The Organization Achievements and Present Work of the Experimental Farms

Published by Direction of the Hon. W. R. MOTHERWELL, Minister of Agriculture

OTTAWA
GOVERNMENT PRINTING BUREAU
1924

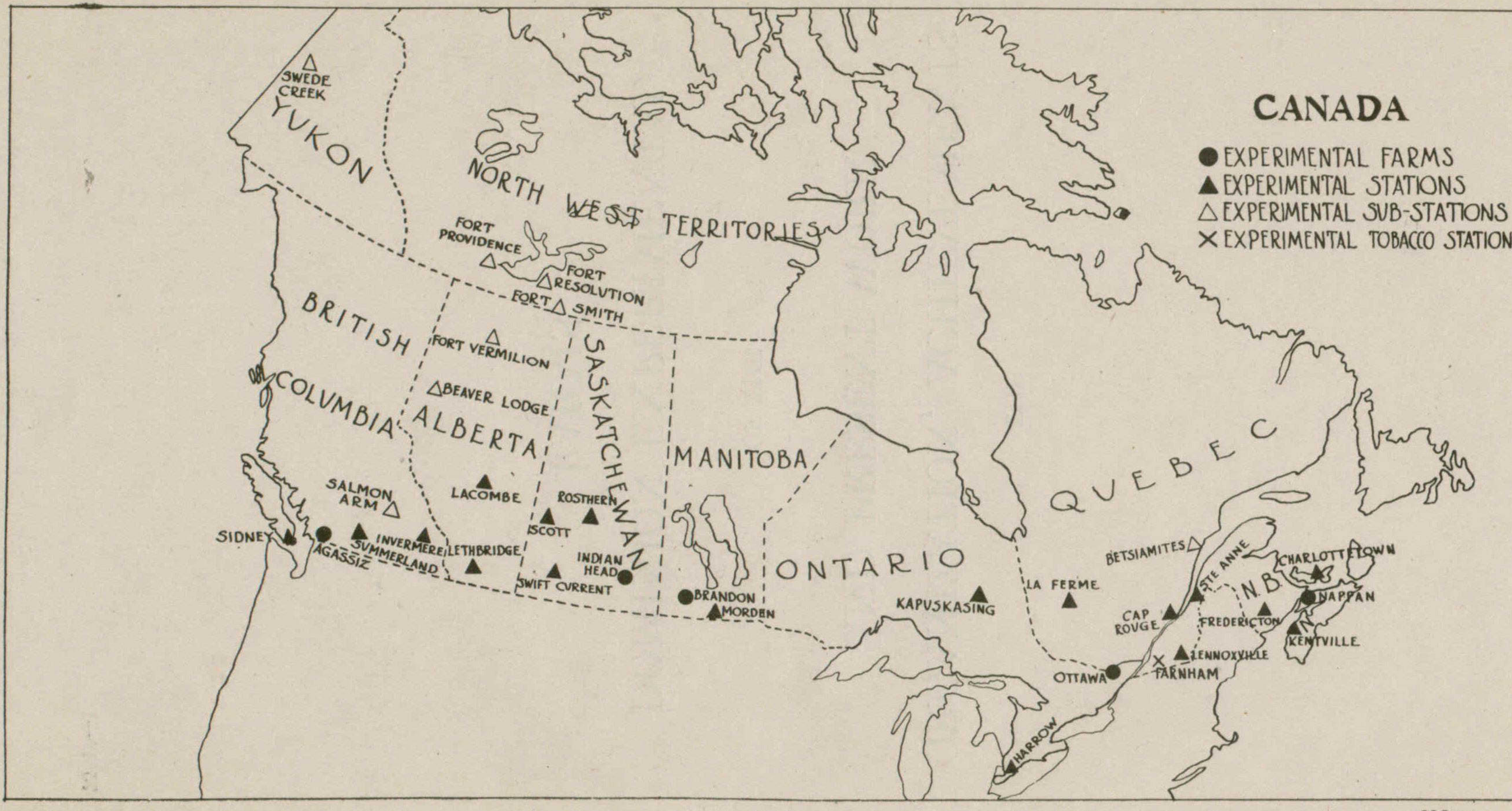
THE

ORGANIZATION, ACHIEVEMENTS AND PRESENT WORK

OF THE

DOMINION EXPERIMENTAL FARMS

75617—1


CANADA
EXPERIMENTAL FARMS
EXPERIMENTAL STATIONS
EXPERIMENTAL SUB-STATIONS
EXPERIMENTAL TOBACCO STATIONS
YUKON
SWEDE CREEK
NORTH WEST TERRITORIES
FORT PROVIDENCE
FORT RESOLUTION
FORT SMITH
BRITISH COLUMBIA
FORT VERMILION
BEAVER LODGE
ALBERTA
SASKATCHEWAN
MANITOBA
ONTARIO
QUEBEC
N.B.
SALMON ARM
LACOMBE
ROSTHERN
SCOTT
SIDNEY
AGASSIZ
SUMMERLAND
INVERMERE
LETHBRIDGE
INDIAN HEAD
SWIFT CURRENT
BRANDON
MORDEN
KAPUSKASING
LA FERME
BETSIAMITES
STE ANNE
CAP ROUGE
CHARLOTTETOWN
NAPPAN
FREDERICTON
KENTVILLE
LENNOXVILLE
FARNHAM
OTTAWA
HARROW
C.E.F.
A.V.H.
17-12-23.

FOREWORD

FOR thirty-seven years, "Service to the Canadian Farmer" has been the motto and sole aim of the Experimental Farms Branch of the Federal Department of Agriculture.

Founded when scientific agriculture in the Dominion was in its infancy, the Farms first took up the study of those elementary, yet basic, problems and principles having so vital a bearing upon agricultural progress.

For the older-settled parts of this country, these have largely been solved. Their solution, however, has only cleared the way for the attack upon research and experiment, more advanced and complex, yet having an equally direct bearing upon successful farming.

As new regions have been opened to agriculture, the organization and work of the Farms have expanded to take in the study of their problems.

At present, then, the Farms stand ready to aid the farmer already successfully established in Canada, in the endeavour still to better his farming practice, excellent though it may already be.

To the settler, the Experimental Farms are as a friend who has gone before, and is now ready and anxious to impart his knowledge and experience to aid the newcomer in making himself a successful and contented Canadian farmer, no matter in what part of the Dominion he may choose to dwell.

At first glance, the reader of the following pages may think that the organization of the Farms is a very complex one, made up of many, almost independent, divisions and farm units. Such is not the case. A more careful perusal will indicate that the work of the divisions of the Central Farm, as headquarters, and of the branch Farms and Stations, is so inter-related, inter-dependent, and, indeed, welded together, as to form the one smoothly functioning machine.

75617—1½

LIST OF PAST AND PRESENT DIRECTORS, CHIEF OFFICERS OF DIVISIONS AND SUPERINTENDENTS OF BRANCH FARMS AND STATIONS

Directors—	
Wm. Saunders, C.M.G., L.L.D	1886–1911
J. H. Grisdale, B. Agr., D.Sc	1911–1919
E. S. Archibald, B.A., B.S.A	1919
Assistant Director—	
Frank T. Shutt, M.A., D.Sc	1912
Agriculturists—	
(Acting) Wm. Saunders, C.M.G., L.L.D	1887–1890
Jas. W. Robertson, L.L.D	1890–1896
(Acting) Wm. Saunders, C.M.G., L.L.D	1897–1898
J. H. Grisdale, B. Agr., D.Sc	1899–1911
(Acting) J. H. Grisdale, B. Agr., D. Sc	1911–1912
Animal Husbandmen—	
E. S. Archibald, B.A., B.S.A	1912–1919
G. B. Rothwell, B.S.A	1919
Field Husbandmen—	
(Acting) J. H. Grisdale, B. Agr., D.Sc	1912–1919
(Acting) E. S. Archibald, B.A., B.S.A	1919–1920
E. S. Hopkins, B.S.A	1920
Horticulturists—	
W. W. Hilborn	1887–1889
John Craig	1890–1897
W. T. Macoun	1898
Poultry Husbandmen—	
A. G. Gilbert	1888–1913
F. C. Elford	1913
Cerealists—	
(Acting) Wm. Saunders, C.M.G., L.L.D	1887–1902
C. E. Saunders, Ph.D. (termed Experimentalist 1903-1904)	1903–1922
L. H. Newman, B.S.A	1923
Agrostologists—	
M. O. Malte, Ph.D	1912–1921
Gordon P. McRostie, B.S.A., Ph.D	1922
Chief, Fibre Division—	
G. G. Bramhill, B.S.A	1917–1918
R. J. Hutchinson	1918
Apiarists—	
F. W. L. Sladen	1914–1921
G. B. Gooderham, B.S.A	1921
Tobacco Husbandman—	
F. Charlan	1913–1924
G. M. Slagg, B.S., M.S	1924
Chemists—	
Frank T. Shutt, M.A.; F.I.C.; D.Sc	1887
Botanist—	
H. T. Güssow	1909
Agricultural Bacteriologist—	
A. G. Lochhead, Ph.D	1923
Chief Supervisor, Illustration Stations—	
John Fixter	1915
Chiefs, Extension and Publicity—	
J. F. Watson	1914–1917
W. A. Lang	1917–1921
F. C. Nunnick B.S.A.	1921
Farm Foreman—	
John Fixter	1887–1906
D. D. Gray	1906–1918
Farm Superintendent—	
D. D. Gray	1918

SUPERINTENDENTS OF BRANCH FARMS AND STATIONS

Experimental Station, Charlottetown, P.E.I.—	
J. A. Clark, B.S.A.	1909
Experimental Station, Kentville, N.S.—	
W. Saxby Blair	1912
Experimental Farm, Nappan, N.S.—	
Wm. M. Blair	1887–1896
Geo. W. Forrest	1896–1897
R. Robertson	1898–1913
W. W. Baird, B.S.A.	1913
Experimental Station, Fredericton, N.B.—	
W. W. Hubbard	1912–1922
C. F. Bailey, B.S.A.	1922
Experimental Station, Ste. Anne de la Pocatière, Que.—	
Jos. Begin	1912–1921
J. A. Ste. Marie, B.S.A.	1921
Tobacco Station, Farnham, Que.—	
O. Chevalier	1912–1916
J. E. Montreuil, B.S.A.	1919
Experimental Station, Cap Rouge, Que.—	
G. A. Langelier, D.Sc. A.	1911
Experimental Station, Lennoxville, Que.—	
J. A. McClary	1914
Experimental Station, La Ferme, Que.—	
Pascal Fortier, Agr.	1916
Experimental Station, Kapuskasing, Ont.—	
S. Ballantyne	1916
Experimental Station, Harrow, Ont.—	
W. A. Barnet	1908–1915
D. D. Digges, M.S.A.	1915
Experimental Station, Morden, Man.—	
E. M. Straight, B.S.A.	1918–1921
W. R. Leslie, B.S.A.	1921
Experimental Station, Brandon, Man.—	
S. A. Bedford	1888–1905
N. Wolverton, B.A.	1906–1907
Jas. Murray, B.S.A.	1907–1911
W. C. McKillican, B.S.A.	1911
Experimental Farm, Indian Head, Sask.—	
Angus Mackay	1888–1913
T. J. Harrison, B.S.A.	1913–1915
W. H. Gibson, B.S.A.	1915–1919
N. D. MacKenzie, B.S.A.	1919
Experimental Station, Rosthern, Sask.—	
Wm. A. Munro, B.A., B.S.A.	1909
Experimental Station, Scott, Sask.—	
R. E. Everest, B.S.A.	1911–1914
M. J. Tinline, B.S.A.	1914
Experimental Station, Swift Current, Sask.—	
Jas. G. Taggart, B.S.A.	1921
Experimental Station, Lethbridge, Alta.—	
W. H. Fairfield, M.S.	1906
Experimental Station, Lacombe, Alta.—	
G. H. Hutton, B.S.A.	1907–1919
F. H. Reed, B.S.A.	1920
Experimental Station, Summerland, B.C.—	
R. H. Helmer	1914–1923
W. T. Hunter	1923
Experimental Farm, Agassiz, B.C.—	
Thos. A. Sharpe	1888–1911
P. H. Moore, B.S.A.	1911–1916
Wm. H. Hicks, B.S.A.	1916
Experimental Station, Invermere, B.C.—	
G. E. Parham	1913–1919
R. G. Newton, B.S.A.	1919
Experimental Station, Sidney, B.C.—	
L. Stevenson, M.S.	1915–1921
E. M. Straight, B.S.A.	1921
Experimental Sub-Station, Fort Vermilion, Alta.—	
Robert Jones	1908
Experimental Sub-Station, Beaverlodge, Alta.—	
W. D. Albright	1915

THE ORGANIZATION OF THE DOMINION EXPERIMENTAL FARMS BRANCH

When the Experimental Farms were first established in 1887, their organization largely followed that recommended by Prof. Wm. Saunders in his report of the previous year, on Agricultural Colleges and Experimental Farm Stations. His recommendation was as follows:—

"The whole should be under the control of one head, known as director or chief, whose residence should be at the central station, and whose duty it should be to visit the substations as occasion required and in conference with the managers of the substations arrange for the course and character of the work to be carried on at each, subject to the approval of the Minister of Agriculture. This arrangement would ensure desirable uniformity in the character of the work performed and prevent the waste which would result from the unnecessary duplication of experiments.

Central Station

"At the central station there would be required, in addition to the director, a superintendent of agriculture charged with the care of farm stock and the dairy and field experiments.

"A superintendent of horticulture, who should conduct experiments in fruit and vegetable growing, in determining the vitality and purity of seeds, and have charge of the nursery and propagating houses.

"A superintendent of forestry, who should direct all forestry experiments, and inquire into all questions relating to tree culture and tree protection in the Dominion.

"An entomologist whose duty it should be to investigate the habits of insects destructive to farm and garden crops, fruit, etc., as well as those affecting animals, with the view of testing such remedies as may be available for their destruction. He should also prepare such collections for the museum at the central station as would illustrate the insects injurious and beneficial to vegetation, and duplicate collections of a similar character as early as practicable for each of the substations.

"A botanist, to whom should be entrusted the special duty of investigating the injury done to field and garden crops, fruit and forest trees, by the lower forms of vegetable life, such as fungi, rusts, moulds, etc., to study the character and modes of growth of the noxious weeds prevailing in all parts of the Dominion, with the object of devising means for their subjugation or destruction. He should also take charge of the botanic garden or arboretum, and of that portion of the central museum illustrating vegetable products.

"A chemist, to whom should be referred all questions relating to agricultural chemistry, such as analyses of fertilizers, the determination of the chemical constituents of any substances which it may be desirable to use in experimental work in feeding; to make analyses of milk in connection with experiments in dairying, of wheats, to determine their relative quality for milling, and to have charge of all other subjects requiring special chemical investigation in connection with the work being carried on at any of the stations.

