate, and was decidedly inferior to soluble phosphate.

(2) In sandy soils to which had been added a manure with an acid reaction, tetraphosphate gave good results; the best however were those with crude, ground phosphate. The yield with tetraphosphate was the same as that obtained with soluble phosphate.

(3) In the cases where tetraphosphate proved superior to superphosphate the results must be attributed to the acidity of the soil, which caused the superphosphate to be ineffective and to certain unknown factors in connection with plant requirements and soil reactions.

1024.—**Production of Phosphoric Acid by the Method of Electric Condensation and Precipitation.**—SWANN, T., in *Industrial and Engineering Chemistry*, Vol. 14, No. 7, pp. 630-631. Washington, July 1922.

Up to the present phosphoric acid has generally been prepared by the treatment of mineral phosphates or bones with sulphuric acid. The new method by electric precipitation, is actually in use at Anniston (Alabama, U.S.), where three electric ovens are employed, which require a power of 10,000 H.P. and 44,000 volts.

This method consists in fusing in the electric oven a mixture of crude phosphate, coke, sand and iron shavings. The phosphorus which by this means is set free combines partly with the iron and forms iron phosphide containing 25 per cent of phosphorus and part volatilizes with other gases in the oven and is oxidized in the air; the phosphoric acid of 90-95 per cent concentration is collected in specially designed condensers, after which it is refined by special methods. The particular advantage of this process consists in the production of a highly concentrated acid which is almost free from iron, as all the iron contained in the phosphorite separates out in the form of phosphide. The acid is sent out in barrels or in transport-tanks lined on the inside with a special acid-resistant, wax compound. For pharmaceutical purposes it is necessary to recrystallize the acid, as by this means a purity of 90 per cent can be obtained for medicinal use or for making oxygenated water.

This proces has already been applied to the manufacture of fertilizers for which purpose a great expansion can be foreseen.

Fertilizers have already been produced containing ammonia, phosphoric acid and potash, with a fertilizing power five times that of the ordinary product.

There should be some means of safeguarding the use of such a concentrated fertilizer, but the concentration will effect a great saving on freight, and it will also be possible to reduce the cost of the fertilizer. In order to fix ammonia, it will be an advantage to replace sulphuric acid by phosphoric acid and in this way to produce a fertilizer which will contain two of the three essential fertilizing elements.

1036.—**The Role of Manganese in Plants.**—McHARGUE, J. S., in *The Journal of the American Chemical Society*, Vol. 44, No. 7, pp. 1592-1598. Washington, July 1922.

The presence of manganese in the soil and in the ash of plants was detected by Scheele in 1774, but during the nineteenth century few researches were made as to the function of this element. Mention should be made of the work of Bertrand (1897) and of Brenchley (1914) who concluded that the manganese is an element essential to the economy of plant life. During the last 20 years, considerable attention has been given to the agricultural problem of manganese and the author knows of as many as 150 investigations on the subject.

While engaged on botanical research work necessitating a test for manganese, the

author found that the latter is present in the seeds of many plants, and especially in the seed-coats, the integument of wheat containing approximately 0·02 per cent of its dry weight of manganese. This induced him to make investigations for the purpose of determining the functions of manganese by growing seedlings in Pfeiffer's nutrient solution after carefully removing all trace of manganese from the compounds used in its preparation. This precaution was necessary as in previous experiments the calcium magnesium and iron salts used as plant nutrients were found to have contained the small percentage of manganese required by the seedlings. Several lots of wheat were grown, some with and others without manganese. No difference between them was noticed for the first 6 or 8 weeks, but a little later the plants deprived of manganese behaved very differently from the others; their leaves, owing to lack of chlorophyll, became yellowish-green instead of deep green. The differences between the two sets of plants increased as they approached maturity, those without manganese made a stunted growth and produced no seed. The dry weight of the plants given manganese exceeded by 135 per cent that of those deprived the element.

Other experiments were made with Alaska peas with very similar results. When analyzed, the plants that had received manganese were found to contain 0·179 per cent of this element, whereas those to which no manganese had been added showed only traces derived probably from the seeds. The importance of manganese to plant development was also proved by growing several different species on sand; at the present time there are 20 different series of experiments in progress on the subject.

It may be assumed that the small quantity of manganese always present in the seed is sufficient to maintain a normal metabolic process during the first few weeks of growth; afterwards the manganese is used up in the formation of new tissues and plants that do not receive a further supply of this necessary element become chlorotic. The first change to be noted is a lack in the development of chlorophyll in the lately formed tissues and the growing parts; finally the tips of the branches die back, and the plant almost ceases to develop further.

It appears that leguminous plants are more sensitive to want of manganese than non-legumes; this suggests that the element is concerned in nitrogen assimilation and the synthesis of proteins. Manganese apparently plays the part of a necessary catalyst in plant metabolism, and together with iron, functions in the synthesis of chlorophyll.

934.—**Supplies of Nitrogen Fertilizers.**—HASKELL, S. B., in *Journal of the American Society of Agronomy*, Vol. 14, No. 5, pp. 167-175. Geneva, N.Y., May 1922.

A comparison of the data collected for 1918 with that of other years has led the author to estimate that approximately one-half of the total supply of fertilizer nitrogen is derived from organic sources and the remaining half from mineral products. There is a tendency, however, for the consumption of organic nitrogen to decrease and that of mineral nitrogen to increase. Cottonseed meal supplies less than one-fourth of the fertilizer nitrogen, which would be better used as a livestock feed which should be encouraged. Dried blood, leather waste, tankage (coming partly from Argentina), fish by-products, etc., are other sources of nitrogen.

Five-eighths of the mineral nitrogen fertilizer is furnished by nitrate of soda; the importation is on the decrease, and some solution must be found.

The remainder is supplied from cyanamide and sulphate of ammonia, etc. The cyanamide is obtained chiefly in Canada, from the American plant which uses the Niagara Falls as a source of power.

The great bulk of the sulphate of ammonia is derived from the by-product of the coke ovens. The consumption of by-products is continually on the increase. The author strongly recommends a more systematic use of available resources.

947.—**The Effect of Nitrates Applied at Different Stages of Growth on the Yield, Composition and Quality of Wheat.**—DAVIDSON, J., in the *Journal of the American Society of Agronomy*, Vol. 14, No. 4, pp. 118-122. Geneva, N.Y., April 15, 1922.

An experiment made by the author in collaboration with La Clerc showed that the application of sodium nitrate during the early period of growth increased the yield of wheat; when applied at the time of heading the quality of the grain was improved, but the use of nitrate at the beginning of the milk stage had no effect either on yield or the quality of the crop. The experiment was carried out in the year 1919 at College Park, Maryland. The period between the resumption of the growth of wheat in the spring and the time of heading was divided into three sub-periods. Each of three corresponding sets of plots received nitrate of soda or nitrate of calcium at one of these sub-periods; the experiments were repeated to make sure of the effect of the nitrates; the number of plots was thirty-six.

The effect of nitrate in increasing the yield decreases consistently as the time of

their application approaches the stage of heading.

The effect of nitrates in increasing the protein content (N x 5·7) of the grain increases as the effect on yield decreases. The deeper colour of the grain showed qualitative modification.

1037.—Influence of Lime on Germination.—Maquenne, L., and Cerighelli, R., in *Comptes rendus de l'Academie des Sciences*, Vol. 17, No. 20, pp. 1270-1272. Paris, May 15, 1922.

Maquenne in collaboration with Demoussy, has shown that lime is indispensable to germination; even in very small quantities it triples the length of the roots of peas in 6 days when compared with pure water cultures.

The writers have examined the question again and made weight tests independently of tests by length, and extended their experiments to various kinds of seeds, namely: peas, wheat, lentil, cabbage, cabbage lettuce, radish, buckwheat and maize. The seeds were washed in sterilized water for 24 hours and the maize seeds sterilized with a 2 per 1,000 solution of sublimate. They were then made to germinate in sand soaked in pure distilled water. After 2 or 3 days they were treated partly with pure distilled water and partly with a 1 millionth solution of sulphate of lime in very weak proportions, similar to those obtained by heating pure water in a burnt clay beaker, which corresponds to about 1-25 of the lime contained in Paris spring water. The growth took place partly in water or in a calcic solution, partly in sand soaked in water or solution. The temperature was maintained at about 20°C. and the experiments were made in the dark. They were continued as long as growth of the young plants in the calcic solution lasted, while the growth of the plants in pure water ceased much earlier.

The favourable action of lime on growth was confirmed for all the seeds, both as regards length and weight. The action was more marked in the roots than in the stalks. At the same time there was a total loss of dry matter, without doubt caused by the fact that respiration had become more active in the calcic solution owing to the larger growth of the young plant and was not compensated by photosynthesis, as growth took place in the dark. Maize alone seemed to be an exception, perhaps, on account of the abundance of its reserves. The reserves were used in unequal proportions, both absolutely and in proportion to final weight, which is in agreement with the earlier observations of Mazé. In the seeds of cabbage, buckwheat and radish, the reserves diminished to a slightly less degree than in the control; consequently the writer suspects some errors in the experiments. In the others the diminution was more marked. In any case, lime exerts slight influence on the organization of the reserves, which proves that it does not act of its own accord on respiration.