"A veterinary surgeon, whose services should be available when required for the treatment of diseases of animals at any of the stations, and whose duty it should be to study such diseases and prepare and submit a yearly report thereon.

Provincial or Substations

"The officers required at each of the substations would be a superintendent of agriculture and a superintendent of horticulture. The superintendent of agriculture to be chief of the station, subordinate only to the director, and responsible to him for the proper government of the station and for the due performance of all work directed to be undertaken. The superintendent of horticulture and all other employees to be subordinate to the superintendent of agriculture and under his direction.

Reports

"The outlying stations to report to the director as often as required, and the reports of the officers of all the stations to be presented through the director to the Minister of Agriculture."

In this comparatively simple plan, the director, in addition to his administrative duties, assumed charge of some of the lines of technical investigation. However, as time went on the work increased, new divisions were formed, new lines of work taken up, and new farms established. Finally, the director found that the duties of administration and general supervision took up practically his whole time.

The original organization plan, therefore, while it has not been superseded, has been elaborated to meet change of conditions and expansion of work and personnel.

At the present time, the System is made up of the Central Farm at Ottawa and twenty-two branch Farms and Stations. There are, in addition, the special horse-breeding Farm at St. Joachim, Que., and the Tobacco Experimental Station at Farnham, Que., under the immediate supervision of the Cap Rouge superintendent and of the chief officer of the Tobacco Division respectively. The number of Illustration Stations in Canada, distributed from the Atlantic to the Pacific, is at present 136. The work on these is under the immediate charge of the Chief Supervisor of Illustration Stations. The Division of Botany has eight field laboratories throughout the Dominion.

In addition, a limited amount of experimental work is conducted upon two main substations and six minor substations, located in the more remote regions of the country.

At the head of the branch stands the Director of Dominion Experimental Farms. He is responsible to the deputy minister and to the Minister of Agriculture for the administration and the experimental activities of the branch. Upon his authorization all expenditures are made and lines of research and experiment carried on.

At the Central Farm, Ottawa, the headquarters of the whole Experimental Farms System, are located the fourteen divisions into which the lines of research and experimental work fall. Each of these divisions is in charge of a chief officer.

Each divisional chief officer is responsible to the director for the efficient carrying on of the experimental work of his division, and has under him an assistant, or assistants, clerical staff, and working force as required. Each division has allotted to it a certain sum from the yearly appropriation voted for the work of the branch.

In the case of the Division of Illustration Stations, while its chief and his supervisors have immediate charge of the work conducted on these, the director first authorizes such work, gives his approval of any suggested changes, and authorizes all expenditures. The same rule obtains with the Tobacco Division, which in addition to its experimental work on the Central Farm has immediate supervision of the work on the Tobacco Station at Farnham, Que.

The Central Farm superintendent is immediately responsible to the director and has charge of the general working force not under divisional control, looks after the providing and adjustment of labour among the various divisions; he is responsible for discipline of the working force, has charge of work horses and machinery, etc. Although looking to the director for instructions, the Farm superintendent works in closest co-operation with the divisional officers in order to facilitate their farm operations.

Each branch Farm and Station is under the charge of a superintendent, who is responsible to the director for the efficient administration and conduct of experimental work on that Farm or Station. To each branch Farm is allotted its share of the total appropriation of the branch. To aid him in the work, the superintendent has under him an assistant, or assistants, a clerical staff, a farm foreman, and skilled and unskilled labour as needed.

The experimental work of the branch Farms is classified under the same general heads as is the work at the Central Farm, and the superintendents act in the closest co-operation with the heads of the various divisions at Ottawa, as to its planning and execution, all such plans, and expenditures connected therewith, being approved by the director before operations are commenced. Copies of all records of experiments are sent to the divisions at Ottawa by the superintendents and the heads of those divisions make one or more visits of inspection over the branch Farms each year, reporting upon the condition of their work on each to the director, upon return.

It has so far been found that the above system, while elastic enough to permit of individual initiative, places supervision over, and responsibility for, the work upon those most immediately in touch with it and best fitted by training and experience to conduct it most effectively, allowing, at the same time, the fullest mutual co-operation. On the other hand, the plan provides that the director, as head of the branch, is thoroughly informed as to plans for experimental work and results being obtained therefrom, while, in administration, all important matters are brought to his attention and all expenditures receive his approval and authorization.

THE DOMINION EXPERIMENTAL FARMS

Their Establishment, History and Growth

The year 1884 found Canada facing the necessity of studying her agricultural conditions and adjusting these to remedy obvious defects and meet more complex needs. In the older settled provinces, primitive agricultural methods no longer sufficed and their consequences were becoming only too apparent. The possibilities of the West were being dimly recognized as was the fact that agriculture on the prairies introduced conditions and problems all its own. Most important of all, it was seen that Canada's possible future as a great nation depended upon a contented and prosperous people; that such contentment and prosperity were impossible unless agriculture were put upon a permanent and profitable footing; that farming, while the most important industry of the country, was also a mode of life and that hence everything bearing upon that industry, and everything tending to a wider, fuller and more complete life upon the farm, were deserving of the most careful attention.

In the above year, then, the House of Commons appointed a Select Committee to look into agricultural conditions in Canada. Briefly, the committee found the cause of the then prevailing agricultural depression to be, mainly, ignorance of good farming methods, leading inevitably to soil impoverishment, poor crop returns, consequent discontent and frequently abandonment of the land and emigration to other countries.

At that time, the only institution in Canada carrying on agricultural education and experimental work was the Ontario Agricultural College at Guelph, established in 1873. It was serving a useful purpose, but having in view the varied soil and climatic conditions of Canada the applicability of its results was limited; of its total farm area of 550 acres, only 24 were devoted to experimental work and that the value of its training was not widely appreciated may be gathered from the fact that, in 1883, the college had only nine graduates and and in 1884, eleven.

The then function of the Federal Department of Agriculture was defined to the committee by the secretary of that department as follows: "There has, however, been no general vote for the purposes of agriculture. There have been special votes for particular branches—for instance, cattle quarantine and inspection, the gathering of statistics in certain particular cases, and also grants to exhibitions. Hitherto, these have comprised the whole functions of the department in relation to agriculture".

Embodied in the report made to the House by the Select Committee, was a recommendation that an experimental farm be established and the next session a vote for this was passed.

It was desired, however, by the Hon. John Carling, then Minister of Agriculture, that before such farm was definitely established, detailed information be obtained as to the operation, organization and scope of such institutions in other countries, particularly in the United States. Prof. William Saunders, of London, Ont., was commissioned to make this enquiry and report to the minister. Professor Saunders at that time was a chemist, horticulturist and entomologist and held a chair in the Northwestern University at London.

His scientific work along the above lines had long shown him to be far in advance of his time in agricultural investigations and naturally pointed him out as the most fitting man to investigate and report upon such researches elsewhere.

In February, 1886, he presented to the minister his *Report on Agricultural Colleges and Experimental Farm Stations, with suggestions relating to Experimental Agriculture in Canada.* Among these suggestions, he recommended the establishment of a Central Farm at or near Ottawa, a Farm in the Maritime Provinces, two Farms on the prairies and one Farm in British Columbia, outlining a plan of organization and indicating the main lines of investigation to be pursued.

In the same year (1886) an Act was passed authorizing the establishment of these five farms and under its authority Professor Saunders was chosen by the Minister of Agriculuture as the first Director of the Dominion Experimental Farms System.

Under the Act, and based upon Professor Saunders' recommendations, the main lines of investigation were to be as follows:—

(*a*) Conduct researches and verify experiments designed to test the relative value, for all purposes, of different breeds of stock, and their adaptability to the varying climatic or other conditions which prevail in the several Provinces and in the Northwest Territories;

(*b*) Examine into scientific and economic questions involved in the production of butter and cheese;

(*c*) Test the merits, hardiness and adaptability of new or untried varieties of wheat or other cereals, and of field crops, grasses and forage plants, fruits, vegetables, plants and trees, and disseminate among persons engaged in farming, gardening or fruit growing, upon such conditions as are prescribed by the Minister of Agriculture, samples of such surplus products as are considered to be specially worthy of introduction;

(*d*) Analyze fertilizers, whether natural or artificial, and conduct experiments with such fertilizers, in order to test their comparative value as applied to crops of different kinds;

(*e*) Examine into the composition and digestibility of foods for domestic animals;

(*f*) Conduct experiments in the planting of trees for timber and for shelter;

(*g*) Examine into the diseases to which cultivated plants and trees are subject, and also into the ravages of destructive insects, and ascertain and test the most useful preventive and remedies to be used in each case;

(*h*) Investigate the diseases to which domestic animals are subject;

(*i*) Ascertain the vitality and purity of agricultural seeds; and

(*j*) Conduct any other experiments and researches bearing upon the agricultural industry of Canada, which may be approved by the Minister of Agriculture.

During the next two years, the five farms were located and put into practical operation. The Farm for the Maritime Provinces was located at Nappan, N.S.; that for Manitoba at Brandon, in that province, that for the Northwest Territories at Indian Head, Sask., and the Farm for British Columbia at Agassiz, B.C. The Central Farm had also been located, an area of 466 acres, just outside the city boundary of the capital, necessary clearing, levelling, fence and road-making had been done, an arboretum and botanic garden laid out, erection of buildings put well under way, and experimental work commenced.

At first, there were only three divisions of the work at the Central Farm, those of Entomology and Botany, Chemistry, and Horticulture. Professor Saunders, in addition to his administrative duties, assumed those of agriculture, that is, field and live stock work, and also experimental work with cereals. Gradually, however, expansion demanded the appointment of special officers to supervise these lines of investigation, although Professor Saunders continued to take the keenest interest in his favourite avocations of breeding work in cereals and horticulture, during his whole career as director.

Early in the present century, the need of further experimental stations became imperative. The West was rapidly becoming settled; the effect of variations of soil and climatic conditions were better understood; the good results obtained from the experimental farms already established were plainly evident; and in 1906, a Station was located at Lethbridge, Alta; in 1907, one at Lacombe. in the same province.

In 1908, experimental work was begun on the Substation at Fort Vermilion, Alta., and in 1912 at the Substation at Beaverlodge, Grande Prairie, Alta. In the same year a limited amount of experimental work in the testing of varieties was arranged for at Forts Smith, Resolution and Providence, and at Grouard, Alta.

In 1909, a Station was established at Rosthern, Sask., and one at Charlottetown, P.E.I. In 1911, one was established at Cap Rouge, Que., and one at Scott, Sask.

In 1911, Dr. Wm. Saunders retired, owing to age and ill health, and was succeeded in the directorate by Mr. J. H. Grisdale, who had been connected with the Experimental Farms Branch, as agriculturist, since 1899.

To Mr. Grisdale, as director, fell the heavy task of getting full lines of work under way on the newer stations so rapidly acquired during the few preceding years. His appointment also coincided with what may be termed the period of transition between the older and the newer, the primary and the secondary, the basic and the more complex, systems of agricultural investigation. Agricultural colleges had been founded in almost every province; knowledge had increased, methods improved and possibilities widened. It was necessary, then, that the Experimental Farms Branch should be kept in the forefront of the new movement. The work of the various divisions was, therefore, thoroughly revised and broadened. Greater specialization was obtained by creating new divisions, such as those of Agrostology, Fibre Plants, Illustration Stations, Extension and Publicity, and Bees, or by dividing former divisions, such as that of Agriculture, into Animal Husbandry and Field Husbandry, as had been done, in 1909, in the formation of the Divisions of Entomology and Botany. This policy naturally led to the appointment of a number of chief technical officers and assistants, with more specialized training and duties.

In 1914, the division of Entomology was made into a separate branch of the department, owing to the fact that its work could not be localized and carried on upon the Experimental Farms, but must necessarily be conducted wherever outbreaks of insect pests might occur.

An important change in supervision of the work became necessary in 1910. Hitherto the director had supervised and inspected all work on the branch Farms. This work had now become so broadened and specialized that he could no longer do so and hence the heads of the various divisions at the Central Farm were given supervision, under the general control of the director, of their respective lines of investigation on the Branch Farms as well. As indicating this wider responsibility the word Dominion was prefixed to their official titles.

In 1912 the Tobacco Division, formerly a separate branch of the department, was made part of the Experimental Farms, and in the same year the Experimental Stations at Ste. Anne de la Pocatière, Que., at Kentville, N.S., Fredericton, N.B., Invermere, B.C., and Sidney, B.C., were established. Early in 1914, work on the new Experimental Stations at Lennoxville, Que., and Summerland, B.C., was put under way.

The Great War, breaking out later in that year, made necessary the postponement of many features of this policy of expansion then well under way. Many of the staff of the Experimental Farms Branch left for the front, and it was considered inadvisable, or found impossible, to fill their places temporarily. The Experimental Farms, moreover, were called upon to play a leading part in stimulating and guiding immediate maximum production—leaving until later the further study of the problems underlying systems of permanent agriculture.

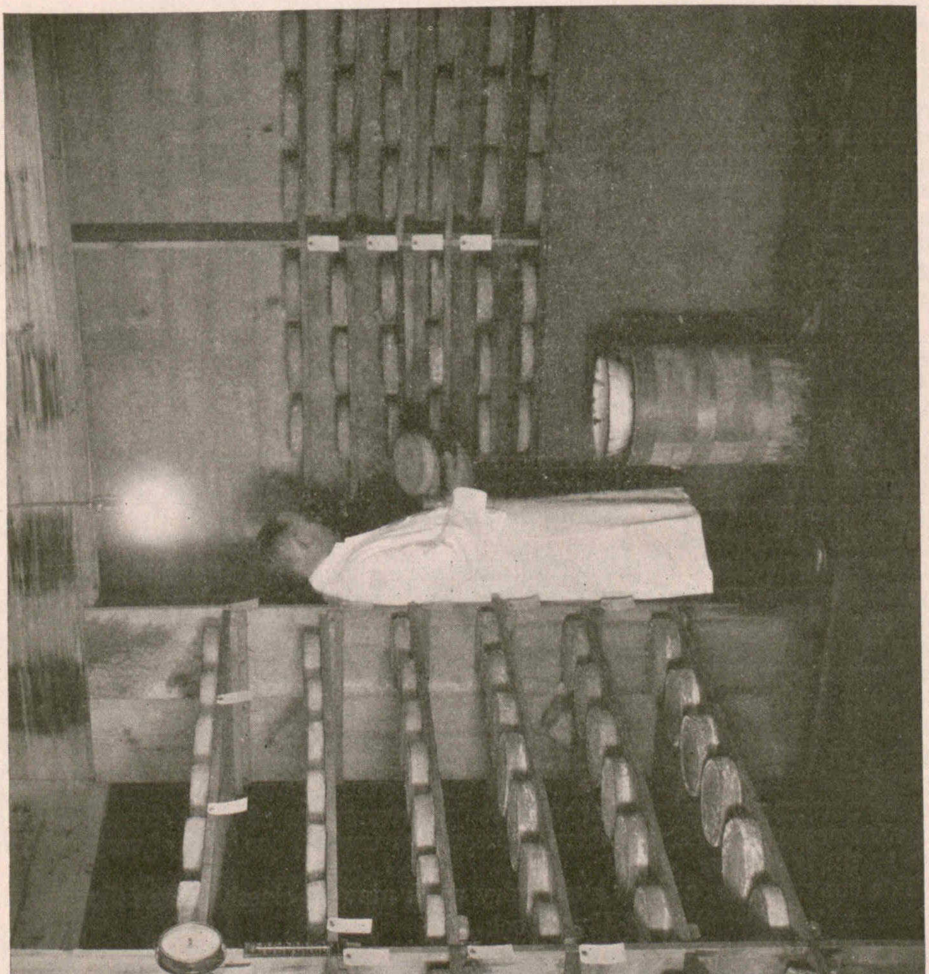
However, even under these adverse conditions, some progress was made. An Experimental Station was located at Morden, Man., in 1915, one at La Ferme, in northern Quebec, in the same year, and one at Kapuskasing, in northern Ontario, in December, 1914. The land in the latter two cases was deeded to the Federal Department of Agriculture, to be used for Experimental Farm purposes, by the Provincial Government of Quebec and of Ontario respectively. Internment camps were located at both these points and the prisoners' labour was used to a considerable extent in clearing operations and erection of buildings.

In 1916, Dr. Grisdale was appointed by the Hon. T. M. Crerar, then Minister of Agriculture, to the post of deputy minister of the department, and the position of Director of Experimental Farms was filled by Mr. E. S. Archibald, who had served since 1912 as Dominion Animal Husbandman.

Under him the policy of expansion and of wider and more systematic investigation has been actively pursued despite the drawbacks of war and post-war conditions. An additional Station has been located, and work got under way, at Swift Current, Sask., while a Farm devoted specially to the breeding of French-Canadian horses has been established at St. Joachim, Que., the work being under the direct supervision of the superintendent of the Cap Rouge Station. The former Tobacco Station at Harrow has been enlarged, prepared for wider experimental work, and is now classed as a regular Experimental Station. At the Central Farm, the Division of Agricultural Bacteriology has been formed and the work of other divisions greatly widened, such as the egg-laying contest work of the Poultry Division and the plant pathological and potato inspection services of the Division of Botany.

At the present time, over 3,000 main experimental projects are being studied on the various farms of the system, not all, of course, on any one farm, the experimental work on each being controlled by the agricultural possibilities of the district wherein the farm is located. Most of these main projects comprise a number of sub-projects, which in themselves are fairly wide experiments.

The above is intended as the briefest resumé of the salient points of the history of the Experimental Farms as a system. The history and main features of the work of each division and of each branch Farm, in greater detail, will be found in the following sections.



The Meilleur Cheese Room, Central Farm.

THE DIVISION OF ANIMAL HUSBANDRY

G. B. Rothwell, B.S.A., *Dominion Animal Husbandman.*

HISTORY

Prior to 1912, the work in both animal and field husbandry was under the direction of the Dominion Agriculturist. In 1912, however, this great field of endeavour was divided into the Animal Husbandry and the Field Husbandry Divisions, permitting of greater specialization. The Animal Husbandry Division, at the present time, is comprised of the Dominion Animal Husbandman, the animal husbandman, and three assistants, and besides the immediate supervision of work on the Central Experimental Farm at Ottawa, has the direction and supervision of all live stock policies and experimental work on the Branch Farm system throughout Canada.

In the following pages, devoted to a present-day survey and an all too brief and general retrospect of live stock activities, it will be realized that, included with the results of the Animal Husbandry Division proper, are those of the parent division, as already described.

Having in view the pioneer nature of much of the work then undertaken, the lack of assistance and the scope covered in the combination of animal and field husbandry work, special mention might possibly be made of that period prior to 1912 when the present Deputy Minister of Agriculture held the position of Dominion Agriculturist.

Concrete evidence of the actual assistance given to the live stock industry through the medium of experimental findings, research and test work and general practice, is difficult to furnish. The field is broad, the need of application of better methods is great. Information is disseminated in a variety of ways in ever increasing volume—through the medium of the Division of Extension and Publicity, bulletins, periodical publications, pamphlets and circulars; press articles, lectures, demonstrations, addresses; correspondence from every Farm in the System; directly to visitors, excursions, etc. From the vast amount of experimental work done in the past thirty years, however, specific mention must be necessarily limited to the most important lines of work carried on and achievements accomplished, where the work in question has been of very evident value to the industry.

For convenience, animal husbandry work may be classified as follows:

1. The Breeding of Live Stock,
2. The Feeding of Live Stock.
3. Live Stock Equipment and Accessories.
4. The Health of Live Stock.
5. Dairy Manufacture.
6. Live Stock Records and Cost Accounting.

The Breeding of Live Stock

Specialization.—The policy with regard to the distribution of live stock over the branch Farm system is one of specialization; that is, each Farm or Station has a clear-cut policy as to the classes of stock maintained and the breeds, grades or crosses kept, such policy being subject to occasional change or amendment. By following such practice in a Canada-wide sense, it is possible, first, to demonstrate the adaptability of the various breeds and classes to certain conditions of climate and demand; second, to further the spirit of community, district and sectional breeding and choice of breeds, as per demonstration;

third, to encourage breeders of high class stock of desirable breeds by purchase, recommendation and advice where necessary; fourth, to discourage the introduction of unsuitable breeds, as indicated by sectional export and local requirements.

Introduction and Trials of Breeds.—During the past twenty years, the three great dairy breeds, Holsteins, Ayrshires and Jerseys, have been introduced on Experimental Farms from the Atlantic to the Pacific; French Canadians have been maintained in Quebec and Ontario; Guernseys in Nova Scotia, the present headquarters of this breed in Canada.

In the beef breeds, special attention has been given the Shorthorn, pure-bred beef or dual-purpose herds being maintained on Farms in six provinces. Aberdeen-Angus cattle are bred in Alberta, and the Herefords are to have representation in the West very shortly. One of the outstanding accomplishments has been the building-up of herds of Shorthorn cattle that may be considered dual-purpose in the right sense,—at Brandon and Kentville. Besides the breeding of beef cattle, steer feeding has been carried on at practically every branch Farm where live stock work is a feature.

With horses, the keynote has ever been the accentuation of the importance of draught type, two breeds being given special attention, Clydesdales and Percherons. Of these two great draught breeds, the Clydesdale has, to date, received the more marked attention. Nor must be forgotten a truly national breed, the French Canadian, of which, at Cap Rouge, there has been maintained since the starting of that Station, one of the foremost studs. Realizing the apparent danger of deteriorat on of the breed in the province of Quebec, mainly due to improper selection, the horse breeding work at this Station has been greatly enlarged of late. Working in conjunction with the French Canadian Horse Breeders' Association, and with a view to standardizing the French Canadian horse, some sixty of the best females available were purchased, and these, with the major part of the Cap Rouge stud, moved to a large farm near Quebec city. The good results which are certain to accrue in the rehabilitating of this great general purpose breed, may largely be attributed to the careful selections and breeding methods which have been a feature in horse breeding at Cap Rouge for the past twenty years. Here, this breed has been kept up to its best traditions and the resulting stud should prove the real nucleus of improvement and standardization during the next few years.

Sheep. There is scarcely a live stock Farm in the system where sheep are not bred in flocks of from demonstration size to those of western range conditions. The policy of specialization has finally meant that, for each Farm, there has been selected a breed or breeds particularly suited to the district, this in many cases only after exhaustive breed trials during the past twenty-five years. Thus by no means all of the breeds are kept. Mention only might be made of Shropshires, Oxfords, Leicesters, Southdowns, Dorsets, Hampshires, Suffolks, Lincolns and Cheviots. Particular attention has been devoted, the system over, to the Shropshire, as representing the best general-purpose breed for general Canadian conditions.

Swine. As with sheep, herds of swine are maintained at practically all. live stock Farms and Stations. For many years, it has been possible to study the various breeds in different sections of Canada The result has been a concentration of attention on the main bacon breeds, the principal objective being to demonstrate that, for the production of a high-class article for competitive export trade, the Yorkshire, Berkshire and Tamworth are particularly suitable. Herds of from fifty to five hundred are maintained. Representatives of the heavier breeds, popular in the West—Duroc Jerseys and Poland Chinas—are maintained at Lacombe, Alberta.

DIRECT EFFECT OF THE INTRODUCTION OF BREEDS. Speaking generally, it may be said that no effort has been spared in the past in the search for, and selection of, individuals for the various pure-bred herds, studs and flocks. Importations have been made direct, purchases have been made from importations, and animals bought the progeny of imported stock. Such blood has been derived mainly from Great Britain and the United States—Clydesdale and Percheron horses; Ayrshire, Jersey, Holstein, Shorthorn and Aberdeen Angus cattle; Shropshire, Leicester, Cheviot, Dorset, Oxford and Corriedale sheep; Yorkshire, Berkshire and Tamworth swine.

Aside from actual introduction, trial and demonstration, there has been a distinct and definite gain to live stock breeders due to the distribution of well-bred stock at nominal, or practically cost, prices. Such an element is cumulative in value. There is no estimating the value of one really high-class sire in a community; and from every Farm and Station in Canada, since their inception, during the past thirty-five years, this distribution of richly-bred, registered and selected stock has gone on. The value of good foundation stock is well recognized to-day. What was it worth thirty-five years ago when high-class herds and flocks were not so thoroughly distributed and in the cases of several Experimental Farms, the work was almost of a pioneer nature?

There are thousands of farms in Canada that have received the first pure-bred impetus from some Experimental Farm or Station. Within a radius of one hundred and fifty miles of many of the older Farms will be found hundreds of farmers whose names have appeared, or whose sons' names now appear, on the pure-bred stock sales books, who come or have come back year after year for a bull calf, a ram lamb, a weanling boar, or some good foundation female stock, feeling confident of obtaining a good individual, rightly bred and priced.

BREEDING METHODS. (a) *Pure Breeding.* At every live stock Farm in the system, pure breeding is being carried on; first, to demonstrate the possible improvement within a breed by correct mating and selection and by the study of families, strains, etc.; second, to permit of studies in line breeding, in-breeding and out-crossing. There are few, if any, of the older Farms that have not achieved at least a provincial reputation, both in show ring and official records, for one or more breeds, and this is due entirely to the proper moulding and developing of breed superiorities and powers through careful heed to breeding principles. (b) *Cross-Breeding.* Although of less general importance than the process of grading-up, considerable work has been done in cross-breeding, particularly with swine and to a lesser degree, with sheep. At the present time, considerable experimental work is under way at all Stations where swine breeding is a feature, with the object of obtaining definite and complete figures as to the improvement to be expected, both in the quality of carcass and cost of production, by cross-breeding as compared with the pure-breds used in the various crosses. This information, together with that already obtained, will be of decided interest in view of the market hog grading regulations now in force. (c) *Grading Up.* Demonstration of the desirable effect of the use of high-class sires on grade herds has been given particular attention since 1910. This fundamentally important work has not been confined to any one particular class of stock, although the best work has been done with dairy cattle, beef cattle and sheep. With horses, no definite experimental work has been carried on with the use of pure bred sires on grade mares. With swine practically no grade stock is maintained.

The really valuable result attained in the actual pure breeding of live stock has been, in brief, in the final adoption, through test, of proven desirable breeds and the concentration of effort in the improvement and popularizing of these breeds.

There are some fifteen separate and distinct projects in the breeding work under way throughout the system, many of which are being conducted at a majority of the Farms and Stations. These deal with the basic principles underlying the methods of breeding and the proper application of these to the different classes of live stock, the nature of the work with these different classes and breeds of live stock being, in a general way, of a somewhat similar nature.

The projects have as their aim the improvement of pure-bred stock, the grading up of common stock by the use of pure-bred sires and also the cross-breeding of the established breeds, this latter line of work being more particularly featured with swine and sheep.

The Feeding of Live Stock

A consideration of this question naturally falls into two lines, feeds and feeding.

Feeds. Possibly the most valuable work in this connection has been in the testing of new feeds the product of both mill and farm, and the trial of by-products and commercial feeds. In farm-grown feeds, the work with ensilage crops has been of outstanding merit. Throughout the past twenty-five years, the silo has been a prominent feature on practically every Farm and it is safe to say that in many parts of Canada, the popularity of silage has been due, in great measure, to early trials and demonstrations on the various Farms and Stations. Still greater attention has been given to silage crops during the last three or four years. Realizing that corn is the greatest of all silage crops, but strictly confined in growing area by climatic conditions, special attention has been given to hardier silage crops for use under western, northern and maritime conditions. The value of peas and oats, clover and other leguminous crops for silage has been demonstrated and, more recently still, work with the growing of sunflowers, where no other silage crop can be profitably grown, has been responsible for radical changes in methods of cattle feeding. Of the numerous experiments carried on with every kind of farm grown feed no mention can here be made.

With the by-products, valuable original work has been carried on in the utilization of elevator offal, popularly known as grain screenings. While the original work was done at Ottawa, later feeding tests with this material have been made at practically all Farms and Stations, with nearly all classes of stock. This work has had a large bearing upon the subsequent standardization and improvement of this material, together with the holding of it in Canada for increased production of live stock during the war period, when standard feeds were high in price. Earlier still, similar work was carried on with the utilization of damaged grains, frozen wheat, etc. Much valuable work has been done in demonstrating the value of dairy by-products. Of the high-priced concentrates, also by-products in nearly all instances, there is not one feed that has not been thoroughly tested. Much valuable experimental work has been done with molasses and kindred feeds. Possibly, however, the most valuable work has been done in the testing out of new feeds as already described, and of commercial feeds and untried by-products.

Feeding. One of the really outstanding lines of work has been in connection with beef cattle, where work at Ottawa, Brandon and Nappan, in the earlier days, concerning such questions as "Long vs. short keep steers," "Finishing steers of different ages," "Baby beef," "Feeding loose vs. tied," "Feeding in barns, sheds, corrals and in the open," "The value of dehorning," etc., were carefully treated along strictly experimental lines. Similar experimental work, with even more definite aims, has been carried on at Lennoxville, Que., Charlottetown, P.E.I., Indian Head and Scott, Sask., and Lacombe, Alta. The sum total of the effect of this work as a guide to beef raisers, particularly in the earlier days, is hard to surmise. One of the outstanding achievements in later years has been the demonstration of the possibility of effectively cutting down beef raising costs by the utilization of cheap shed and corral quarters, even in the colder parts of Canada.

Another noteworthy line of work of more recent development and arising out of the experimental feeding work is the experimental shipment of beef cattle to Great Britain in an endeavour to ascertain the most profitable method of shipping and the most profitable type of cattle to ship, under the latest regulations governing the landing of cattle in the Old Country. Four large shipments have been made and valuable data on this phase of the beef cattle feeding business collected.