1050.—Action of Various Manures on Beans.—Van Hauten, in *Journal fur Landwirtschaft*, Vol. 70, No. 1, pp. 1-7. Berlin, July 1922.

Autumn sowings were made in 8 plots, which had already been manured in previous years and in which the last crop had been barley; they contained average amounts of phosphates and lime. Spring manuring was given with 50 per cent potassic salt, sulphate of ammonia and basic slag variously compounded.

During growth the lack of potash was already revealed in the plots to which no potassic fertilizer had been applied; the plants did not flourish and the leaves turned yellow, these differences becoming more marked after flowering. In the plots which were defective in potash, maturation was earlier, but the yield lower; on the other hand manuring with potash caused the yield to show a constant increase though to a less degree when manuring with potash was accompanied by manuring with phosphates. Nitrogenous fertilizers did not have any beneficial effect, which is to be explained by the fact that the beans are able to supply themselves with nitrogen. Phosphatic fertilizers were clearly injurious, evidently because the soil was already over supplied. The yield, in quintals per hectare, was as follows: control 12·20—with potassic fertilizer 16—with phosphatic 11·40—with nitrogenous 10—with potassic and nitrogenous 16—with potassic and phosphatic 13—with phosphatic and nitrogenous 8—with the three fertilizers combined 15·60.

At the same station, Fest had obtained, in 1908, a similar result with the same fertilizers. In estimating the yield in dry matter, the general results are not modified appreciably. The average size of the seeds was very nearly the same, their weights varied from 36·23 to 41·01 gm. per 100 seeds.

The percentage of crude protein was less in the seeds of the potash plots, because, in the latter stages of maturation, the non-nitrogenous extracts are preferentially deposited in the seeds. In the potash plots, the maturation of the seeds and consequently the deposit of the non-nitrogenous substances, could be completely effected. Absolutely, however, the amount of protein was greater in the potash plots.

Contrary results were given for starch and fats. On the other hand, the percentage of ash was greater in the potash plots, and potash in large quantities was found in the ash.

814.—Experiments on the Use of Artificial Light in the Growth of Plants in Germany. —HOSTERMANN, in *Verein Deutscher Ingenieure*, Vol. XVI, pp. 523. Berlin, May 27, 1922.

The first experiments on the use of electric light for inducing the growth of plants were made in 1880 by Wilhelm Siemens, with a 1,600 candle-power arc lamp; these experiments were next reproduced at Bromberg by means of arc lamps and mercury lamps with unsatisfactory results; on the other hand experiments made in England and Ireland in 1919 by Tjebbes and Uthoff induced an increased yield up to 50 per cent. In the buildings of the Experimental Station of plant physiology at Dahlem (Germany), experiments were made during the winter of 1921 22, to ascertain the influence of artificial light on the growth of plants in glass frames; in winter, in a heated place, the difference of growth of plants, compared with the summer, is determined not only by the temperature and by the manuring which may be the same at both seasons, but also by the duration of daylight; in fact, it is the light absorbed by the chlorophyll which furnishes the energy required for the reduction of carbonic acid into carbon, from which carbohydrates are produced through assimilation. But it is not only daylight which exercises a beneficial action on the process of assimilation; this action can also be exercised by light coming from another source, provided that it is comprised in the category of wave lengths in the compass of which the colouring matters of the leaves have a power of absorption. The question is to select the light which will give the best return.

According to what can be deduced from researches on the physiology of plants, with a luminous intensity of about 1000 Lux, the assimilation may be considered as proportional to the illumination, while with a more intense light, assimilation is less and less accelerated and this is why artificial light was not used simultaneously with the winter light, but the day's light was prolonged from dusk by means of an electric current.

Over a plot 16 ft. long by 5 ft. broad were arranged 5 "Nitra" lamps of 200 watts, in such a way that the light could be diffused as uniformly as possible; the lamps were placed 27½ inches from the edge of the plot, at a distance of 47 inches from each other at a height of 23½ inches above the plot, and were furnished with Wiskott reflectors. The intensity of the illumination of the plants varied over different points of the surface of the plot from 300 to 900 Lux, and was exactly 900 Lux under the lamp and 300 at the edge of the plot. The daily consumption of electric power by the lamps, lighted for about 6 hours every day commencing at dusk, amounted to 4·8 kilowatt-hours for lighting a surface of 75 sq. ft. Forced cultures were made on that surface; the preceding period of vegetation of some of them had already made it possible to have an idea of the principles assimilated; others, having just germinated had still to construct their vital elements. Close to the plot of illuminated plants was the control plot, with the same plants and separated from the former by a partition of white wood; this plot, except for light, received the same care as that of the illuminated plants.

Cabbage-lettuces, illuminated from mid-November, had after 12 days on an average about two and a half times as many fresh leaves as those not illuminated; moreover, the leaves of the former were larger and firmer. Plants exposed only to daylight required from 4 to 5 weeks, or double the time to attain this degree of development; it would therefore be possible, in practice, to obtain in the same period of time two crops of lettuce instead of one. In 18 days the consumption per lamp was 21·6 kilowatt-hours.

To examine its subsequent growth, the lettuce was left in its place, since it did not flower but continued only to grow. However this very probably, should not be attributed to lack of power of the electric light relatively to solar light, but more especially to the richness of the artificial light in red rays, compared with daylight. The crop was gathered after 7 weeks of prolonged illumination; a comparison was then made between the plants of the illuminated plots and those of the plot not illuminated; a superiority of weight of the former over the latter of 50 per cent in the green state and 68 per cent in the dried was found.

The effect was equally good on beans and vetches. *Lathyrus odoratus* grew much more vigorously under the influence of the illumination and it flowered earlier and more abundantly. Strawberry plants illuminated yielded, as early as the middle of March, very sweet and scented fruit, while those not illuminated were 4 weeks later. The favourable effect of electric light in the prolongation of the short daylight from November to May, was very clearly shown on all greenhouse crops and especially on lilac which gave very fine inflorescences under this treatment, with more intense perfume and brighter colour. But certain data are lacking regarding:—(1) the most correct and suitable illumination for certain species of plants; (2) the duration of illumination; (3) the most favourable colours of the light; hence without exact knowledge of the sources of light and of the physiological effects of the light, it is not yet possible to form a correct judgment.

1057.—Mangolds in Combination With Maize.—Succi, A., in *L'Italia agricola*, Year 50, No. 8, pp. 265-268. Piacenza, August, 1922.

The writer calls attention to the economic advantage of growing mangolds mixed with maize, a combination which he has tried with success for about twenty years. The mangolds are sown between the lines of maize and at the same time or a little earlier. The two plants spring up and grow together; the maize then develops rapidly and the growth of the mangolds gradually slows down until it stops completely; by degrees as the maize begins to ripen the pressure is eased and the mangolds again begin to grow and after the maize is harvested, develop quite normally.

At this time, the beginning of autumn, the soil is the seat of a powerful chemico-biological activity by which the mangolds are able to profit; they leave therefore to the next crop, which is generally wheat, smaller quantities of fertilizing principles and especially of nitrogen; it is therefore necessary to make up the deficiency by abundant manuring of the maize when combined with mangolds or by applying a quick acting fertilizer to the wheat.

That there is no danger of the mangolds dying during the suspension of growth has been ascertained by the writer even in the case of its combination with Caragua giant maize, as well as in southern districts with dry summers and in light mellow volcanic soils.

The combination allows for compensation for the damage which in some years drought causes to the maize, for the reduced growth of the maize allows the mangolds to grow larger.

Lastly, the writer gives the appropriate cultural rules:—The soil to be sown should be crumbled; the space between the lines of maize should not exceed or but slightly that of maize grown by itself e.g., for early Reggio drawf maize, it should measure 16 to 20 inches; no special attention is necessary for the associated crops; weeding and earthing up are done at the same time; the uprooting and transplanting of the mangolds causes no injury to the maize.

Sugar beet is much less suitable for growing with maize; whatever variety is grown the roots can only be used for feeding cattle; it is therefore better to grow mangolds in combination with maize as they give a more abundant crop.

1155.—Study on the Pollen of Fruit Trees.—Casella, D., (*Cattedra di Arboricoltura della R. Scuola Sup. di Agricoltura in Portici*) pp. 24, bibliography of 46 publications. Cosenza, 1922.

In fruit trees imperfect setting of the flowers is due to numerous causes. The writer has undertaken its study, selecting among anemophilous trees the vine and the mulberry and among entomophilous trees the Rosaceae such as the apple, pear, peach, apricot, almond and plum.