With sheep and swine, one great result of the experimental work has been the demonstration, not only of the possibility, but the desirability of cheap feeding quarters and methods. With swine, most important work has been done in demonstrating the value of milk products, wheat by-products, pastures, self-feeding methods, etc.

In the experiments with the feeding of horses the most valuable work has been in connection with economy of feeding and rearing, and the utilization of cheap succulents and roughages as desirable in conjunction with grain feeding, both from the standpoints of health and economy.

With dairy cattle, while the volume of experimental work done is possibly greater than with any other class of stock it is difficult to point to any one phase of this important department that might be worthy of particular mention over others. Experiments as conducted at Ottawa to show the comparative value of high-priced concentrates; tests of silages for dairy cows carried on from coast to coast; experiments with the rearing of calves; the relation of feed consumed to milk produced; commercial meals as compared with home compounded mixtures; molasses for dairy cattle; ratio tests for calves, yearlings, cows in milk or on test; these are but a few of the more important lines of experimental work carried on, from which conclusive findings have been derived and disseminated.

The testing of feeds and also of different methods of feeding dairy cattle covers a rather extensive field of experimental work and constitutes an important phase of that work. Some 25 major projects are included in these methods of feeding young and mature stock, of the utilization of feeds and different combinations of feeds, and also of the economy of production both of stock and of dairy products.

In beef cattle there are 31 separate projects under way. These deal with the feeding of mature and young, growing stock and also steer feeding. Different methods of treating the steers and breeding stock and also the utilization of different feeds and methods of feeding are featured in these tests.

For sheep there are some nine different projects which deal with the feeding and rearing of sheep and lambs for both breeding and market purposes and the application of the best known practices for both summer and winter feeding.

There are some twenty-six projects for swine, dealing with different phases of feeding, these including economy of production and maintenance and the comparison of feeds and different combinations of feeds for the various classes of hogs under both summer and winter conditions.

Live Stock Equipment and Accessories

BUILDINGS.—The construction over the Farm system of buildings sound in principle, convenient, sanitary, and at reasonable cost, has been the aim of the Animal Husbandry Division. The main achievements in building work as now being demonstrated on every live stock Farm in the System, may be summed up as follows:—

1. That cheap shed and corral quarters are best suited to winter steer feeding.
2. That growing colts and idle horses may be economically housed and fed under somewhat similar semi-out-door conditions.
3. That the expensive shelter is usually an abomination to sheep and swine, where, outside of certain limited periods in the life of these animals, cheap sheds or cabins form the most suitable shelter, the year round.

This clear-cut vindication of the economical building, embodying essential principles, has been an outstanding result in animal housing investigations.

With the more expensive type of building, as for cattle and horses, the development of sanitation and convenience has been kept in the forefront. Possibly, fairly extensive studies, in the earlier days, of ventilation problems, combined with later work in the proper correlation of ventilation and insulation in farm building construction, have proven one of the most valuable lines of investigation in construction work.

The dissemination from the Central Farm of much detailed information in the way of plans, etc., to prospective builders, these plans based on the result of practical tests, has proven of much value. These stock plans show buildings which include practically all of the essentials of correct construction for housing the various classes of stock. The feature of economy of construction is outstanding, not only in these plans but in all buildings erected on the system.

The main achievements in building work, then, may be summed up as follows:—

1. Standarization of construction as far as possible, depending upon the various classes of stock and their essential requirements.
2. Tests of silos for the past thirty years or from the time when this process was first recognized.
3. Studies and tests of ventilation and insulation as applied to farm buildings.

Equipment.—There has been very little farm building equipment of importance that has not been tested out by this division. The term, as here used, would include stall fittings, watering devices, flooring materials, litter carriers, unloading devices, etc., etc. At Ottawa, for example, in the one barn will be found four different makes of stall fittings and watering devices. Incidentally, over the Farm System, will be found practically every method of stable arrangement, and all types of mangers, gutters, drainage arrangements, etc. Thus it is possible to test thoroughly in a large way, such manufactured outfits and to present conclusive results to the farmer.

Accessories.—The testing of accessories to live stock work covers a wide field. In the dairy it has included separators, churns, and different makes of the essential dairy utensils; in the cattle barns, types of pails, milking machines, marking or identification devices and systems, etc.; in the piggery and sheep barns, tests of troughs, self-feeders—both home-made and commercial—feeding racks, creeps, and marking devices. All of such work, carefully done, has made possible definite and direct statements and comparisons. In such test work, the trials of milking machines at Ottawa, where there are now thirteen different makes, and at Branch Farms, where different machines are in use, should be specifically mentioned. The development of home-made-types of self-feeders for swine, and thorough trial of this system of feeding, have proved of material assistance in connection with swine raising.

The Health of Live Stock

Research and control work in animal pathology is dealt with by another branch of the Department of Agriculture—that of Health of Animals. Much valuable information has been secured by the branch mentioned through cooperation and through the use of the Experimental Farm herds. Particularly would this have reference to tuberculosis control work. While, therefore, the field of work of the Experimental Farms Branch is distinctly limited as to studies in animal pathology, it may be claimed that much useful work has been done in prophylaxis, or disease prevention. It has been clearly ascertained that environment, feeding and management of the pregnant dam, may have much.

if not all, to do with such conditions as joint-ill in foals, goitre in calves and lambs, hairlessness and goitre in pigs, etc. In this connection, testing of necessary supplements to the regular ration, —potassium iodide, bone meal, mineral feeds, etc.—has been carried on.

The outdoor system of swine feeding and housing finally evolved has practically eliminated rheumatism in the Experimental Farm herds. This complaint, little understood, easily preventable and practically incurable, is responsible for very heavy loss in our severe winter climate. In Eastern Canada, the phenomenon of hairless litters has been controlled entirely by diet and environment. In the West, results are not so certain and deeper investigation is under way. Considerable study has been given to the question of parasitism in both sheep and swine. Preventive measures have been found. In the case of swine, the system developed to prevent the fatal results of intestinal parasitism was largely original, thoroughly effective, and is now being widely adopted.

Practically every treatment recommended or advertised for the prevention of abortion of cattle has been tried out. A system of treatment of the various ages and classes of cattle found in the average herd has been finally adopted, after thorough trial, on the Farm System. Particular attention has been given to serum and vaccine treatments, these being used as manufactured by commercial and Government laboratories. Along with abortion control work, treatment and study of conditions following abortion, such as retained placenta, sterility and its causes, calf ailments, etc., have been carried on.

With tuberculosis in cattle, while all herds on the Experimental Farm System have been for years under the control of the Health of Animals Branch, no specific research work has been attempted by that Branch. At Ottawa, a careful study of herd infection has been made and a herd of reactors, operated under the Bang System, has afforded useful information. It is interesting to note that, at present writing, out of nineteen herds on Experimental Farms in all parts of Canada, thirteen are now duly accredited, with indications that the balance will be similarly classed within a year's time.

Great importance may be attached to the comparatively simple methods employed in the outdoor rearing and feeding of live stock, in their relation to health. While employed with practically every class of stock the system over, the possibilities of open-air feeding and rearing have been particularly well demonstrated for many years at Cap Rouge, Que. Here, with the exception of dairy cattle and calves, practically all classes of stock lead an outdoor or semi-outdoor life the year through. Here the climate is rigorous, and the health of the live stock excellent. Tests of a routine character have been continually carried on with animal insecticides, disinfectants, applications for skin affections, fly repellants, etc., together with trials of all recommended treatments of disease, when they are such as might be applied by the ordinary stockman.

In brief, then, while studies of animal disease are not part of the work of the Division of Animal Husbandry, much has been found out with reference to the value of application of treatments, in a comparative way; complicated treatments have been reduced to a practical basis, and of major importance, much useful information has been deduced with reference to prophylaxis. "An ounce of prevention is worth a pound of cure."

Dairy Manufacture

On all of the Farms where dairy herds of any size are maintained, farm dairies are in operation. Here, as already outlined, tests are conducted with various makes of the essential dairy machinery. In so far as manufacture is concerned, the aim has consistently been to demonstrate methods and costs of marketing milk in various forms and under varying conditions. Outside such regular products as butter and Cheddar cheese, several other types of cheese, including Stilton, Camembert, etc., and soft cheese such as Cream, Coulommier, and Cottage, have been manufactured. Investigational work along these lines has been mainly carried on at Agassiz, B.C., and Ottawa Ont. Of all the work done, possibly the most useful, in the sense of originality has been in the improvement of soft cheese manufacturing methods. Much information and direction have been given to both private and commercial concerns in this connection. More recently, an entirely new cheese has been originated at Ottawa, after considerable experimental work. This product is simple in process of manufacture, requires little special equipment, has met with most favorable criticism, and should have a place in the list of special products.

Incidentally, much study has been given to the question of farm dairy construction, ice refrigerators, cooling rooms and ice-houses.

Research Work in Hybridizing and Cross-Breeding

Interesting work is in progress at the Buffalo Park at Wainwright, Alta. In 1915, a small herd was purchased, made up of hybrids (bison + domestic) and cattalo—the latter term being applied to the offspring of the mating of hybrids. This herd was the result of many years of private experimentation and, on dispersion, was purchased by the Dominion Experimental Farms, with the idea of investigating the possibilities of the bison-domestic cross and the advisability of carrying on further work along this line. While, for a variety of reasons, little result has been obtained from the originally purchased herd, some extremely interesting first crosses have been brought about within the last year—bison-domestic, yak-domestic, and yak-bison. More extensive work is being planned for the future.

The practical objective of this work is to investigate the possibility of developing a fertile, prepotent animal, combining the ruggedness, rustling qualities, size, and valuable hide or robe-producing qualities of the bison, with the more domestic tendencies and better balanced and generally superior beefing qualities of the domestic beef breeds.

All of the usual barriers of nature against tampering with her species, have been met with—infertility of hybrids (males particularly), abnormal condition at parturition, etc. The yak-domestic cross, however, aside from its interest and ease of accomplishment generally, holds out even more valuable potentialities, in that the yak is zoologically the missing link between the bison and the domestic race of cattle. The infusion of the yak blood—apparently far from a violent cross—may therefore greatly aid in the desired fusion as represented by fertile, prepotent animals of both sexes.

It may be of interest to note that at the Buffalo Park, Wainwright, Alta. (Dominion Parks Branch), is maintained the largest herd of bison in the world, some 8,000 head, representing, also, incidentally, one of the world's greatest examples of true animal conservation.

The work, thus briefly described, has been made possible by the concerted effort and co-operation of the Experimental Farms Branch, Department of Agriculture, and the Parks Branch, Department of the Interior.

Live Stock Records and Cost Accounting

It may be objected that the above heading would described simple routine work only, which in no sense should be regarded as outstanding. Nevertheless, the call for data as afforded by carefully kept records covering many years' time, with reference to costs of rearing and production, comparative experimental costs, and all of the data relative to such work—weights at different ages, feed requirements as related to gain at different ages or under varying conditions, etc., has been such as to indicate this work as one of the most important carried on with live stock since the inception of the Experimental Farm system. Particularly was this information found of value during the era of price -setting in the war period. Indeed of such a fundamentally important nature is it, that live stock maintenance on the Farms over Canada would seem justified in this connection alone and aside from the wide field of experimental feeding, breeding, manufacturing and construction work to which reference has already briefly been made. More and more stress is being laid each year on the importance of care, accuracy and scope in this, at-first-sight, humble, routine work, derived from several sources in every province in the Dominion.

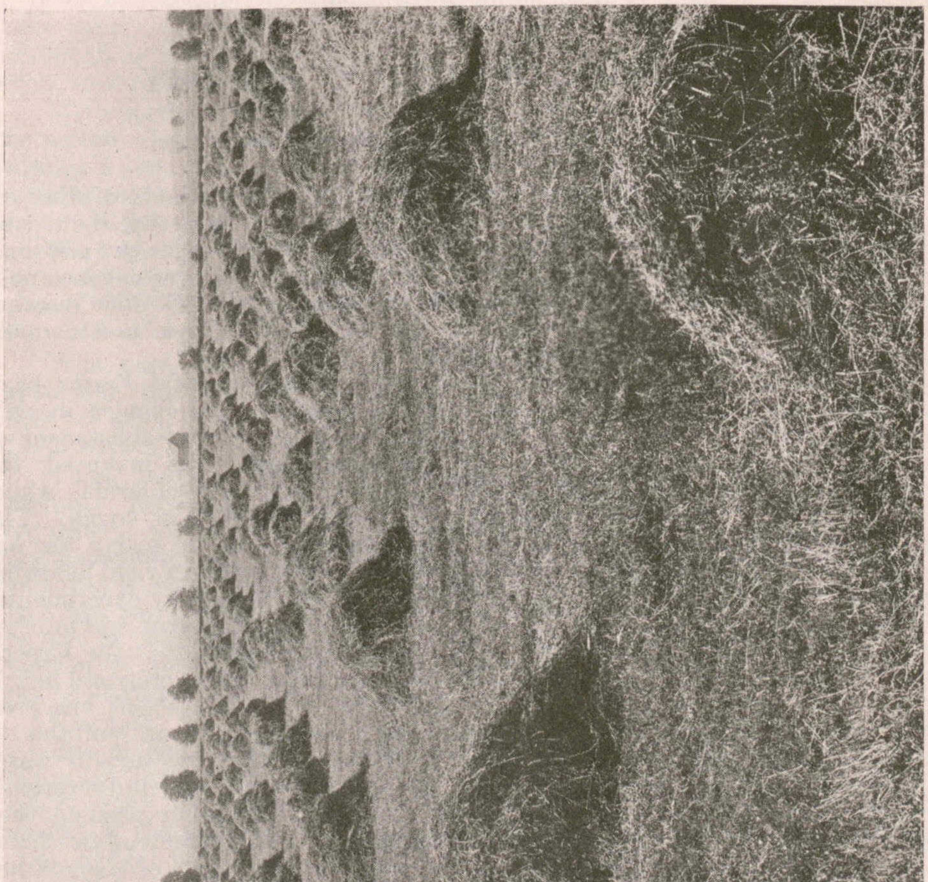
Publication and Extension Work

In that experimental and investigational work is of little value to the public except after official report, mention would seem fair of the value of publications issued by the Animal Husbandry Division and branch Farms during the past thirty years, including annual reports, bulletins, pamphlets and circulars. Such publications as Bulletin 72, Milk Production in Canada; Bulletin 78, Ventilation of Farm Buildings; and Bulletin 51, Bacon Pigs in Canada, might be specially mentioned. The above are representative of many other useful publications as shown in the official list.

While extension service has been somewhat outside the function of the Animal Husbandry Division in the past, work such as that of supplying printed forms free to dairymen desirous of taking up record keeping, is worthy of mention. Thousands of dairymen have taken up this essentially useful work in this way, developed therein an interest and commenced cow-testing in earnest, following up with Record of Performance and Record of Merit work. Incidentally, due to the voluntary return of yearly summary forms by many of these men, some most interesting data have been collected to show the yearly improvement in farm herds due to better breeding, feeding and selection.