The writer refers to and confirms certain opinions already maintained and adds some personal observations. Firstly he examines the influence of meteorological conditions. A light wind helps pollinization because it transports the pollen of anemophilous plants without scattering. Moreover, by favouring evaporation, it accelerates dehiscence; finally by shaking the flowers it facilitates the opening of the anther. On the other hand a strong wind scatters the pollen and blows away the insects which assist in pollinization; it may also break off the flowers and break the branches. Hail has a similar injurious effect. Rain washes away the pollen and makes it burst and germinate prematurely in the anthers; it causes browning and necrosis of the stigma; makes transport of the pollen by wind impossible; washes away the sugary excretions which attract insects, keeps the insects away and prevents them from feeding on the flowers. In the vine during rain, the hood adheres to the stigma and obstructs the anther; in the Rosaceae the stamens adhere to the style; if the stamens are longer than the style, the stigma remains immersed in the water and comes off; if, later, the water evaporates, the stamens regain their normal position and the anthers dehisce, but meanwhile the germinative power of the grains of pollen which have burst or germinated has diminished. Mist is just as injurious as rain; its moisture causes partial bursting and premature germination of the pollen and necrosis of the stigma; pollinization is specially hindered by a thick mist, which deposits a film of water and sometimes small drops. Light and solar heat accelerate all vital functions and consequently pollinization; moreover they have an indirect action inasmuch as they cause the secretion of nectar and the production of colours and scents which attract insects; they also stimulate the insects themselves. A high temperature accelerates the germination, the bursting of the pollen grains and the elongation of the pollen tubes. On the other hand, low temperatures retard the dehiscence of the anthers, hinder the germination of the pollen and prolong the duration of the elongation of the pollen tube.

The writer has made numerous observations on pollen and ascertained that not only does the pollen vary in different species but also in certain cases in different varieties and that, in certain varieties of fruit trees, the pollen from the same anther has various forms and dimensions and a different percentage of grains which contain no protoplasmic substance.

The writer undertook numerous tests on the germination of pollen. With this object

he tried to use little drops of liquid taken from the stigma of the almond and difficult to collect, as well as the juice of the plum, pure water, moist air, etc. He found that the best was a solution of saccharose in the proportion of 10 per cent (apple) 15 per cent (pear), 20 per cent (almond). He often found abnormal teratologic forms of which he gives a description. The pollen grains of the vine always emit a bubble which persists at the insertion of the pollen tube and keeps it inflated.

The writer has studied germinative power in various conditions. It remained constant for each variety of fruit tree. Pollen from diseased plants are relatively more sterile. The influence of temperature was greater; the optimum temperature was 59°F. for the almond, 68°F. for the vine. Fungicidal and insecticidal preparations were almost all decidedly injurious. The writer also tested the effect of these preparations on the setting of vine-flowers; he painted them on the stigmas with a brush. All the preparations were injurious. Sulphur, to which some persons attribute a beneficial action on setting, was also injurious, and it is probable that the beneficial action attributed to the sulphur is due to the dissemination of the pollen helped by the movement of the air and of the cluster at the time of applying the sulphur. Water proved injurious, it intensified the harmful effects of the fungicides and insecticides on the germinative power. The use of such substances should be regulated so as to obtain the advantages which are desired from them, without injury to production.

1162.—**Influence of the Weight of the Potato Set on the Crop.**—Salaman, R.N., in *The Journal of Agricultural Science*, Vol. XII, 2nd Part, pp. 182-196. London, April 1922.

Experiments carried out at Barley (Herts, England) with potatoes of the Barley Bounty variety grown on well-tilled vegetable mould, without farmyard manure but which had been manured with superphosphate + sulphate of ammonia + kainit. The results may be summed up as follows: The total crop is directly proportional to the weight of the sets. The use, as sets, of tubers weighing less than 1 ounce, gave a large return and a good proportion of marketable tubers (that is to say not too small), but such sets do not give the greatest yield. If the total weight of the sets, the proportion of good tubers and the total crop, are considered, the best sets are those of tubers weighing about 2 ounces each. Portions of tubers consisting of secondary tubers gave much more abundant crops than any other kind of set; slightly smaller crops were obtained by using as sets whole tubers bearing secondary tubers; both also gave equally a large proportion of marketable tubers. There is an inverse relation between the size of the sets and the percentage of large tubers in the crop. A large production of secondary tubers and a large proportion of heavy tubers in the crop may be connected with want of maturity of the sets. There is no relation between the quantity of secondary tubers among the sets and the quantity of secondary tubers in the crop raised from such sets.

LIVE STOCK AND BREEDING

840.—**A Disease of Young Pigs Consequent on Dry Years.**—Moussu, G., in *Comptes rendus de l'Academie d'Agriculture de France*, Vol. VIII, No. 18, pp. 534-541. Paris, May 17, 1922.

Study of the osseous cachexy of young pigs aged 2 to 5 months. Clinically, the disease is characterized by the following stages:—

(1) Stopping of growth and difficulty in walking (period of the disease called the squalor period);

(2) articular deformation and walking on the knees (gout period);

(3) deformations of the skeleton and of the head;

(4) final decay, the sick animals die of starvation.

The first stage only lends itself to therapeutic intervention, in any case of doubtful value.

This disease may break out any year and occurs chiefly in certain regions (Aube, Marne, Yonne, etc.), but consequent on dry years, it spreads a little everywhere, except where the pigs are regularly run on pasture. A ration given at too early a stage, composed of a large proportion of farinaceous matter, without dairy refuse, vegetables, roots and green fodder, favours the disease. Up to date, no micro-organism capable of reproducing the disease has been isolated, but the writer has shown, a long time ago, that it may be reproduced experimentally by direct contagion and by starting with emulsions of the diseased osseous marrow.

Treatment recommended by the writer:— 1 gramme of chloral per day per 10 kg. of live weight, in the rations, as anodyne to the painful condition and as general antiseptic; sometimes hydrochlorate of ammonia as a stimulant to nutrition; salts of lime (phosphates, bi-phosphates, carbonates, chloride of calcium, etc.) to facilitate the osseous recalcification.

1076.—**The Identification of Cattle by Means of Nose-Prints.**—Peterson, W.E., in *Journal of Dairy Science*, Vol. 5, No. 3, pp. 249-258. Baltimore, May, 1922.

The various breeding associations have always been confronted with a serious problem in the proper identification of

animals for registration and of animals on official test. All other means having proved unsatisfactory, O. H. Baker, of the American Jersey Cattle Club, suggested using nose-prints for the purpose. The author describes the method of taking the prints and the best way of identifying the prints so obtained. The most satisfactory results were given by mimeograph newsprint paper and black stamping-pad ink. From different tests made with some 350 cattle the author drew the following conclusions: (1) no two animals have identical pattern nose-prints, therefore these prints will enable positive identification; (2) the taking of nose-prints is simple enough to be practical; (3) it is possible to identify prints as being of the same animal, even if they are not perfect; (4) the pattern remains the same through life; (5) this test is practical for the identification of cows on official test and may prove valuable in connection with the registration of all solid colour cattle; (6) the method affords a positive means of identification when claim for loss is made under live stock insurance policies.

851.—**Butter-Fat Percentage of Cow's Milk Increased for Two Days by Partial Milking.**—Regan, W. M. and Mead, S. W., in *Journal of Dairy Science*, Vol. IV, No. 6, pp. 495-509. Baltimore, November, 1921.

In the supervision of advanced registry tests, it is required that cows be milked dry at the milking preceding the test period. This entails considerable loss of time and expense and the question has arisen as to the necessity for the operation.

The author carried out some experiments with Holstein, Jersey, and Ayrshire cows. The animals were milked dry twice daily for 6 days; on the 7th day only half the milk was drawn, and during the 4 subsequent milkings, the cows were again milked dry.

Samples were taken at each milking and tested for butter-fat. It was found possible to increase the percentage of butter-fat in milk during a period of 2 days by leaving half the milk in the udder during the milking prior to the two-day period. Although the average increase in butter-fat was only 0·27 per cent the data collected seem to show that it is possible to obtain an increase of over 0·5 per cent by leaving a certain amount of milk in the udder, but if too much is left, the contrary effect is produced. The highest fat percentage was not always reached at the milking following the partial milking; it was only attained in 12 out of the 27 trials. As there was an average increase of only 0·766 lb. of milk for the two days following the partial milking, the practice of leaving part of the milk in the udder could not be detected by a study of the cow's milk record.

The data collected in this experiment show that a preliminary milking is necessary as a measure for safe-guarding the accuracy of advanced registry testing.

1084.—**Insulating Capacity of Double-Walled Bee Hives.**—Phillips, E. F., in *United States Department of Agriculture, Department Circular* 222, 10 pp. Washington, May, 1922.

The great number of double-walled beehives on the market, where they find ready purchasers among beekeepers by whom they are largely used, has given rise to considerable discussion as to their comparative merits. In order to decide the question, the author carried out a series of experiments and obtained the following information:

The shape of the hive has a considerable influence upon its insulating power, and therefore upon its capacity for preventing loss of heat and protecting the bees from winter cold. The heat escapes most readily from the bottom and the insulation of the walls and top is never so complete as to prevent a large amount of heat from being dissipated.

Beekeepers however never trouble about the insulation of the bottom of the hive, as they are under the impression that the heat escapes through the top. It is a mistake to uncover the front of the hive, even if it faces south, for if any part of the hive is left with only a single wall, or without some other means of protection, all the efforts made to keep the rest of the hive warm are to a great extent nullified.

In the double-walled hives on the market the heat escapes so readily from the bottom, that little is lost through the roof and still less through the walls.