Agricultural survey work in the province of Quebec has been taken up during the past few years. To date, two publications have been issued on the results. In so far as the province of Quebec is concerned, these surveys have been original and are considered to have supplied fundamentally useful information. This work is being continued.

In conclusion, the work of the Animal Husbandry Division is of a practical nature. The facilities for true research work, with the possibility of valuable discoveries, have not presented themselves in great measure. No new breeds have been introduced. No light has been thrown on sex-control. No marvellous cures have been discovered. The foregoing pages cover—all too superficially—some of the main lines of work in which achievement might be claimed. It is possible, in the final analysis, that the greatest good has come from those influences of example and precept of which no mention whatever has here been made.



Mixed Alfalfa and Clover Hay, yielding 3·1 tons per acre; Second cutting, 1 ton per acre. Central Farm, 1923.

THE DIVISION OF FIELD HUSBANDRY

E. S. Hopkins, B.S.A., *Dominion Field Husbandman*

Such marked differences exist between the farming methods of Eastern Canada and British Columbia and those on the Prairie Provinces that the results of the field husbandry experimental work have been divided under two sections. The reader may turn, therefore, to the section in which he is most concerned; if time permits, a glance at some of the chapters relating to work done in other parts of Canada may be interesting, but the conclusions drawn must not be used in regions where they are not applicable.

The long period during which the Dominion Experimental Farms have conducted their experimental work has included many marked changes in agricultural practice. It was only a few years previous to the establishment of the Dominion Experimental Farms that the grain binder was invented, the introduction of which has greatly facilitated the harvesting of grain, while, in many parts of Canada, the broadcast seed drill was still in vogue. The urgent need in Ontario and Quebec of seeding grain early in the spring was not known until definite experiments showed the enormous increases in yield following early seeding. The best rates of seeding have been established by experimental work throughout various parts of Canada. Corn as an ensilage crop was practically unknown and it is certainly not saying too much to claim that the Experimental Farms have done a great deal in showing the value of this crop and how it should be cultivated and ensiled The usefulness of crop rotations has been demonstrated and types of rotations have been tested which are suitable to various kinds of farming. The value of drainage in removing surplus water in Eastern Canada and British Columbia has been demonstrated, and improved methods have been learned regarding the best means of accomplishing this. A great increase has taken place in the use of manure and commercial fertilizers as the need of increasing the fertility of the soil in certain parts of Canada has become realized. Finally, the invention of the small tractor has enabled the farmer to do his work when conditions are most satisfactory.

With these great changes, the Dominion Experimental Farms system has constantly striven, by the conduct of experimental work, to establish farm practice upon an economical and permanent basis. The following statement is a brief outline of some of the more important lines of work. At the Central Farm, these are divided into some 49 main experimental projects, each comprising a number of sub-projects.

EASTERN CANADA AND BRITISH COLUMBIA

Date of Seeding Grain

To determine the value of early, medium and late seedings of grain, extensive experiments were started in 1890 at Ottawa. The first seeding was made as soon as the land was ready to sow and five successive seedings were made at one week intervals.

At Ottawa, the advantage of seeding wheat, oats and barley early in the spring was found to be very outstanding. The best results in every case were secured at the second date of seeding, that is, seven days after the land was ready to sow. After this date, all the seedings, except in the case of peas, very rapidly decreased in yield. Perhaps, with many farmers and especially in fields containing wet pot-holes or water courses, their first seeding would more nearly correspond with the second seeding at the Experimental Farm. Inasmuch as the land and the seed were uniform, this decrease in yield was due solely to the late seeding.

With spring wheat, the loss in yield by delaying seeding one week beyond the period which these experiments have shown to be the most favourable has entailed a loss of over 30 per cent; by delaying two weeks, fully 40 per cent; by delaying three weeks, nearly 50 per cent; and by delaying four weeks, a loss of over 58 per cent.

With barley, the loss in yield by delaying seeding one week after the most favourable time, has occasioned a loss of 24 per cent; a delay of two weeks, a loss of more than 28 per cent; a delay of three weeks, about 40 per cent; and a delay of four weeks, a loss of 46 per cent.

With oats, the loss in yield by delaying seeding one week after the most favourable time has caused a loss of 15 per cent; a delay ot two weeks, a loss of 22 per cent; a delay of three weeks, a loss of over 32 per cent; and a delay of four weeks, a loss of about 46 per cent.

These heavy losses show the urgent need of seeding the crop as soon as possible. They show that the grains should be seeded in the following consecutive order: wheat first, then barley, oats and finally peas, so as to make the most economical use of time during seeding. While this summary of ten years' work was given to the public by the Dominion Experimental Farm twenty-two years ago and the first reports of it as early as thirty-two years ago, the results are just as true to-day as then. These points are facts established beyond all question of doubt, and it is folly for a farmer not to be guided by them; it is folly to learn this by experience.

However, not all parts of Canada have conditions the same with respect to value of early seeding While experiments at Ottawa show an enormous advantage from early seeding, and experiments at the Ontario Agricultural College show even greater advantage than at Ottawa, nevertheless, in cooler sections of the country, this superiority is not as marked and, in some cases, is not evident at all.

At Nappan, N.S., and at Agassiz, B.C., experiments were commenced in 1891 to gain information on this question. The first seeding was made as soon as the land was ready to sow and five successive seedings were made at one-week intervals.

At Nappan, N.S., with the single exception of the sixth seeding with oats and barley, no significant difference exists between early and late seedings. At Agassiz, B.C., no superiority whatever was gained from the earlier seeding. It is possible that in these regions, some cultivation might be given the land previous to seeding in order to check the growth of weeds.

Rate of Seeding Grain

At Ottawa, experiments were started in 1901 to determine the best rates of seeding wheat, oats and barley on a sandy loam soil and also on a clay loam soil.

Results have shown that heavy seedings of grain are entirely unnecessary and an absolute waste of seed. Just how small a quantity can be seeded and still produce the maximum yield cannot be stated definitely, unfortunately, because it will vary with different soils. However, according to these experiments, 1¼ bushels of wheat, 2 to 2½ bushels of oats and 1½ bushels of barley would be quite a safe seeding. At Cap Rouge, Que., as an average of eight years' work, a seeding of 2½ bushels of oats was recommended.

Mixed Grains vs. Grains Separately

To determine the economy of sowing each grain by itself or mixed with one or more other grains, experiments were started at Ottawa in 1900. After five years of experimental work on various types of soil, it was found that oats alone gave an average yield per acre of 1,976 pounds, barley an average yield of 1,507 pounds, a mixture of one bushel each of oats, barley and peas a yield of 1,764 pounds, and a mixture of 1½ bushels of oats and one bushel of barley a yield of 1,597 pounds. From these results it was concluded that single pure grains may be expected to give more pounds per acre than mixtures. It may be added that at the present time, the soil being now much improved in fertility, barley gives somewhat larger yields per acre than oats.

Somewhat different results, however, were obtained at Nappan, N.S., where the mixed grain gave a slightly larger yield per acre than the grains sown separately. As an average of thirteen years' work, commencing in 1897, a mixture of 2 bushels of oats, 1 bushel of barley and ½ bushel of peas, seeded at the rate of 3 bushels per acre, yielded 1,929 pounds of grain per acre, compared with a yield of 1,676 pounds per acre of oats seeded alone at a rate of 3 bushels per acre. Barley seeded at the rate of 2 bushels per acre gave, as a ten-year average, 1,663 pounds per acre.

Ensilage Experiments

To discover what was the best distance to leave between the rows of corn, extensive experiments were commenced in 1898 at Ottawa, Ont., Nappan, N.S., and Agassiz, B.C. At that time very little was known regarding the use of corn for ensilage and no one knew the best methods of cultivation. Accordingly, experiments were undertaken to learn the best distance to leave between the rows.

The yields of corn at Ottawa and Nappan were practically as high when the rows were 42 inches apart as they were when at closer distances. Moreover, at the 42-inch distance the corn is more mature and would contain a larger amount of grain and total dry matter; besides, it is more easily cultivated and hence the weeds are kept in check more successfully. At Agassiz, an increase was found for the narrower seedings but in view of the disadvantages associated with these seedings as previously mentioned, perhaps a width of about 35 inches between the rows would be most satisfactory at Agassiz.

A comparison between seeding corn in rows and in hills was commenced in 1894. At Ottawa, the rows were spaced 35 inches apart and the plants thinned from 6 inches to 8 inches apart in the row, while the hills were placed 35 inches apart with from four to five plants per hill. At both Agassiz and Nappan, the rows were spaced 36 inches apart and the plants thinned to about 6 inches apart in the row, while the hills were placed 36 inches apart with from four to five plants per hill.

The results showed that there is no difference in yield of corn sown in rows or in hills. It is somewhat quicker to seed in rows and not quite as hard on the corn binder when cutting, but in weedy ground the hills offer a much superior opportunity to cultivate the land and certainly do not require as much hoeing.

While corn is now believed to be the most satisfactory crop for ensilage, it may be interesting to know that many experiments were undertaken at Ottawa in the early days to discover what crop gave the largest yield per acre and the most satisfactory ensilage. In addition to corn, ensilage was made from clover, peas, rye, a mixture of oats, barley and peas, a mixture of corn and horse beans, a mixture of corn and pole beans, and a mixture of corn and horse beans to which was added, at silo filling time, the heads of sunflowers. The latter mixture was known as the "Robertson Mixture" and was thought to comprise a combination of crops which would make a more balanced ration. However, none of the crops or mixtures was found as satisfactory as the corn and, accordingly, that information was given to the public.

In recent years, considerable experimental work has been done with sunflowers alone for ensilage. The results indicate, very strongly indeed, that in cool regions where corn does not grow successfully, sunflowers make a very much superior crop for this purpose. In northern Ontario, in northern and eastern Quebec and in many sections of the Maritime Provinces, the sunflower may, from present indications, come to occupy an important role as an ensilage crop. Where corn grows satisfactorily, on the other hand, such as in old Ontario and districts in Quebec of similar climate, there seems to be no reason for changing to sunflowers.

Drainage

Extensive underdrainage work has been done on the Dominion Experimental Farms in Eastern Canada. The greatest value of tile drains consists in improving pot-holes and watercourses and thereby enabling seeding to be done very much earlier in the spring.

Owing to the cost of underdrainage varying enormously, depending upon the type of soil and even upon the time of year when the work is done, it is thought inadvisable to present figures on this operation. One point, however, may be mentioned, namely, that it is unnecessary to place tile drains deeper than two feet in clay lands, not only on account of the greater length of time required for the water to percolate to the tile, but also on account of the greater expense entailed.

Adequate surface drainage is also very profitable. It is folly to allow the water to stand on the surface of the land when it may be removed by running a furrow through the field and shovelling a small outlet at the proper place. This takes but very little time and is one of the most profitable things a person can do, especially in a wet year.

Hay Crops

One of the most outstanding results of many years' experimental work with hay crops at Ottawa is that alfalfa included in the regular hay mixture has markedly increased the yield. The inclusion of only six pounds of alfalfa seed has always enabled two cuttings of hay to be made and, in some years, as many as three cuttings. The average yield of hay for the last ten years on the large fields at Ottawa was 3·37 tons per acre, while in the province of Ontario, as a whole, the average yield was only 1·5 tons. It is certainly advisable to include alfalfa in the regular hay mixture, in districts where alfalfa will grow successfully.

Another outstanding result in hay production is the value of a fertile soil. Hay responds to applications of manure or commercial fertilizers and is likely to give greater financial returns than when these materials are put on cereal crops. The results of these experiments are to be found under the heading of Manure and Fertilizers.

To determine which grain would be most suitable as a nurse crop for grass and clover mixtures, extensive experiments have been conducted at Cap Rouge, Que., and Charlottetown, P.E.I. At Cap Rouge, slightly superior results were secured from barley while, at Charlottetown, slightly superior results were secured with oats. On the whole, there does not seem to be sufficient evidence yet to warrant the selection of either barley, wheat or oats for the express purpose of getting the best nurse crop; it seems advisable to select whichever grain seems most likely to produce, in itself, the largest monetary returns.

Whether grass and clover seed should be seeded at a light rate per acre or at a heavy rate is a very controversial question. An experiment was conducted at Cap Rouge in which a seeding of 8 pounds of timothy, 12 pounds of red clover and 2 pounds of alsike was compared with a seeding of exactly one-half this amount. As a result of ten years' work, the heavier seeding gave only 8 per cent larger yields than the lighter seeding—an increase which cannot be regarded as significant. At Charlottetown the indications were that a seeding of 7 to 8 pounds of red clover combined with timothy and alsike was quite as satisfactory as larger quantities of red clover.

Rotations

The practice of rotating crops in definite order is comparatively recent in agricultural practice. It is true that farmers in older days changed the crops on their field every few years but the changes were not in definite order and were not based on a knowledge of any principle. Thanks largely to the work of the Rothamstead Experiment Station, in England, and to the researches of Hellriegal, who, after more than twenty years of work, announced in 1886 that leguminous plants could draw their nitrogen from the air, the practice of rotating crops became established on an intelligent basis.

The Dominion Experimental Farms commenced at Ottawa, in 1904, an extensive system of rotations, designed to learn the most economical rotations for various types of farming. It was stated at that time that the "200-acre farm," on the Central Farm, Ottawa, had, five years previously, been arranged into a definite five-year rotation of clover hay, timothy hay, grain, corn or roots, and grain, and that the improvement in the yields was so noticeable as to warrant the establishing of extensive experiments on this problem.

The most important deduction which can be made from these rotations is that fertility of the soil is, in Eastern Canada, the main limiting factor in crop production. Additions of manure or fertilizers must be made to secure heavy yields of crops and the response to these applications is greatest on root crops, followed in order by hay, corn and cereals.

Barley responds to manurial treatment much more than does wheat or oats, this fact explaining why, on poor soils, oats is superior to barley while the contrary is the case on rich soils.

Leguminous hay crops, such as red clover, alsike and alfalfa, are very valuable in improving soils low in fertility. On rich soils, however, this influence is not so noticeable. Alfalfa, as has been stated, has considerably increased the yield of hay at Ottawa and while its influence on soil fertility cannot as yet be definitely stated in comparison with that of clover, it is believed to be more potent on account of its deeper and more vigorous root system. Experiments on the influence of clover will be discussed under the next heading.

In addition to the influence of the rotations upon the fertility of the soil, a splendid opportunity is offered to clear the lands of weeds which is a difficult, if not an impossible, task when the same crops are grown year after year on the same land. Moreover, desired acreages of crops can be arranged in definite rotations which will give the proper proportion of the various crops and distribute the labour throughout the season.

Clover for Soil Improvement

To learn the value of seeding clover with a grain crop and ploughing the clover under in the fall to benefit the crop next year, it was found at Ottawa, as an average of five years' work on different land each year, that this land gave an average yield of 57·0 bushels of oats compared with 48·5 bushels on land which had not grown any clover. In a similar experiment with corn, the clover being ploughed under in this case in the spring, it was found as an average of four years' work that the land on which clover had grown gave a yield of 23·4 tons per acre compared with a yield of 17·9 tons on land which had not grown any clover. Under exactly similar circumstances, potatoes yielded 380·0 bushels on the clover land compared with 344·6 bushels on land which had not grown clover. These increases may be taken to indicate the value of clover in improving certain soils.

However, at Nappan, N.S., oats gave, as an average yield for five years, 59·8 bushels on land which had grown clover, compared with 55·2 bushels on land where clover had not been grown with the grain crop the year previous. Wheat yielded 26·4 bushels, compared with 24·5 bushels, and barley 33·3 bushels, compared with 31·0 bushels, under conditions exactly similar to those of the oats. These increases are not significant although it must be said that, in the later years of the work, greater increases appeared to follow the use of the clover in this manner.

An experiment was commenced at Ottawa in 1896 to learn whether seeding 10 pounds per acre of Mammoth red clover with a grain crop would increase the yield of grain the same year as that in which the clover was seeded; in other words, to learn if the associated growth of this legume crop would increase the growth of the non-legume. Three years of work showed no increase from such a practice. Moreover, in another experiment extending over four years, in which the rate of seeding increased from four pounds up to fourteen pounds of Mammoth red clover seed per acre, no increase was noted when the larger amounts of clover were seeded.

Manure and Fertilizers

Farm manure is a much more important by-product than many people realize; indeed to realize its worth it is necessary to figure in dollars and cents the value of the increased crop returns from applications of manure. Experimental work at Ottawa has shown that a dressing of 15 tons of manure per acre applied once in four years on a four-year rotation of mangels, oats, clover hay and timothy hay has resulted in increased crops worth, during the last nine years, \$64.23 on four acres of land—one acre being in each of the above crops. The manure has been worth, on the average, \$4.17 per ton, varying from \$2.29 in 1914 to \$7.45 in 1920. These figures are sufficient to show the great money value of this by-product and to impress one with the need of care in its conservation.

Unrotted manure appears to be as valuable as rotted manure where equal but rather heavy applications are made to the land. Extensive experiments extending from 1888 to 1909 have shown very little difference in yields where manure was applied each year to the land. Twenty-one years of work gave an average yield of 21·7 bushels of wheat on land to which was applied 12 tons per acre per year of green manure and 21·6 bushels from rotted manure; 35·6 bushels of barley from 15 tons per acre per year of green manure and 35·9 bushels from rotted manure; 54·3 bushels of oats from the green manure and 51·6 from the rotted manure; and 20·5 tons of mangels from 20 tons per acre per year of green manure and 20·2 tons from rotted manure. These yields are strikingly uniform and show that, with such applications, no difference can be expected in yield from either class of manure. In view of the enormous losses in weight consequent upon rotting, it will readily be seen that a much larger supply of manure will be available from the unrotted source.

Accordingly, unrotted manure is preferable whenever it contains no noxious weed seeds. If these are present, the manure should be allowed to rot in order that they may be destroyed before application is made to the field. This practice is extremely important; it may save a farmer hundreds of dollars.

Another important point which has been learned from experimental work is that smaller applications of manure, either made more frequently or covering larger acreages, have proved more profitable than heavy applications. While it is impossible, owing to the differences in the fertility of various soils, to prescribe what might be called smaller applications, it may be said in a general way that an application of 15 tons per acre once in four years has given as good returns in a four-year rotation as an application of 18 tons per acre once in three years on a three-year rotation. Manure pays best when applied to an intertilled crop or to hay; on cereals it is not nearly as profitable.

Commercial fertilizers are very valuable where the supply of farm manure is insufficient, for special crops, or where, on account of some marked deficiency in the soil, additional elements must be given beyond those supplied by manure. In recent experiments conducted at Ottawa during the last nine years where commercial fertilizers have been compared with farm manure and unmanured land on a four-year rotation of mangels, oats, clover hay and timothy hay, the fertilizers have given increased crops over unfertilized and unmanured land worth, per year, $52.02 on four acres of land—one acre being in each of the above crops. As these fertilizers have cost, on the average for the last nine years, $23.11 for the four acres of land, the net profit is $28.92, an increase of over 125 per cent, which is certainly worth while.

In this experiment, the following fertilizers were applied per acre: to the mangels, 100 pounds of nitrate of soda, 300 pounds superphosphate, 75 pounds muriate of potash; to each of the oat, clover hay and timothy hay crops 100 pounds of nitrate of soda were given. The average yields for nine years on the fertilized land compared with that not fertilized were respectively: mangels 19·6 tons, compared with 12·0 tons; oats 51·4 bushels, compared with 44·2 bushels; clover hay 3·6 tons, compared with 2·0 tons. As the timothy hay was pastured, comparative yields cannot be definitely stated.

This topic is too extensive to discuss adequately in the short space allotted to this section. It is important, however, for farmers to make trials in a small way on their own farms before purchasing large quantities of fertilizers, in order to learn if profitable results are secured. It is important also to purchase the fertilizers on the basis of their composition and to make applications to such crops as give most profitable response. As lack of fertility in the soil is the main limiting factor in crop production in Eastern Canada, a study of this subject is well worth while.

Cost of Producing Crops

As early as 1892, accurate records were taken at the Central Experimental Farm, Ottawa, of the cost of producing farm crops. The object of these studies has been not only merely to learn the definite cost per acre required to handle the various farm crops but also to indicate which crops were most profitable and which crops utilized labour throughout the season most satisfactorily.

It may be of interest to study the profits and losses per acre during the last ten years on hay, oats, corn and mangels. The cost of producing these crops has been figured at the prevailing rates while the returns have been based on the average market price throughout the year. As corn and mangels are not sold on the market, it has been necessary to estimate their value and while such estimates may vary widely, the following method is offered as an attempt to arrive at a logical basis.

According to experiments quoted by Henry and Morrison, "Feeds and Feeding," page 382, it is stated that 315 pounds of silage are equal to 100 pounds of hay. Corn ensilage contains about 25 per cent of dry matter while hay contains about 88 per cent; 315 pounds of silage, therefore, would contain 78 pounds of dry matter while 100 pounds of hay would contain 88 pounds of dry matter. The dry matter in the mangels, about 9.4 per cent of the harvested crop, is given the same value as the dry matter in the corn, according to feeding experiments referred to by Henry and Morrison "Feeds and Feeding", page 240. As hay has a regular market value from which it is possible to calculate the value per pound of the dry matter contained, it is possible to figure the approximate value of the corn and the mangels.

The average yield of these crops at Ottawa for the past ten years was hay, 3·2 tons; oats, 61·5 bushels; corn, 15·0 tons; and mangels, 20·3 tons.

The average cost at the Central Experimental Farm for the last ten years to produce and put in the silo one acre of corn was $43.12, while to produce and store in the root cellar one acre of mangels cost $54.87. Now from the average yields of these crops, as previously given, it will be seen that corn produced 7,500 pounds of dry matter while the mangels produced only 3,816 pounds. Accordingly, to produce one ton of dry matter of corn it cost $11.50 while to produce one ton of dry matter of mangels it cost $28.76. Moreover, as eighteen years' results at Ottawa showed mangels to give slightly more than 40 per cent larger yields than turnips, it is obvious that the latter crop in this district is inferior to the mangels. Such results, it seems fair to assume, indicate that corn in districts where it can be grown successfully is very much superior to roots. In districts where corn cannot be grown, sunflowers or a mixture of oats and peas offer an opportunity to escape from the heavy burden of root growing.

THE PRAIRIE

On the establishment of the Dominion Experimental Farms system in 1887, farms were located at Brandon, Man., and at Indian Head in that part of the Northwest Territories now forming the province of Saskatchewan. Volumes could be written contrasting conditions on the prairies at that time with those which now obtain and outlining the changes and progress made during those thirty-six years. Briefly, however, and merely as indicating the great opportunity which the Experimental Farms system has had in the Prairie Provinces, one might state that in 1881 there were in both Manitoba and the Northwest Territories combined only 10,091 occupiers of farm land, while in 1921 there were over 255,000, and that while the wheat crop of Manitoba in the former year was 1,033,673 bushels, in 1923 it is estimated at thirty-eight and a half millions; in 1881 in the Northwest Territories it was estimated at 119,655 bushels, while in 1923, the crop of Saskatchewan is estimated at 259,000,000 bushels and that of Alberta at 149,000,000 bushels.

Rapid immigration brought to the prairie people who knew nothing about western farming and to the success of these, the early work of the Dominion Experimental Farms at Brandon and Indian Head contributed not a little. Even to-day there are thousands of farmers who have not yet abandoned some old method learned in former days when they farmed in a humid climate, and to-day there is a constant stream of new settlers who must learn new methods if their farming is to be profitable. Indeed, inasmuch as there is now under cultivation only about one-fifth of the area of the prairies which is capable of being devoted to agricultural purposes, there will be for many years to come a very large immigration and a consequent urgent demand for expert assistance in crops and methods best suited to prairie conditions.

Differences Between Farm Practices on the Prairie and in Eastern Canada

On account of this large immigration to the prairie from Eastern Canada and other humid regions, it may be advisable to mention some marked differences in farming methods between these two regions. Not only must a newcomer to the west be prepared to change the old methods to which he has been accustomed, but old residents on the prairie must be on guard against false doctrine or doctrine which should be used in the East only.

The following points may be enumerated as representing some of the more important differences in field husbandry practices:—

1. When virgin land is broken on the prairie, it is necessary to let the sod decompose one complete summer before planting grain. The land should be broken before July 1 and thoroughly disced during the remainder of the season. In Eastern Canada, the land may simply be broken in the fall and the grain crop seeded next spring, but this is an utter failure on the prairie.

2. In most parts of the prairie and especially in the drier parts, spring ploughing of stubble land is much superior to fall ploughing. Indeed, there are only a few places, such as central Alberta, where fall ploughing may be superior to spring ploughing. In some parts of the prairie, where not much difference exists, it may be wise to fall plough, in order to enable earlier seeding the following spring. In Eastern Canada, no one would think of spring ploughing for grain, fall ploughing being so superior.

3. It is not absolutely essential, in most parts of the prairie, to plough clean stubble land for another grain crop. Frequently a good seed bed can be made by merely discing or cultivating the land before the seeding is done. However, if the land is weedy and especially with grassy weeds or weeds having underground root stalks, ploughing is absolutely necessary. It is the height of folly to "stubble in" such land.

In Eastern Canada no one would think of seeding grain on stubble land without having it ploughed. The soil would be so hard that the seed would lie on the surface as on a table.

4. Burning the stubble in the spring on the prairie often provides an excellent seed bed when the land is not going to be ploughed. This practice destroys some fibre which is commencing to be greatly needed to prevent soil drifting, but the fact remains that the burning has given good results and who is to say that fibre could not be put into the soil more economically by growing grass crops?

5. The fertility of the prairie soil is much greater than in Eastern Canada, with the result that applications of manure produce very much less effect. Indeed, on many virgin soils, the application of manure has not given any increased crop. When the soil has produced crops for several years, the need of manure is more in evidence but rarely does it pay for the cost of application when labour is figured at current rates. It is well to remember that the manure should be ploughed in and not top-dressed if the best results are to be scured; it should be applied on the lighter soils and poorer parts of the farm. The practice of green manuring, that is, of ploughing under a growing crop to enrich the soil, has not given any better results than summer-fallowing.

These conditions are quite different from those which prevail in Eastern Canada, where lack of fertility is the main limiting factor in crop production.

6. On the prairie, every effort should be made to conserve moisture while, in the East, drainage is provided to remove the surplus water. Soil moisture, on the prairie, is the main limiting factor in crop production and special methods are used to utilize the supply most economically. The summer-fallow constitutes the greatest single means of conserving moisture and improved methods of summer-fallowing were early worked out by the Dominion Experimental Farms. In Eastern Canada the summer-fallow is almost unknown except as used for weed eradication or in preparation for fall wheat.

7. Western rye grass and brome grass are, generally speaking, the best grasses for the prairie. In some districts alfalfa may be used either alone or with Western rye as a good mixture; sweet clover has also a value in dry areas.

In Eastern Canada, timothy, red clover and alsike are the standard hay and pasture crops, but it is not good business, and in many cases it is absolutely folly, to grow these crops on the prairie. It is too dry for them to grow successfully.

8. Frost is a danger on the prairie which, although not very serious, must be taken into account in the northern areas; in such areas every effort should be made to seed early and to use reasonably early varieties of grain.

In view of these marked differences between the farming methods on the prairie and those of Eastern Canada,and to acquaint the reader with some of the more important results of the early work, it may not be out of place to describe the pioneer experimental work at the Brandon and Indian Head Experimental Farms. It is very probable that even old residents may find some results very interesting and, perhaps, quite profitable in their own work.

Pioneer Experimental Work

METHODS OF SEEDING GRAIN.—When the Dominion Experimental Farms commenced operations at Brandon and Indian Head, broadcast seeders were in vogue. The hoe drill was just being introduced and experiments were conducted to determine which implement would give larger yields. As a result of eight years' experimental work commencing in 1889, the Brandon Experimental Farm secured an average yield of 27·7 bushels of wheat from the drill seeder as compared with only 21·8 bushels from the broadcast seeder—an increase of 5·9 bushels per acre. As a result of five years' work, the Indian Head Experimental Farm secured an average yield of 29·2 bushels of wheat from the drill seeder as compared with 25·6 bushels from the broadcast seeder—an increase of 3·6 bushels per acre.

It is very interesting to read what Mr. S. A. Bedford, former Superintendent of the Brandon Experimental Farm, says on this question which in the early days was very important indeed: "We had quite a controversy with a certain large manufacturer in the East about this time. This well known firm had not commenced manufacturing drills of any kind and they were very much annoyed that I should publish the results of a drill made in the United States, when they were only making broadcast machines, and wrote me to say that they considered I was very unpatriotic. I sat down and told them that as long as our experiments proved that drill seeding produced a larger yield than broadcast, I felt I was at liberty to publish the returns. I sent a copy of my letter along with a copy of their own to the director at Ottawa and Dr. Saunders wrote to say that I was perfectly right and that I was to continue to publish such returns. The first thing I heard was that the firm had decided to manufacture drills the same as their American competitors. I received no further letter from them."

It is not saying too much to state that this experimental work at Brandon and Indian Head did a great deal to hasten the introduction and use of this improved seed drill. While the broadcast machine is now almost unknown in the West, it was extensively used in the early days. It may not be out of place to mention here that an important field of experimental work still remains in the testing of farm implements. Farmers have to pay, by purchasing implements, for the experimental work of machine companies. Such work can be much more economically done by Experimental Stations.