An air-space left between the two walls does not retain the heat as well as a layer of some material that is a bad conductor, especially if the interstices are very small. Convection currents which dissipate the heat are doubtless always present in the dead angles of the cavity of the hive. The board forming the ceiling should extend as far as the external wall upon which the roof rests. It is more effective to close the double wall only, than merely to shut the opening of the hive.

A thicker layer of insulating material should be used than is generally the case. If sawdust is used, the layer ought to be 4 to 6 inches thick.

FARM ENGINEERING

867.—**Electricity and Agriculture.**—Matthews, R. B., in *Journal of the Royal Society of Arts*, Vol. LXX, No. 3620, pp. 367-368. London, April 7, 1922.

The problem of increasing the yield from the numerous small holdings in England and Wales has directed attention to the possibilities of use of electricity on the farm in districts where it is difficult to use gas and coal for machinery, etc.

The author points out the economic advantages to be derived from electric lighting for cow sheds, the improvement in cleanliness, reduction in waste of milk, cattle food, etc., by providing adequate light in habitually darkened buildings. In addition the electric motor can be readily utilized for machine work, for chopping cattle food, working churns, milk separators, etc. Such motors are easily handled and require a minimum of labour. The fact that hay can be dried artificially by means of electrically driven fans gives the farmer more control over his crops and makes him more independent of the weather. Successful results with electric heating for the prevention of frost amongst stores of roots and vegetables have been reported and also for drying fruits in bottling factories, etc. The use of electric heat has also already proved its value for incubation purposes and has given an increased yield of eggs at a time of year when they are of the highest market value. There are undoubtedly great possibilities in its application to milk sterilization and ensilage purposes.

Recent experiments on a practical scale have demonstrated that an extremely small amount of electrical power converted in a suitable apparatus to a very high tension and discharged from overhead wires strung across the fields has a remarkable effect upon most forms of vegetable life, increasing yield and in many cases advancing the period of harvest. Although it is at least possible that the effect may be rather in the nature of a stimulant than a food, and due to some effect upon the plant which improves its power of absorbing and assimilating nutriment from suitable soil, there is already sufficient evidence to justify careful and continued research in this direction.

AGRICULTURAL INDUSTRIES

1225.—The Milking Machine and the Hygienic Qualities of Milk.—BREW, J.D., in *The Journal of Dairy Science*, Vol. V, No. 4, pp. 412-420. Baltimore, July 1922.

The "New York City Board of Health" has laid down that first quality milk, that is to say milk sold raw for direct consumption, must not contain more than 30,000 micro-organisms (colonies) per cubic centimetre; milk which is sterilized must not contain more than 100,000 if of second quality or more than 300,000 if it is third quality. Beyond these limits milk is considered unfit for direct consumption. The three qualities above referred to are designated respectively by the letters A, B, C.

To encourage the production of hygienic milk the sellers pay the producers a premium on first quality milk and a much smaller one on second quality milk. It is therefore of great interest to the producer to know the rules to be followed to produce hygienic milk.

In March 1921 the Dairy Department of New York State College of Agriculture, undertook a propaganda and instruction campaign for the production of hygienic milk. The work was based on bacteriological study, by means of the direct microscopic method, of milk delivered by every producer to retailers on 2 or 3 successive days; the results so obtained were explained and discussed at a meeting of producers to whom previous notice was given. The examination of milk carried out in this way from March to September has enabled important information to be collected on the subject of the principal bacterial factors which affect the number of bacteria in milk. Observations made in classifying 3243 samples of milk delivered by 1104 producers have led to the conclusion that the most common causes of a large number of bacteria in milk when it is delivered to the seller in town are: (1) want of rapid and effective chilling of the milk immediately after milking; (2) high contamination of the milk by jugs or other dairy utensils which were not sufficiently sterilized by means of a jet of steam, boiling water or by drying in a current of hot air immediately after washing; (3) heavy contamination by dirty milking machines.

The comparative examination of milk supplied by 790 producers, 635 of whom milked by machine and 155 by hand, has enabled it to be ascertained that:—before the meeting of producers 31·6 per cent of those who used milking machines supplied A. quality milk, 12·9 per cent milk of B. quality and 55·5 per cent C. quality milk; after the meeting, 54·0—18·5—27·5 respectively; those who milked by hand:—before the meeting A. quality milk 70·7—B. quality 9·3—C. quality 20·0 per cent; after the meeting 84·6—5·9—9·5 per cent respectively.

These results, from a hygienic point of view, are not in favour of milking machines; on the other hand they indicate the possibility of improving present conditions, which is much to be desired, since, owing to the high cost of manual labour, milking machines are becoming more and more common.

One of the main reasons for insufficient cleaning of milking machines is that the manufacturing firms, in the instructions for the use of their machines, do not sufficiently emphasize the necessity of careful cleaning. To eliminate these drawbacks the representatives of various factories met at a conference at which the question was explained to them and they will try to find a solution.

1228.—Common Defects in Butter and How to Avoid Them.—HAMILTON, D., in *Bulletin No. 427, Department of Agriculture, Salisbury, Rhodesia*, 11 pp. Salisbury, August, 1922.

The most common defects in butter, so far as flavour is concerned, are as follows:—insipidity—flavour of burnt meat—flavour of fish—flavour of cheese—flavour of yeast—bitterness—mouldiness — rancidity. The writer (Dairy Expert, Specialist for Dairy and Milk Food Industries to the Department of Agriculture of Rhodesia), describes them in detail, examines their causes and shows how to avoid them; finally, he gives the following summary of the precautions to be taken in making butter.

The place where butter is made should be cool, hygienic, clean; the walls should be frequently whitewashed. The receptacles intended for holding cream should only be used for that purpose and should be suitable. The cows should get succulent green food, even in winter. The cream should be kept in as cool a place as possible in summer and at a temperature of 60°F. in winter; very low temperatures cause the development of a bitter taste in the cream. Churning should be done at least every three days in summer and every four days in winter.

Churning should not take too long, as in that case the butter loses its consistency. The butter should be washed twice while still granular, with water as cold as possible. Butter should not be kept in a damp, dark place. Butter should not be worked up to such a degree as to make it soft. Granular butter should be turned out on the working up table, covered with damp muslin and well drained. If the butter is too much worked up, it has the texture of lard. For salting, use a saturated solution of salt; this hardens the granules of butter and helps to give a good texture. If salt is used in solid form it must be very pure, thoroughly pounded and evenly distributed. The pats of butter should be nicely shaped and wrapped in good butter-paper. Boxes for packing butter should be divided into compartments, each able to contain one pound. It is preferable to use a shallow box with a wide bottom holding 2 layers of pats, rather than a box with a narrower bottom containing 5 or 6 layers.

Regarding the causes of defects in butter, the writer explains them in the following manner:—

Insipidity.—This is one of the most common defects. It is due to various causes, but mainly to lack of green forage, to preservation of the cream, to too low a temperature while ripening and to excessive washing of granular butter.

Flavour of fat.—This flavour is ordinarily due to excessive ripening of the cream.

Flavour of cheese.—Is due to the decomposition of proteins in the buttermilk left in the butter owing to insufficient washing.

Flavour of yeast.—Due to keeping the cream too long before churning, or to insufficient cleaning of the cream separator. To avoid it, the cream should be refrigerated as soon as it is collected and should be quite clean.

Bitterness.—This has often been noticed during the dry season when the cows are obliged to eat tough grass, but the most frequent cause is the presence of impurities in the salt.

Mouldiness.—Is due to the growth of mould in the cream; to avoid it the receptacles should be thoroughly cleaned, and the cream should be covered with muslin while being kept and when sent to be churned.

Rancidity.—Is due to being kept at insufficiently low temperatures; it occurs especially in defective butter. Well made butter keeps very well, as is proved by an experiment made in New Zealand. Some butter made from pasteurized cream, well churned and washed, was sent to London and kept there in a refrigerator for 10 years; at the end of that time it was still perfectly sound.

PLANT DISEASES

1109.—The Ascomycete Ophiobolus Cariceti, as the Cause of Take-All of Cereals and Grasses.—FITZPATRICK, H. M., THOMAS, H. E., and KIRBY, R. S., in *Mycologia*, Vol. XIV, No. 1, pp. 30-37. Lancaster, Pa., 1922.

In July 1920, perithecia of a species of *Ophiobolus* were observed at East Rochester, (New York) on wheat plants showing characteristic symptoms of the take-all disease, subsequently reported in various localities in the state and also elsewhere.

The fungus has been obtained in pure culture and repeated inoculations have shown it to be a specific agent of this disease.

This fungus, after comparative experiments made with material from America, England, Italy, France, Japan and Australia, has been classified as *O. cariceti* (Berk and Br.) Sacc.

A complete diagnosis of the parasite is given.

OTHER ARTICLES ON SCIENCE AND PRACTICE OF AGRICULTURE

On account of lack of space the following articles in the International Review of the Science and Practice of Agriculture can only be referred to. Anyone desiring the articles may obtain them from the Institute Branch, Department of Agriculture, Ottawa.

Problems of Cotton Growing.—CORTESI, Dr. F., in *International Review of the Science and Practice of Agriculture*, August 1922, pp. 927-938.