Experiments were commenced in 1890 with what was called a press drill in comparison with an ordinary hoe drill. This press drill did not have a wheel in the rear of the spout, the seed being merely dropped behind a shoe and covered with a chain; pressure could be applied to force the shoe deep into the soil. At

Brandon, as an average of six years' work, the hoe drill gave a yield of 30 bushels and 19 pounds of wheat compared with a yield of 29 bushels and 19 pounds when the press drill was used. At Indian Head as a result of eight years' work, the hoe drill gave a yield of 35 bushels and 26 pounds while the press drill gave a yield of 36 bushels and 38 pounds. The difference between these yields is not large enough to be regarded as indicating any superiority of either type of drill. In 1892, at Brandon, a comparison was made between seed drills which covered the seed with a chain as distinguished from those covering with a wheel. One plot yielded 37 bushels and 50 pounds while the other yielded 38 bushels, showing that no appreciable difference existed between these methods of covering the seed.

The claim is occasionally made that it is better to cross seed than to seed only once in the ordinary way. It is contended that if one-half the seed is used in one seeding and the other half in seeding at right angles to the direction of the first seeding, larger yields will be secured. The argument is that the seed is distributed more uniformly over the surface and that more economical utilization of the soil moisture will be effected. In 1894, this experiment was tried at Brandon, the cross seeding yielding 17 bushels and 30 pounds of wheat while the ordinary seeding yielded 17 bushels and 50 pounds.

Date of Seeding Grain.—Extensive experiments over a period of nine years, were conducted at Brandon and Indian Head in order to learn what date of seeding would give the largest yields of grain. The first seeding was made as soon as the land was ready to sow and five successive seedings were made at one week intervals.

At Brandon, the early seedings of wheat were slightly superior to later seedings and especially the last two seedings; with oats, the second and third seedings gave slightly the best results while, with barley, later seedings were quite the equal of the early seedings. At Indian Head there seemed to be practically no difference between the various seedings with either wheat, oats, or barley. These results, together with results secured in other parts of Canada, indicate very strongly indeed that, in the warmer districts, early seeding produces larger yields than late seeding while in cooler districts no such superiority exists.

These results were quite a surprise, owing to the very marked superiority of early seeding in Ontario. They did not show as much superiority from early seeding as was expected and in many cases, with the exception of the very last seeding, gave no increase whatever. Nevertheless, while early seedings have not given, in these experiments, much superior yields, it is very important to seed early in order to avoid possible danger from frost. In some years the last seedings have been seriously injured by frost and undoubtedly it is unwise to risk this danger by late seedings. However, this point should be clearly borne in mind that, in many parts of the prairie, the reason for early seeding is to avoid frost injury rather than that a natural superiority exists in the earlier seeding.

Rate and Depth of Seeding Grain.—Commencing in 1892, the Indian Head Experimental Farm compared different rates of seeding wheat. As a result of eight years' experiments, a rate of one bushel per acre yielded 32 bushels and 40 pounds, a rate of $1\frac{1}{4}$ bushels per acre yielded 34 bushels and 36 pounds, and a rate of $1\frac{1}{2}$ bushels per acre yielded 34 bushels and 32 pounds, per acre. These experiments indicated that $1\frac{1}{4}$ bushels per acre of good wheat was quite as satisfactory as $1\frac{1}{2}$ bushels. At Brandon, as a result of four years' experiments conducted in widely separated years, there was a slight superiority in the seeding of $1\frac{1}{2}$ bushels per acre.

In drier districts than Indian Head or Brandon, however, it must be remembered that lighter seedings are preferable. At Lethbridge, for example, a seeding of about one bushel of wheat gave, as a result of four years, the most satisfactory result.

Regarding the most suitable depth of seeding, experiments were commenced in 1892 at Indian Head. As a result of eight years of experimental work, seeding at a depth of 2 inches gave an average yield per acre of 34·47 bushels of wheat, while seeding at a depth of 3 inches gave an average yield per acre of 32·6 bushels. There is not sufficient difference between these yields to warrant a definite statement regarding any best depth, although other figures show that seeding 1 inch deep or 4 inches deep are not as satisfactory as the 2-inch to 3-inch depth. It is usually advisable to seed down to moisture but not to go too deep and certainly not below 4 inches.

Breaking Land.—Owing to the large areas of virgin land which every year are being broken from the prairie, it is very important to know the most satisfactory methods of doing this work. One very elementary, but nevertheless quite cardinal, factor is the necessity of early breaking in order to allow the sod one complete summer to decompose. On no account should breaking be done late in the summer or in the fall, because the yields of the two succeeding crops are distinctly inferior to the yields on earlier breaking. As long ago as 1890 the Brandon Experimental Farm called attention to this and reported a yield of 28 bushels 38 pounds of wheat on land which had been broken the previous spring, as compared with a yield of only 14 bushels and 20 pounds on land which had been broken the previous fall.

There are two methods of breaking land: first, to shallow break and backset and, second, to break deep without backsetting. Mr. Angus Mackay, for twenty-five years superintendent of the Indian Head Experimental Farm, has had extensive experience with this problem. He states: "In all sections where the sod is thick and tough, breaking and backsetting should be done; while in districts where scrub abounds and the sod is thin, deep breaking is all that is necessary. The former is generally applicable to the southern parts of Saskatchewan and the latter to Alberta and the northern parts of Saskatchewan where the land is more or less scrubby."

Mr. Mackay mentions that in shallow breaking and backsetting "the sod should be turned as thinly as possible and when the breaking is completed (which should not be later than the second week in July) rolling will hasten the rotting process and permit backsetting to commence early in August. The backsetting should be done in the same direction as the breaking and the same width of furrow turned. Two inches below the breaking is considered deep enough but three or four inches will give better results. After backsetting, the soil cannot be made too fine." Deep breaking consists in turning over the sod as deeply as possible, usually from four to five inches. The surface should then be thoroughly worked in order to promote decomposition of the sod. A very important point is emphasized by Mr. Mackay. "Whether the land is broken shallow or deep, it is necessary to have the work completed early, so as to take advantage of the rains which usually come during June or early in July. These rains cause the sod to rot, and without them, or if the ploughing is done after they are over, the sod remains in the same condition as when turned, and no amount of work will make up for the loss."

The Summer-Fallow.—Owing to the small precipitation on the prairie, it is necessary to use a summer-fallow at more or less frequent intervals, depending upon the locality, in order to store moisture in the soil. When settlers come from humid regions they are unfamiliar with this practice and frequently fail to handle the fallow in the most intelligent manner. Indeed, in this new country, there was no background of agricultural experience and even old residents used quite faulty methods in doing their summer-fallow work. As early as 1904 the Dominion Experimental Farms at Brandon and Indian Head showed an increased yield of wheat and oats of about 50 per cent on summer-fallow as compared with stubble land.

In southern Manitoba, it was quite a general practice twenty-five years ago to leave the summer-fallow unploughed until the first of July. It was thought bad farming to start ploughing the land before that date. This meant that the summer-fallow was not finished until the end of July and consequently that a very great growth of weeds had developed and that the soil had become exhausted of its moisture supply.

In Saskatchewan and Alberta, Mackay stated in 1902, "that the usual custom of summer-fallowing is to leave it untouched until the weeds are full grown and in many cases have fully matured seeds. It is then ploughed. By this method, which, no doubt saves work at the time, the very object of the summer-fallow is defeated. In the first place, moisture is not conserved because the land has been pumped dry by the weeds; secondly, instead of using the summer-fallow as a means of eradicating weeds, a foundation is laid for years of labour and expense by the myriads of foul seeds turned under." It is not out of place to mention that Mr. Mackay's work on the Dominion Experimental Farm at Indian Head has done more than anything else to improve the methods of summer-fallowing land, and as this problem has received further very careful experimental work during the last ten years at all the prairie Experimental Farms, the present most approved methods are later on described.

Preparing Stubble Land.—Preparing stubble land for seeding grain is very much different on the prairie from what it is in Eastern Canada. On the prairie the land is much more easily handled and, consequently, a seed bed can be prepared with very much less work. It is often possible merely to drill the grain into the stubble without any previous preparation and harvest a crop quite the equal of that which has been given a great deal more work. Fall ploughing, which, in Eastern Canada is the approved method of soil preparation, is, in most parts of the prairie, distinctly inferior to spring ploughing.

Both the Experimental Farms at Brandon and at Indian Head discovered these facts long ago and advised farmers regarding them. As early as 1895, Mr. S. A. Bedford, Superintendent of the Brandon Experimental Farm, stated, "it would appear from several years' experience that fall ploughing on clean stubble land is a waste of time as it has invariably given a less return than if the seed is sown on the unploughed stubble." Definite results of many years of recent experimental work are given under the heading of "Stubble Treatment."

Weedy land, and, especially, land infested with grassy weeds, it is very important to remember, must be ploughed. It is folly to "disc in" such land because the crop will invariably be smothered by the weeds. This is an extremely important point on which the most earnest advice is given.

Corn Silage. Distance Between Rows.—In 1899, definite experiments were commenced at Brandon and Indian Head to learn the most satisfactory distance between rows of corn. Three varieties of corn and four distances between rows (21, 28, 35 and 42 inches) were used.

At Indian Head, the closer seeding gave a somewhat heavier yield but it must be remembered that this corn was less mature than that growing on the wider rows and consequently had a larger moisture content. At Brandon, the wider seeding was quite the equal of the narrower seeding. Owing to the better opportunity of cultivating between the wider rows and hence the greater chance of eradicating weeds, the 42-inch distance is usually preferred.

Manure and Fertilizers.—Experiments were commenced with farm manure as early as 1889 and, in later years, quite extensive experiments have been planned on this subject. It may be said, in a general way, that farm manure has not given as large increases as has been expected and, indeed, in some cases when large quantities of manure have been applied in the spring, decreased yields have been experienced. As this subject is more exhaustively treated in recent experimental work, a complete statement cannot be made here.

Regarding commercial fertilizers, quite extensive experiments were commenced in 1901 and as a result of five years' work, it was decided that their use was not profitable.

Some isolated experiments were also made in the early days in ploughing down leguminous and other crops as green manure but without satisfactory results.

Other Early Work

Fall rye was grown in the early days on the Experimental Farms. In 1906 Mr. Mackay mentioned that "for several years winter rye has been sown each fall early in September and has never failed to stand perfectly and give a good yield of straw and grain. For early spring fodder, either for pasture or cutting green, it surpasses all other grains so far tested." At Indian Head from 1905 to 1908 inclusive, fall rye gave an average yield of 44 bushels per acre; in three of these years the fall rye was seeded on summer-fallow and one year it was seeded on sod.

Fall wheat was repeatedly tried at Brandon and Indian Head but without success. It must be mentioned, however, that at Lethbridge some success was secured with fall wheat.

Experiments with mixed grains were tried at Brandon for three years—in 1899, in 1909, and in 1910. The results indicated that oats alone gave a larger yield of grain than any of the mixtures which were tried.

Experimental rotations were started at Brandon in 1895 and at Indian Head in 1899, but inasmuch as more extensive experiments along this line were commenced later, discussion of this topic will be deferred.

Soil drifting problems were experienced in the early days. In 1900 Mr. Bedford wrote: "The past season was exceptional for the large amount of injury done through drifting soil, thousands of acres of crop, both east and south-west of this place, being almost entirely destroyed from this cause. On the Experimental Farm, the benefits of seeding grass were very evident. Knolls and other exposed spots which, in the early history of the farm, were often so badly blown as to lose the seed, were so protected by the fibre of grass plants ploughed under in former years, that the injury was scarcely noticeable."

Mr. Mackay in 1900 also stated: "On this farm during the past season nothing was more apparent than the advantage of having grass roots in the soil to prevent drifting by the high winds that prevailed at that time. While the top soil of fallowed fields was day by day being carried away in clouds and the crops drying by inches, the land containing grass roots was not in any way disturbed and the injury done to crops was by dry weather alone."

MORE RECENT EXPERIMENTAL WORK.

In 1911, Dr. J. H. Grisdale, then Director of the Dominion Experimental Farm system, arranged a considerably enlarged programme of cultural and rotation experiments on the prairie Farms. The same cultural experiments were conducted at all the farms while variations were made in the rotations in order to suit the varied needs of the different districts. The experiments were conducted at Brandon, Indian Head, Scott, Rosthern, Lacombe and Lethbridge. At Lethbridge additional experiments relating to irrigation were also commenced.

A very complete summary of the results of these experiments is now available in the interim reports of all of these Experimental Farms for the year ending March 31, 1921. Only a very cursory statement of the more outstanding results can be given here.

The extended experiments on breaking land on the prairie have amply confirmed the earlier work on this problem, the results of which, have been given previously. Anyone contemplating breaking new land should read these results.

Much discussion has been given in the past to the question of the best depth of ploughing. The claim is frequently made that deep ploughing is much superior to shallow ploughing, it being alleged that the soil is opened more deeply and made more receptive of moisture. However, repeated trials have failed to substantiate any such claim and while local conditions may in some cases require deeper ploughing, a depth of from 4 inches to 6 inches seems as satisfactory as any. It is well to remember in this connection that the plough will have to be set at about 6 inches in order to insure ploughing four inches in certain places in the field; if the plough is set at 4 inches it will run too shallow in places and occasionally jump out of the ground altogether, making a bad job and causing a decreased yield. On the other hand, it is a waste of power to sink the plough too deeply for no increased yields are secured.

Summer-Fallow Treatments

As there are several million acres of land summer-fallowed every year on the prairie, it is very important to learn what methods are most suitable. Improved methods, either of increasing the yields of the crop following the summer-fallow or of reducing the amount of labour required to work the land, are alike extremely important for the farmer to know.

In order to study this question thoroughly, seventeen different methods of summer-fallowing were tried. The results showed, in brief, that ploughing early in June, about 6 inches in depth, and cultivating throughout the season to control the weeds, have given most satisfactory results. It is not necessary, under ordinary conditions, to plough excessively deep or to subsoil as was sometimes claimed. It is not necessary to plough the summer-fallow twice unless the land has become infested with bad weeds and especially with grassy weeds. However—and this is very important—it is necessary to plough the summer-fallow early if the best results are to be secured. Moreover, it is inadvisable to seed a forage or pasture crop late in the summer on the summer-fallow; the yield of wheat next year being distinctly decreased.

In recent years, soil drifting has become quite a serious problem on summer-fallow land. After years of cropping and summer-fallowing, the fibre has become exhausted and the soil, in many districts, has started to blow. In such districts, therefore, some modified method of summer-fallowing must be employed, some acreage of fall rye instead of all spring wheat grown, and some land seeded to grass periodically.