805.—Researches on the Efficacy of Deep Tillage and on the Distribution of the Roots of Certain Plants in Different Strata of Soil.—AVANZI, E., in *L'Agricultura Italiana*, Year XLV, parts 1-3, pp. 41-56. Pisa, 1922.

842.—The Insufficiency of Lime and Phosphoric Acid in the Feeding of Animals.—GOUIN, R., in *Revue de Zootechnie*, No. 6, pp. 526-534. Paris, March 15, 1922.

858.—The Effect of Food Upon the Fat Content of Goats' Milk.—SHEEY, E. J., in *The Scientific Proceedings of the Royal Dublin Society*, Vol. XVI, Nos. 35-39. pp. 478-488, bibliography of 11 works. Dublin, 1922.

864.—Egg-Laying Characteristics of the Hen.—DRYDEN, J., in *Oregon Agricultural College Experiment Station, Bulletin* 180, pp. 1-96. Corvallis, Oregon, August 1921.

899.—The Agricultural Problem of the South of Italy and Its Dependence on Biological Conditions.—V. RIVERA, in *Atti della Societa Agronomica Italiana*, Years II and III, No. 2, pp. 27-73. Rome, June 30, 1922.

911.—Soil Acidity and Bacterial Activity.—STEPHENSON, R. E., in *Soil Science*, Vol. 12, No. 2, pp. 133-144 and 145-162, bibliography of 13 works. Baltimore, August, 1921.

933.—Potassium Nitrate Ratio of Red Clover as Influenced by Potassic Fertilizers.—EMERSON, P., and BARTON, J., in *Journal of the American Society of Agronomy*, Vol. 14, No. 5, pp. 182-192, bibliography of 17 works. Geneva, N.Y., May, 1922.

951.—Smooth-Awned Barleys.—HAVES, H. K., and WILCOX, A. N., in *Journal of the American Society of Agronomy*, Vol. 14, No. 4, pp. 113-117, bibliography of 9 works. Geneva, N.Y., April 15, 1922.

955.—Sunflower Growing in Rhodesia.—MAINWARING, C., in Bulletin No. 423, *Department of Agriculture, Salisbury, Rhodesia*, pp. 8. June, 1922.

962.—The Duration of the Contagious Period in Foot-and-Mouth Disease.—LEBAIL, C., in *Comptes rendus de l'Academie des Sciences*, Vol. 174, No. 24, pp. 1580-1582. Paris, June 1922.

966.—Quantitative Botanical Analysis of Artificial Stock Feeds.—AZENDAM, JOH. A., in *Verslagen van Landbouwkundige onderzoekingen, der Rykslandbouwproefstations*, No. XXV, pp. 1-83. Gravenhage, 1921.

996.—Researches on "Incappucciamento," a Disease of the Red Clover.—MANZONI, L., in *Le Stazioni sperimentali agrarie italiane*, Vol. LV, Parts 4-6, pp. 136-144. Modena, 1922.

Cocoa Growing in the State of Bahia (Brazil).—DR. J. W. de ARANJO PINHO, in *International Review on the Science and Practice of Agriculture*, October, 1922, pp. 1169-1181.

1013.—Plant Indicators of Soil Types.—KELLEY, A. P., in *Soil Science*, Vol. XIII, No. 6, pp. 411-423. New Brunswick, N.J., June 1922.

1015.—Factors Influencing the Determination of Sulphate in Soil.—HIRST, C. T., and GREAVES, J. E., in *Soil Science*, Vol. XIII, No. 4, pp. 231-239. New Brunswick, N.J., April 1922.

1018.—The Influence of Moisture and Soluble Salts on the Bacterial Activities of the Soil.—GREAVES, J. E., and CARTER, E. G., in *Soil Science*, No. 4, pp. 251-270. New Brunswick, N.J., April 1922.

1021.—Effect of Tree Products on the Bacterial Activities in Soil; Ammonification and Nitrification.—GIBBS, W. M., and WERKMAN, C. H., in *Soil Science*, Vol. XIII, No. 4, pp. 303-322. New Brunswick, N.J., April 1922.

1027.—Assimilability of Various Phosphate Manures.—VON WRANGELL, M., in *Landwirtschaftliche Jahrbucher*, Vol. LVII, No. 1, pp. 1-77. Berlin, March 1922.

1028.—The Supply of Nitrogen for Agriculture in Germany.—WIRTSCHAFT UND STATISTIK, Year 11, No. 3, pp. 72-73. Berlin, February 1922.

1031.—Seeds and Plants Introduced by the Agricultural Department of the United States.—*Inventory of Seeds and Plants imported by the Office of Foreign Seed and Plant Introduction during the Periods from January 1 to March 31, 1917; April 1 to June 30, 1917; July 1 to September 1917;* No. 30, 83 pp.; No. 51, 100 pp.; No. 52, 55 pp. Washington, 1922.

1047.—Is the Transplantation of Maize Advantageous?—MORETTINI, A., in

L'Italia agricola, Year 50, No. 8, pp. 259-263. Piacenza, August 1922.

1050.—Action of Various Manures on Beans.—Van Hauten, A., in *Journal fur Landwirtschaft*, Vol. 70, No. 1, pp. 1-7. Berlin, July, 1922.

1071.—Experimental Contributions to the Knowledge of the "Working Conditions" of Draught Animals Under Different Dietary Conditions.—Albertoni, L., in *Le Stazioni sperimentali agrarie italiane*, Vol. LV, No. 4-5-6, bibliography of 46 publications. Modena, 1922.

1077.—Studies on Reproduction of Cattle.—I. Grau, A., in *Revue de Zootechnie*, No. 9, pp. 869-880. Paris, June 15, 1922.—II. MacCandlish, A. C., Studies in the Growth and Nutrition of Dairy Calves, in *Journal of Dairy Science*, Vol. V, No. 3, pp. 301-321. Baltimore, May 1922.

1081.—The Goat as an Economic Factor.—Crepin, J., in *Le Lait*, Year II, No. 5, pp. 313-320. Lyons, May 1922.

1103.—The Clarification of Unfermented Fruit Juices.—Caldwell, J. S., in *United States Department of Agriculture, Bulletin* No. 1025, pp. 1-30, bibliography of 35 works. Washington, January 23, 1922.

1105.—Studies on the Biology of Lactic Acid Bacteria.—Gorini, C., in *Journal of Bacteriology*, Vol. VII, No. 2, pp. 271-276. Baltimore, March 1922.

1110.—Observations Made in New York State on the Take-All Disease of Cereals and Grasses (Ophiobolus Cariceti).—Kirby, R. S., in *Phytopathology*, Vol. XII, No. 2, pp. 66-68. bibliography of 31 works. Lancaster, Pa., 1922.

AGRICULTURAL STATISTICS

THE WORLD'S WHEAT 1922-23 AND 1923-24

By T. K. Doherty

To what extent will the supplies of the past season 1922-23 be absorbed by the closing of the grain year? What are the prospects of wheat production for the present season and what are the prospects of supply and demand for the grain year 1923-24?

The following statistics, the basis of which is the May number of the "Statistical Bulletin" of the International Institute of Agriculture," are answers to these questions and need very little comment.

In the matter of areas sown to wheat and wheat production, official data are not yet available for a certain number of countries. For these, estimates are made, based on the most reliable official and unofficial information.

Earlier reports gave the statistics for Europe as particularly favourable, and there seems now justification for assuming that there will be a per acre yield during the present season in general equal to that of the good crop reaped in 1921. We have acted on this assumption for nearly all the countries of Europe except where, in a few cases, reliable correspondents indicate important deterioration for various causes Thus, from France comes the news, through the "Corn Trade News" of June 5th, "that persistent rain and heavy falls of hail have caused the crops to lose the advantage they obtained from favourable seeding. Prospective yields are diminishing." Rust has also occurred to some extent. Then it must be remembered that the area sown to wheat in France this year is still 2,500,000 acres less than before the war and with average conditions cannot be expected to reach the average production of that period, namely 320,000,000 bushels. From Spain "the latest mail advices state that crop prospects are very favourable in the provinces of Castile and Extremedura, but in Aragon and Navarre a comparatively poor crop is anticipated." From New South Wales it is stated that "rain is mentioned in two districts only, so we fear that droughty conditions must still prevail over the greater part of this State." Droughty conditions are also said to exist in southern Italy. This recent news has somewhat modified the very optimistic earlier reports from these four countries.

Nineteen countries whose wheat represents on an average 60 per cent of the total world's harvest officially report an aggregate area of 168,031,000 acres compared with 169,290,000 last year and the average 1917-1921 of 164,431,000. From this official statement the majority of European countries report slight decreases for the current year, but France reports an increase of one million acres, which leaves a net increase for the Continent of about 700,000 acres.

In this article, for the purpose of getting at the practical results for the current year, derived chiefly from the official reports but, in their absence, also from private estimates, we present the following statement of the areas sown to wheat and the world's total wheat production:

WORLD'S PRODUCTION OF WHEAT

Countries	Area			Production		
	1923	1922	1921	1923	1922	1921
	Acres	Acres	Acres	Bushels	Bushels	Bushels
EUROPE:—						
Great Britain and Ireland	2,000,000	2,073,000	2,076,000	70,000,000	64,000,000	73,795,000
France	13,660,000 (a)	12,702,000	13,300,000	312,000,000	243,243,000	323,470,000
Germany	3,200,000	3,396,000	3,562,000	97,000,000	71,934,000	107,824,000
Belgium	328,000 (a)	337,000	344,000	13,800,000	10,615,000	14,495,000
Netherlands	160,000	156,000	180,000	8,000,000	5,236,000	8,425,000
Denmark	235,000	237,000	220,000	11,200,000	9,370,000	11,145,000
Norway	41,000	41,000	41,000	970,000	643,000	972,000
Sweden	360,000	356,000	360,000	12,500,000	9,381,000	12,577,000
Finland	22,000 (a)	22,000	20,000	280,000	296,000	280,000
Spain	10,379,000 (a)	10,309,000	10,386,000	142,000,000	125,470,000	145,151,000
Portugal				10,000,000	9,782,000	9,418,000
Italy	11,614,000 (a)	11,491,000	11,779,000	180,000,000	160,570,000	192,838,000
Switzerland	160,000	152,000	173,000	5,000,000	3,571,000	5,284,000
Luxemburg	40,000 (a)	42,000	45,000	660,000	500,000	661,000
Poland	2,324,000 (a)	2,574,000	2,093,000	42,000,000	42,451,000	37,410,000
Czechoslovakia	1,483,000 (a)	1,526,000	1,556,000	37,000,000	33,621,000	38,382,000
Austria	450,000	454,000	379,000	7,700,000	7,150,000	6,530,000
Hungary	2,900,000	2,855,000	2,888,000	53,000,000	45,074,000	52,716,000
Jugoslavia	3,602,000 (a)	3,723,000	3,824,000	49,000,000	42,248,000	51,810,000
Roumania	6,150,000	6,547,000	6,149,000	80,000,000	92,008,000	78,564,000
Bulgaria	2,259,000 (a)	2,226,000	2,361,000	39,000,000	37,705,000	42,510,000
Greece	900,000	890,000	988,000	10,000,000	9,553,000	11,170,000
TOTAL EUROPE	62,267,000	62,109,000	62,724,000	1,181,110,000	1,024,421,000	1,225,427,000
(a) Official figures						
NORTH AMERICA:—						
Canada	22,165,000 (a)	22,423,000	23,261,000	340,000,000	399,786,000	300,858,000
United States	58,253,000 (a)	61,230,000	63,696,000	817,000,000	856,211,000	814,905,000
TOTAL NORTH AMERICA	80,418,000	83,653,000	86,857,000	1,157,000,000	1,255,997,000	1,115,763,000
ASIA:—						
India	30,550,000 (a)	28,635,000	25,783,000	401,000,000	366,351,000	250,356,000
Japan	1,199,000 (a)	1,229,000	1,264,000	25,000,000	27,615,000	26,921,000
TOTAL ASIA	31,749,000	29,864,000	27,047,000	426,000,000	393,966,000	277,277,000
AFRICA:—						
Algeria	3,049,000 (a)	3,103,000	2,816,000	30,000,000	18,233,000	33,764,000
Egypt	1,500,000	1,518,000	1,458,000	37,000,000	36,648,000	37,011,000
Morocco	2,350,000 (a)	2,068,000	1,790,000	23,000,000	12,894,000	23,220,000
Tunis	1,112,000 (a)	882,000	1,500,000	10,000,000	3,674,000	10,623,000
South Africa	850,000	839,000	867,000	7,000,000	6,696,000	8,689,000
TOTAL AFRICA	8,861,000	8,410,000	8,431,000	107,000,000	78,145,000	113,307,000
SOUTH AMERICA:						
Argentina	16,500,000	16,081,000	13,927,000	200,000,000	194,070,000	180,642,000
Chili	1,300,000	1,285,000	1,296,000	23,000,000	25,420,000	22,179,000
Uruguay	500,000	493,000	812,000	8,000,000	3,674,000	9,944,000
TOTAL SOUTH AMERICA	18,300,000	17,859,000	16,035,000	231,000,000	221,164,000	212,765,000
AUSTRALASIA:—						
Australia	9,000,000	9,800,000	9,719,000	100,000,000	108,811,000	132,285,000
New Zealand	300,000	285,000	353,000	8,000,000	8,500,000	10,565,000
TOTAL AUSTRALASIA	9,300,000	10,085,000	10,072,000	108,000,000	117,311,000	142,850,000
WORLD'S TOTAL	210,895,000	211,980,000	211,166,000	3,210,110,000	3,091,004,000	3,087,389,000

(a) Official estimates.

Taking into consideration, therefore, all the twenty-two countries of Europe, exclusive of Russia, there is to be noted a marked steadiness of areas under wheat which, for the years 1921, 1922 and 1923 (estimated) range about 62,000,000 acres. On the basis previously explained—assuming a yield equal to the exceptionally good yield of 1921, with the figures slightly shaded for France, Spain and Italy—there is a promise of production for Europe 156,000,000 bushels in excess of last year's, but about 45,000,000 bushels less than the production of 1921.

On the other hand, Canada and the United States, the chief supply countries of the Northern Hemisphere, exhibit a decrease in area of over 3,000,000 acres, chiefly accounted for in the United States and, as compared with last years' crop, a decreased production of nearly 100,000,000 bushels and, as compared with the crop of 1921, an increase of about 41,000,000 bushels. There is compensation for this in the Southern Hemisphere where there is an important increase of nearly 2,000,000 acres in India, with a crop already officially reported at 401,000,000 bushels, and in Argentina an increase for the forthcoming season roughly estimated at 500,000 acres, with a correspondingly increased prospective production.

There results from all the details of the foregoing table a world's total area of 210,895,000 acres compared with 211,980,000 last year, a decrease of a little over 1,000,000 acres and a total world's production of 3,210,110,000 bushels, compared with 3,091,004,000, an increase of 119,100,000 bushels.

MOVEMENT OF WHEAT IN 1922-23

What has been the movement of wheat during the present year which is to end on August 1st next? The official reports show up to March 31st net exports of the amount of about 489,000,000 bushels. Assuming exports continue at the same rate—and the exports have been well sustained during the last three months in preceding years—there would be, up to August 1st, a further export of about 230,000,000 bushels and an annual total of 720,000,000 bushels. Making, from the exporter's viewpoint, a fairly generous estimate for the concluding months not yet officially reported, the total net exports of wheat and flour from the chief exporting countries will stand on August 1st as follows:

Canada	276,000,000	bushels
United States	213,000,000	"
India	21,000,000	"
Australia	52,000,000	"
Argentina	147,000,000	"
Total	709,000,000	"

Again, on June 5th, Mr. Broomhall renewed his estimate of the importers' needs at 696,000,000 bushels with 574,000,000 bushels shipped and 122,000,000 bushels still to be received. At the end of May Canada had exported 236,000,000 bushels and the United States estimating the May shipments as equal to those of April were in the same period only 185,000,000 bushels, from which should be deducted the imports from Canada. We estimate United States shipments for the remaining two months at 30,000,000 bushels. The Indian shipments will be heavier for the last four months, averaging possibly 3,000,000 bushels a month, Australia's lighter, with an average of about 5,000,000, while Argentina's shipments will continue heavy for the last three months unreported at about 17,000,000 bushels per month. These estimated shipments for the balance of the grain year amount to 153,000,000 bushels and would bring the total to 709,000,000 as above shown. And it is quite possible if the European harvest is a week or ten days late that the figure will reach 720,000,000.

United States grain writers expect a large unexported surplus on August 1st next. The last United States wheat crop may be briefly analyzed as follows:

		Bushels
Crop of 1922		856,000,000
Deduct 5 per cent for cleaning, waste and unmerchantable wheat		42,000,000
Total merchantable wheat		814,000,000
Add carry-over Aug. 1, 1922		61,000,000
Total for distribution.		875,000,000
Food for 110,000,000 at an average of 5 bushels per capita	550,000,000	
Seed for 58,000,000 acres	87,000,000	
		637,000,000
Balance available for export		238,000,000
Exported approximately		213,000,000
Carry-over on August 1, 1923		25,000,000
The corresponding showing for Canada follows:		
1922 crop		399,786,000
Less for cleaning and unmerchantable wheat		21,793,000
Balance		377,993,000
Add carry-over of Aug. 30, 1922		30,000,000
Total available for distribution		407,993,000
Deduct food and seed.		92,000,000
Total available for export		315,993,000
Estimated exports to August 1st next		276,000,000
Probable carry-over August next		40,000,000

On the incoming of the new crop September 1st the unexported balance of the old crop is estimated at 20,000,000 bushels. This is assuming that the 1922 crop has not been overestimated, as is claimed by some of the best Western crop experts. In our opinion the unexported surplus will be less than that shown by the above calculation.

Taking a world wide view we can see no indication that on August 1st next there will

remain unexported from the 1922 crop an abnormal surplus of wheat. The average in the exporting countries is likely to be about normal, while the importing countries' stocks are small and need replenishing.

PROSPECTS FOR 1923-24

What are the prospects for the grain year 1923-24?

The world's exports for the good European crop year 1921 were about 648,000,000 bushels and the total exports for the forthcoming grain year will probably not be less but rather larger. It is likely that Europe's production, as shown by the preceding table, will be 45,000,000 bushels under that of the record year of 1921. There are already evidences of general economic and financial recovery in many important countries of Europe, and this movement once begun is likely to continue to increase Europe's general credit and incline her people to be more generous with their food. Their own good crops are increasing their credit for further purchases. If the indications are not for the unusually large imports of the past year, there is a likelihood that there will be a market for practically all the exportable surpluses. These exports might be estimated as follows:—

	Bushels
United States	175,000,000
Canada	250,000,000
Argentina	120,000,000
Australia	40,000,000
India	40,000,000
Balkans	15,000,000
Russia	15,000,000
Other sources	10,000,000
Total	665,000,000

The average world exports of wheat, for the pre-war years 1909-1914, amounted to 664,000,000 bushels. There is little likelihood of a glutted market during the forthcoming grain year, but rather of a production closely approximating requirements and which would fall short of requirements should adverse weather develop in any important wheat region. The producer can therefore face the future with confident hope.

There is some probability that Russia will re-enter the market, although on a small scale. It will be of interest to note what the "Corn Trade News" of June 5th says of the Russian situation:

"Of the Russian crop, very little news has recently been received, but as seasonable and favourable weather has prevailed in the Balkans, it is very likely that good conditions have also prevailed in Southern Russia, where a big part of the wheat crop is grown. It will be prudent not to depend on Russia for a great deal of wheat, but if the Soviet Government decide that exports must be made, we expect they will make extraordinary efforts to collect the needful material. When Russia re-enters the market as an exporter of sizeable quantities, the chances are that the event will have far reaching effects on the international trade. In this connection we have just received a letter from an Englishman abroad who in pre-war days frequently visited South Russia specially to make himself acquainted with crop conditions there. He says: I consider it as quite impossible that any such surplus as 140 million bushels mentioned recently in Chicago reports will be available this coming season, even the Soviets do not claim that the area under cereals approaches the pre-war figure. No doubt rye is now perfectly safe and will go far toward satisfying the internal food requirements, but wheat, chiefly spring sown, has much yet to face. I should say that an export of 16,000,000 bushels from August 1923 to July 1924 is as good a guess as can be made at present."

AREAS SOWN TO RYE, BARLEY AND OATS

RYE

Countries	1923	1922	Average 1917 to 1921
	Acres	Acres	Acres
Belgium	475,000	531,000	535,000
Bulgaria	457,000	442,000	476,000
Spain	1,755,000	1,757,000	1,803,000
Jugoslavia	388,000	369,000	404,000
Finland	578,000	578,000	596,000
France	2,172,000	2,087,000	2,019,000
Italy	321,000	321,000	316,000
Latvia	618,000	592,000	523,000
Lithuania	1,385,000	1,369,000	1,196,000
Luxemburg	21,000	21,000	20,000
Poland	11,325,000	11,159,000	8,795,000
Roumania	456,000	481,000	666,000
Czechoslovakia	2,127,000	2,160,000	2,211,000
Canada	2,046,000	2,105,000	782,000
United States	5,234,000	6,210,000	5,130,000
Totals	29,358,000	30,182,000	25,472,000

BARLEY

Countries	1923	1922	Average 1917 to 1921
	Acres	Acres	Acres
Belgium	82,000	63,000	79,000
Bulgaria	531,000	534,000	553,000
Spain	4,151,000	4,082,000	4,225,000
Jugoslavia	488,000	484,000	549,000
France	1,592,000	1,427,000	1,613,000
Italy	568,000	577,000	530,000
Roumania	166,000	259,000	137,000
Czechoslovakia	1,686,000	1,686,000	1,650,000
Japan	2,518,000	2,746,000	2,912,000
Canada	2,556,000	2,600,000	2,708,000
United States	7,980,000	7,390,000	8,047,000
Algeria	2,781,000	2,868,000	2,729,000
Morocco	2,802,000	2,548,000	2,246,000
Tunis	988,000	603,000	1,173,000
Totals	28,889,000	27,867,000	29,151,000

OATS

Countries	1923	1922	Average 1917 to 1921
	Acres	Acres	Acres
Bulgaria	344,000	352,000	376,000
Spain	1,509,000	1,514,000	1,533,000
Jugoslavia	70,000	103,000	.....
France	8,540,000	7,905,000	7,677,000
Italy	1,211,000	1,214,000	1,184,000
Czechoslovakia	2,938,000	2,031,000	1,992,000
Canada	14,410,000	14,541,000	15,171,000
United States	40,768,000	40,693,000	43,116,000
Algeria	588,000	583,000	592,000
Morocco	32,000	28,000	14,000
Tunis	124,000	112,000	152,000
Totals	69,634,000	69,076,000	71,807,000

FOREIGN CROP CONDITIONS

(June 22nd, 1923)

Conditions in April.—In many parts of Western Europe the cold weather of early April delayed growth of the winter crops to some extent, but later in the month improvement set in and at the beginning of May, the crops were almost everywhere reported in satisfactory condition. At that time the European crop condition varied from average to good and was generally more promising than at the beginning of April and quite decidedly better than at the same time last year. Spring sowings were somewhat hindered by unfavourable weather, but, where completed, looked well.

Conditions generally in May.—According to the International Institute of Agriculture all European crops were in general good condition on June 1st.

United Kingdom.—During the second halt of May cold, rainy weather was experienced. Winter wheat appeared to be the best crop but was in need of sunshine. In a general way the condition of both winter and spring crops on June 1st was indicative of average yield. According to the Institute the area sown to winter wheat is slightly less than last year.

France.—In the latter part of May there were heavy rains, and rust had made an appearance in some areas. On June 1st prospects for the winter crops were described as satisfactory. Spring crops needed warmth and sunshine. The area sown to winter wheat is about 1,000,000 acres larger than last year. The latest report, on June 5th, indicates that cereal growth has been checked by cold, wet weather. There have also been frequent hailstorms.

Germany.—At the end of May the weather had turned cold, but crop prospects were well maintained. Spring sown crops were doing well. The area sown to winter wheat was expected to be slightly less than last year.

Portugal.—Prospects are for a remarkably good harvest. Reports indicate the best crops in fifteen years.

Spain.—Early reports were very favourable, but latest reports indicate only a fair outturn of wheat, a short crop in some districts being forecasted.

Italy.—Following recent rains in the latter part of May, cereal growth made rapid progress. According to the later reports, however, the outlook is not so favourable. Drought in the South and hail damage in Northern districts are reported.

Austria.—Growth was rather backward owing to excessive rains. A decrease in acreage is reported.

Hungary.—On June 1st the outlook was excellent and wheat and rye were reported above average condition. Later reports indicate that the eastern part of the country has suffered from drought.

Czechoslovakia.—An official report describes the condition of wheat and barley as good and that of rye and oats as average.

Poland.—The condition of winter crops on May 1st was above average.

Jugoslavia.—On May 14th the wheat crop was reported as satisfactory. Later good rains were reported.

Bulgaria.—On June 1st all crops were reported to be in excellent condition.

Roumania.—The area sown to winter wheat is 500,000 acres less than last year, but the condition of the crops is very satisfactory. On June 1st prevailing weather conditions were all that could be desired.

Russia.—An increase in the winter wheat acreage is reported, and a considerable one is expected in spring sowings.

North Africa.—According to reports received at the end of May, weather conditions were very favourable. Prospects in Algeria were described as excellent, while in Tunis the yield of wheat and barley is forecasted as 20 per cent above average.

India.—Threshing was carried out under satisfactory conditions. The first estimate of the wheat crop of 1923 was 425,000,000 bushels compared with 366,000,000 last year. A later estimate gives this year's production as 401,000,000 bushels.

Japan.—The latest report received from the Institute states that the weather in April was unfavourable.

Argentina.—Weather conditions were favourable for seeding. Broomhall's correspondent reports that an all-round increase in the acreage of wheat, oats and flaxseed is expected as a result of the good weather conditions and the heavy influx of foreign labour. The corn crop is estimated as 156,000,000 bushels against 230,000,000 last year and a five years' average of 175,000,000 bushels.

Australia.—Following the injurious drought there were good rains in May and the crop outlook improved. Prospects are described as favourable in Western and South Australia, Victoria and part of New South Wales. Elsewhere rain is required.

SUGAR PRODUCING SEASON 1922-23

BEET SUGAR—PRODUCTION OF RAW SUGAR

Countries	Production from the opening of the season (Sept. 1 to April 30)			Total yield during the season 1921-22
	1922-23	1921-22	Percentage (1921-22=100)	
	Short tons	Short tons	Per cent	Short tons
Germany (1)	1,564,263	1,393,258	112·3	1,429,284
Austria (2)	26,856	18,036	148·9	18,036
Belgium (1)	292,274	315,112	92·8	315,497
Bulgaria (2)	18,210	14,238	127·9	14,238
Denmark (2)	98,987	155,757	63·6	155,757
Finland (3)	1,746	2,244	77·8	2,244
France (1)	541,359	333,810	162·2	402,990
Hungary (4)	87,720	66,646	131·6	67,097
Italy (4)	284,158	222,880	127·5	227,514
Netherlands (1)	256,178	380,463	67·3	381,910
Poland (3)	355,278	.....	.....	200,588
Sweden (2)	79,186	258,792	30·6	258,792
Czechoslovakia	808,272	727,425	111·1	730,305
United States (2)	785,226	1,159,644	67·7	1,159,644

(1) Yield to the end of March. (2) Total yield. (3) Yield to the end of January.
(4) Yield to the end of February.

CANE SUGAR—TOTAL YIELD OF RAW SUGAR

Countries	1922-23	1921-22	Percentage 1922-23 (1921-22=100)
	Short tons	Short tons	Per cent
Argentina	.....	212,747	.....
Brazil	.....	910,959	.....
Cuba	.....	4,476,794	.....
United States	241,336	324,431	74·4
Nicaragua	12,677	14,881	85·2
Peru	.....	341,717	.....
Porto Rico	392,782	405,936	96·8
Dominican Republic	.....	205,974	.....
Formosa	372,053	368,041	101·1
India	3,346,560	2,910,880	115·0
Java	1,986,042	1,858,610	106·9
Egypt (1)	103,134	111,785	92·3
Mauritius	258,720	224,660	115·2
South Africa	157,960	146,987	107·5
Australia	342,640	336,477	101·8
Hawaii	.....	592,000	.....

(1) Yield to the end of April.

INDEX NUMBERS OF THE PRICE OF WHEAT

Dates	EXPORTING MARKETS			
	Canada Winnipeg — No. 1 Manitoba	*United States* Chicago — No. 2 Winter	*India* Karachi — Karachi white	*Argentina* Buen. Aires — Barletta
Average 1913	100	100	100	100
9 May "	106·0	101·9	102·9	104·6
12 " 1922	167·9	160·9	178·8	155·5
2 March 1923	126·3	132·7	127·3	138·7
9 " "	126·0	133·0	128·1	137·0
16 " "	128·7	134·5	128·9	137·6
23 " "	130·3	135·7	133·0	138·2
29 " "	130·1	133·1	134·2	137·0
6 April "	133·5	136·4	131·4	138·7
13 " "	138·8	140·2	135·9	141·0
20 " "	138·1	140·4	136·7	140·5
27 " "	138·6	141·3	137·5	141·6
4 May "	135·4	134·6	137·5	140·5
11 " "	132·7	132·7	133·0	137·6

Dates	IMPORTING MARKETS					
	Germany Berlin — Home grown	*Belgium* Antwerp — Home grown	*France* Paris — Home grown	*Great Britain* London — Home grown	*Italy* Milan — Home grown soft	*Netherlands* Rotterdam — Home grown
Average 1913	100	100	100	100	100	100
9 May "	107	104·6	104·6	101·0	107·7	104·6
12 " 1922	7,245	338·4	281·0	167·7	395·0	137·8
2 March 1923	452,466	404·0	337·1	119·8	395·0	101·0
9 " "	350,788	404·0	342·0	118·7	398·6	99·8
16 " "	391,459	419·2	332·1	119·8	402·1	105·2
23 " "	399,085	383·8	325·9	116·7	402·1	109·3
29 " "	421,962	378·8	n.q.	118·7	402·1	114·1
6 April "	503,305	404·0	326·8	118·7	400·4	.....
13 " "	518,556	409·1	325·0	121·9	400·4	122·8
20 " "	594,814	429·3	329·4	132·3	403·9	127·1
27 " "	630,402	429·3	329·0	133·3	403·9	126·0
4 May "	747,331	434·3	334·8	134·4	407·5	122·3
11 " "	762,583	429·3	340·2	132·3	407·5	120·4

PRICES AND OCEAN FREIGHT RATES REDUCED TO CENTS

Products, Markets and Descriptions	4 May 1923	6 April 1923	5 May 1922	Aver. 1913
WHEAT (*cents per 60 lbs.*)				
Canada:				
Winnipeg: No. 1 Manitoba	117	115	142	88
United States:				
Chicago: No. 2 Winter	121½	123⅛	141¼	90¼
Minneapolis: No. 1 North	126	126	158	87⅝
New York: No. 2 Winter	136½	136¾	153½	97¼
India:				
Karachi: Karachi white	120	115	142	91
Argentina:				
Buenos Aires: Barletta	120	120	133	100
Germany:				
Berlin: Home grown	56	127	138	128
Belgium:				
Antwerp: Home grown	134	122	145	104
France:				
Paris: Home grown	169	162	197	146
Great Britain:				
London: English	133	119	159	104
Liv. and Lond.: No. 1 Man	142	136	167	110
Liv. and Lond.: No. 2 Win	141	n.q.	143	109
Liv. and Lond.: Pacific	151	142	157	111
" " Plate	140	135	155	108
" " Australian	151	152	160	117
" " C.W. Kar.	145	141	n.q.	110
Italy:				
Milan: Home grown soft	153	152	162	148
Netherlands:				
Rotterdam: Home grown	137	138	151	115
RYE (*cents per 56 lbs.*)				
United States:				
Minneapolis: No. 2	76½	78	103	56⅜
Germany:				
Berlin: Home grown	44	103	94	101
Belgium:				
Antwerp: Home grown	99	96	119	80
France:				
Paris: Home grown	n.q.	115	118	97
Netherlands:				
Rotterdam: Homegrown	100	101	127	86

Ocean Rates of Freight, and Voyages	4 May 1923	6 April 1923	5 May 1922	Aver. 1913
OCEAN RATES OF FREIGHT (WHEAT AND MAIZE) (*cents per 100 lbs.*)				
Rumania:				
Danube to U.K.	22	18	17	11
Danube to Genoa	20	17	15	10
Canada:				
Canada to U.K.	16	17	16	14
United States:				
New Yor. to Liverpool	8	11	9	10
North Range to U.K. Cont.	14	16	16	13
North. Range to Genoa	18	21	20	20
North Pacific Ports to U.K.	39	39	37	43
Argentina:				
Plate Down River-U.K.	35	24	26	18
Plate Up River-U.K.	37	25	30	20
India:				
Karachi to U.K.	30	30	19	20
Rangoon to U.K.	34	35	26	29
Australia:				
Australia to U.K.	37	40	46	34
COTTON FREIGHTS (*cents per 100 lbs.*)				
United States:				
New York to Liverpool	20	20	25	30
New Orl. to Liverpool	n.q.	n.q.	50	43

Directory of the Department of Agriculture

Minister.....The Honourable W. R. Motherwell.

Deputy Minister.....J. H. Grisdale, B.Agr., D.A.Sc.

Commissioner, Dept. of Agriculture.....Duncan Marshall.

Assistant Deputy Minister and Secretary.....Lt.-Col. A. L F. Jarvis, I.S.O.

The Dominion Experimental Farms, Director, E. S. Archibald, B.A., B.S.A.

Functions—To administer the Central Experimental Farm at Ottawa, twenty-one branch farms, eight sub-stations, eighty-six illustration stations, and two tobacco stations. The divisions of work are: Administrative, Chemistry, Horticulture, Cereals, Poultry, Animal Husbandry, Forage Plants, Bee, Tobacco, Botany, Field Husbandry, Flax, Illustration Stations, and Extension and Publicity.

Health of Animals Branch.....Veterinary Director General, Frederick Torrance, B.A., D.V.S.

Functions—To administer enactments for the protection of live stock from contagious diseases, and to inspect meats, meat products and canned foods; to conduct research work.

Live Stock Branch.....Commissioner, H. S. Arkell, M.A., B.S.A.

Functions—To develop the live stock industry through the use of superior stock; to improve marketing facilities; to administer The Live Stock and Live Stock Products Act.

Dairy and Cold Storage Branch.....Commissioner, J. A. Ruddick.

Functions—To develop the dairy industry; to inspect public cold storage warehouses; to carry on shipping experiments; to administer Dairy enactments.

Seed Branch.....Commissioner, George H. Clark, B.S.A.

Functions—To encourage the production and use of pure seed; to test and inspect seed; to inspect feed manufacturing plants; to inspect Fertilizers; to supply seed in case of shortage.

Entomological Branch.....Dominion Entomologist, Arthur Gibson, F.E.S., F.E.S.A.

Functions—To investigate injurious insects and methods of control; to enforce the Destructive Insect and Pest Act.

Fruit Branch.....Commissioner, G. E. McIntosh

Functions—To develop the fruit industry; to enforce the Inspection and Sales Act as it relates to fruit, fruit packages and potatoes; to enforce The Root Vegetables Act; to adjust transportation difficulties.

International Institute of Agriculture...Commissioner, T. K. Doherty, LL.B.

Functions—To represent Canada at the Internation Institute of Agriculture at Rome; to publish world agricultural information and statistics; to maintain the departmental library.

Agricultural Instruction Act Branch.....Commissioner, (Acting), J. H. Grisdale, B. Agr., D.A.Sc.

Functions—To administer the Agricultural Instructional Act, and to report upon the work carried on by the provinces under its provisions.

Publications Branch.....Director of Publicity, J. B. Spencer, B.S.A.

Functions—To publish "The Agriculture Gazette;" to distribute departmental publications; to prepare and issue other publicity matter.