Stubble Treatments

Exhaustive experimental work done in recent years has amply confirmed, in most parts of the prairie, the findings of earlier days and Mr. Bedford was right when he said, twenty-seven years ago, "that fall ploughing on clean stubble land is a waste of time." In 1921 there were over thirty million acres of stubble land on the prairie; it cost millions of dollars to prepare this land for crop; this enormous expense can be considerably reduced. Years of experiment on the Prairie Farms involving wheat yields on stubble prepared in ten different ways, have demonstrated that ploughing stubble is not an absolute necessity in most places where there are practically no weeds in the land. All that is necessary is to form a seed bed and this can often be done without ploughing and certainly at an enormous reduction in cost. At Lacombe, only, did fall ploughing appear superior to other treatments and it is not known for certain yet whether this superiority may be regarded as significant or not; however, as the Lacombe figures are averages of seven years' work the conclusion that fall ploughing is the best treatment should be accepted in central Alberta until contrary evidence is forthcoming. Grave warning must be given, however, against neglecting ploughing when the land is weedy—especially with grassy weeds. In such cases it is absolutely essential to plough.

Seeding to Grass and Clover

Extensive experiments have been conducted to learn the most satisfactory method of seeding grasses and clovers. Comparisons have been made between seeding alone without an accompanying grain crop—ordinarily called a nurse crop—and seeding with a nurse crop. The results of several years' work have shown that while slightly larger crops of hay have usually been secured from the seedings without the nurse crop, it is more profitable to use it in view of the money value of the nurse crop itself.

In many districts it is sometimes difficult to get a good "catch" of grass or clover seed. In such districts it is advisable to seed down with the grain crop immediately after the summer-fallow in order that more moisture will be available for the young grass crop. Wheat is usually regarded as being a slightly better nurse crop than oats or barley.

Breaking Sod from Cultivated Grasses and Clovers

As a general rule, it is advisable to break the sod immediately after the hay crop has been removed, work the surface down and give such additional cultivation throughout the season as will control the weeds. This plan is more profitable because it enables the additional crop of hay to be harvested and while it does not give quite as large yields as ploughing in the spring and handling the land similar to the method used in breaking virgin prairie, nevertheless, it is usually more profitable.

Where the hay crop is brome grass, it may be advisable to backset in September, although, in some districts, once ploughing followed by thorough surface cultivation has controlled this grass quite successfully. With western rye grass backsetting is unnecessary.

Applying Barnyard Manure

Extensive experiments were commenced in 1911 to determine what value, if any, farm manure possessed and, if so, what method should be used in making applications to the land. This question is still controversial and conflicting evidence is given not only by farmers but by experimentalists as well. Taking the average results of five Experimental Farms on the prairie where twelve tons of manure were applied once in a three-year rotation of summer-fallow, wheat, wheat, there was an increased yield of wheat on the rotation of 6·7 bushels. With wheat worth 80 cents a bushel this increased yield would be worth $5.36; the return, therefore, for applying the twelve tons of manure would be 44 cents a ton. It is probable that better results would be secured on sandy or poor soil and it is to these places on the farm that the manure should be applied if profit is to be secured. The best method of applying the manure is to spread it on the stubble land and plough it under, either in the fall or in the spring.

Green Manuring

So much is said about soil fertility and so much discussion is given to the nitrogen-fixing power of leguminous plants, that extensive experiments have been conducted on the Experimental Farms to learn if there is any real advantage, as expressed in increased yields, to be gained by ploughing under leguminous crops for green manure. There is, as yet, no such advantage to be gained. In many cases there is no increase at all over summer-fallowed land and in no case is the practice profitable.

Soil Packers

The first mention made by the Dominion Experimental Farms of the use of this implement is found in the Report of the Lacombe Experimental Farm for 1908. In this report it is stated that "Professor Campbell of dry farming fame in the United States, travelled this country during June and July under the direction of the Provincial Department of Agriculture explaining his method." It may be said that Campbell is regarded as the originator of this implement.

In view of the great need of conserving moisture on the prairie, many methods are tried in an effort to gain the greatest success in this very important undertaking. It is necessary, however, carefully to examine all these methods, by means of intelligently conducted experiments, in order to decide just what is useful and what is not useful, because if a method is not useful, it is a waste of money to continue it.

The Dominion Experimental Farms have conducted over 1,460 trials on this question at five Experimental Farms in representative districts in the three Prairie Provinces. As the trials have been conducted over a period of ten years, including seasons of widely varying precipitation, the results should be fairly reliable.

The results of these tests show little difference in yield between packed and unpacked land. Only on spring ploughed stubble did the packer show any increase, and this was not large enough to warrant the conclusion that it had been due to the packing. Experimental error would easily account for this difference. Moreover, the plots which were not packed received less cultural treatment than those which were packed.

Rotations

While rotations were established as early as 1895 at Brandon and in 1899 at Indian Head, it was not until 1911 that a comprehensive system of rotations was arranged on all the prairie farms. These rotations are used to gain information regarding the influence of certain cropping methods on the permanent productiveness of the soil, in its broadest sense. It is obvious that no haphazard system of cropping will ever throw light on permanent methods of farming. No one can tell what methods are good and what are bad, if the land is cropped a few, and an irregular, number of years in succession, then summer-fallowed and grain planted again with an occasional seeding down of grass crops. After twenty or thirty years of such work, one's knowledge would be exactly the same as at the beginning. It is for this reason, then, that these rotations were established—in order that the most permanent system of cropping land on the prairie might be discovered.

While the work has not yet progressed far enough to draw very definite conclusions, nevertheless a few facts have been brought to light. By using a grass crop in the rotation, soil drifting is prevented and, thereby, serious economic loss averted. In districts where corn grows satisfactorily, the yield of wheat after corn is quite the equal of wheat after summer-fallow. Land cannot be left in grass many years—usually not more than two years—owing to the decrease in yields. Where alfalfa is used with western rye grass, this decrease is not so apparent.

Other Recent Work

Experiments have been conducted in order to learn the influence of a very good seed bed compared with a medium and a poorly prepared seed bed, on the yield of wheat and oats. Contrary to expectations, no difference in yield was noticed and hence it may be concluded that there is no reason for making the surface very fine at seeding time. This finding is rather welcome, inasmuch as a fine seed bed is more liable to drift as well as being more expensive to prepare.

Additional experiments relating to the proper depth of seeding have confirmed the findings of earlier work. A depth of from 2 inches to 3 inches is the most satisfactory. Seeding over 4 inches in depth is liable to be too deep while, on the other hand, seeding 1 inch in depth is too shallow.

Further work with commercial fertilizers has not shown profitable results. Underdrainage, even in what were thought the more humid sections of the prairie, has not given increased yields.

In recent years, considerable work has been done with sunflowers for ensilage. It may be said that in the cooler sections of the prairie where corn is not successful, sunflowers make a very satisfactory ensilage crop. Contrary to earlier views, sunflowers have not proved as drought resistant as corn; the latter crop not only grows with less water but is better able to resume growth after a protracted period of drought.

Irrigation has been fairly extensively studied at Lethbridge, Alberta, as well as at Summerland and Invermere in British Columbia. Information has been secured showing what crops have been most profitable under such an intensive method of farming and what amount of water and at what times water should be applied to various crops.

Since 1921 technical experiments under controlled conditions have been commenced to gain information regarding the more fundamental principles of moisture conservation. In the Prairie provinces precipitation is the most important factor limiting the yields of crops. If the rainfall is sufficient during the summer months and, of course, if good farming practices are followed, large crops are secured, but if the rainfall is not sufficient or does not come at the time when it is required, the crops are poor. However, it is the object of scientific agriculture to study how the precipitation which does fall may be most effectively utilized. Extensive experiments on this problem are being undertaken on the Dominion Experimental Station at Swift Current, Saskatchewan and, in addition, further work is being done on the other Dominion Experimental Farms on the Prairie.

Potatoes from poor seed on left. Potatoes from good seed stock stock on right. (Skinner irrigation system in action). Central Farm, Ottawa.

DIVISION OF HORTICULTURE

W. T. Macoun, *Dominion Horticulturist.*

The Division of Horticulture is one of the original divisions in the Experimental Farms Branch and work was begun in the spring of 1887. At that time available information in regard to fruit growing was based on the experience of fruit growers who, when opportunity offered, told of how certain varieties had succeeded with them, and the methods they employed. Farmers' meetings were comparatively few in those days and information was slow in being disseminated and, as all the principal factors affecting the success or failure of fruits were not usually known, the information was sometimes misleading. Furthermore, at that time farmers were willing to take the word of agents of nurseries who frequently did not know which varieties were suited to the district in which they were selling trees. Great losses followed, as a large proportion of the trees were winter-killed.

With the establishment of the Central Experimental Farm at Ottawa, it was possible to begin definite experimental work, the government taking the risk and chance of losses and reporting the results through the many agencies which have developed since that time.

In 1910, the horticulturist of the Central Farm was appointed Dominion Horticulturist and his duties were extended to the branch Farms and Stations.

The Horticultural Division, as it is now constituted, is divided into five main subdivisions of work, namely: Pomology, Vegetable Gardening, Ornamental Gardening, Painting and Herbarium, and correspondence and office work. In addition there is much to do in connection with the Branch Farms and Stations, in the preparation of reports and bulletins and matter for the press, in addressing public meetings and visiting horticultural districts in different parts of Canada for the purpose of studying the horticultural industry.

POMOLOGY.

The study of varieties of fruits for the purpose of getting information in regard to their relative merits in regard to yield, season, quality and profit is included in pomology. It also deals with the identification, classification and description, as well as the propagation, planting and care of fruits, and with experiments in cultural methods, including spraying. The exhibition and judging of fruits may also be grouped under pomology, as also the origination of new varieties. At present, some thirty-eight main projects are under study in this branch of horticultural work.

During the past thirty-four years, much information useful to fruit growers throughout Canada was obtained as a result of the many experiments conducted by the Horticultural Division, and following will be found some of the results which affect the largest number of people and should be of the greatest monetary value.

Fruits—Origination of New Varieties

Apples.

The McIntosh apple is acknowledged to be one of the most, if not the most, popular apple in Canada to-day, its handsome appearance, tender flesh and fine flavour making a combination which few other apples possess. The McIntosh apple at Ottawa is in season from late October to February or later.

Before the season of McIntosh there are no hardy varieties in commerce of as handsome appearance, or as good in quality, and this may be said also of varieties that are not hardy at Ottawa; hence there is room for new varieties all over Canada where the apple is grown, that will be in season in August, September and October, and will be as handsome as McIntosh and as good, or almost as good, in quality.

The dearth of good summer and autumn dessert varieties was early recognized in the Horticultural Division, and in 1898 the present Dominion Horticulturist took steps to overcome this. Thousands of new varieties were raised from seed of sorts such as Fameuse, McIntosh, Wealthy, Northern Spy and many others, while a large number of others were inter-crossed. Out of the many which have fruited, more than one hundred have been named, as being promising for some part of Canada, and as being better than varieties grown there at present. but extended reference need only be made here to certain seedlings of McIntosh, though a number of seedlings of Northern Spy and others are almost equally promising and some of these will doubtless prove very useful where Northern Spy will not succeed, as they have much of the Northern Spy flavour.

As a result of the many experiments which have been carried on in order to obtain a winter apple of good quality for the colder parts of Eastern Canada, it may be said that, whereas in 1887 when the work was begun there were not more than five or six hardy, long-keeping apples available to the fruit growers, there are now, mainly as a result of the work at the Central Experimental Farm, more than two hundred long-keeping varieties under test at Ottawa, which are being sifted out in order that those possessing the largest number of good qualities may be retained. Much cross-breeding is now done under glass, where varieties which cannot be grown outside are grown in pots, thus giving a much wider range of varieties to work with.

The following seedlings of McIntosh have been thoroughly tested and need but increasing in large numbers to give Canadians a series of apples of the McIntosh type which would have a season from August to February, and in some of the crosses, with McIntosh as a parent, not yet thoroughly tested, there are varieties which keep until spring.

Melba.—This is a seedling of McIntosh which comes into condition from the middle to the end of August at Ottawa and has a relatively long season for a summer apple. It is of good size, handsome appearance, and very good quality. This is a red summer apple, comparing very favourably with McIntosh in appearance and quality. The tree is an early bearer and a good cropper. This variety is firmer than most summer apples. It should soon become a very popular commercial sort.

Joyce.—A McIntosh seedling which is fit for use from two to three weeks later than Melba and continues in season through September and October. It is of good size, a red apple, attractive in appearance, good to very good in quality, comparing very favourably in quality with McIntosh itself. While, perhaps, not quite as early a bearer as Melba, it is a fairly early bearer, and we highly recommend this to follow Melba in season.

Pedro.—This McIntosh seedling is in season from late September to December, being ready for use about three weeks after the Joyce and keeping much longer. It is, perhaps, the handsomest of these apples of the McIntosh type, being of a lively, attractive shade of red, and having a perfume. While the Melba and Joyce are subacid, this may be called briskly subacid. The quality is good. This variety is recommended to replace the Wealthy where an apple of better quality is desired. The tree is evidently very hardy, is a vigorous grower, and is a regular and heavy bearer. Trees of this will soon be available in quantity.

Lobo.—Lobo is a McIntosh seedling which is in season just before McIntosh, colouring before the latter variety. It is one of the most highly-coloured of the McIntosh seedlings and is considered very promising, especially in the province of Quebec and in the State of New Jersey, where it is now fruiting.

Hume.—This variety, also a seedling of McIntosh, resembles the parent very much in colour of skin, flesh and flavour, and is of good to very good quality. It also has a perfume somewhat similar to McIntosh. It is, however, in season earlier than McIntosh, and, like Lobo, is very promising as a variety to precede it.

Patricia.—By some persons, the Patricia is considered the best dessert apple of all these McIntosh seedlings, but, as a commercial apple, it may not prove quite large enough, unless severely thinned, as it bears very heavily in rope-like masses. The character of the flesh of this apple is superior to any of the others, and the quality is also very good. The fruit is deep red in colour and it is in season from October to December. This is particularly recommended for home use.

SEEDLINGS OF NORTHERN SPY

The Northern Spy, while not hardy at Ottawa, has been crossed with Milwaukee, Lawver, North Western Greening, Walbridge and others at Ottawa, in the hope of obtaining hardy, late-keeping apples of good quality, and many long-keeping sorts have been obtained as a result of this work. Brief descriptions follow of some of the best of the open-pollinated seedlings. Most of these are long keepers. They will be tested thoroughly and gradually reduced in number.

Ascot.—Fruit medium to large in size, roundish to oblate; predominate colour crimson; flesh yellowish with traces of red, crisp, tender, juicy; flavour subacid, pleasant; quality good; season November to middle of February or later. Resembles Northern Spy a little in outward appearance and considerably in flesh and flavour.

Bingo.—Fruit above medium to large, roundish conical; predominate colour crimson; flesh yellowish with traces of red, tender, moderately juicy; flavour subacid, sprightly, spicy, pleasant; quality good; season December to late winter. Resembles Northern Spy considerably in outward appearance, flesh and flavour.

Donal.—Fruit above medium to large, oblate to roundish, regular; predominate colour, crimson; flesh yellowish, crisp, tender, rather coarse, juicy; flavour subacid, sprightly, pleasant; quality good; season late October to March or later. A handsome apple resembling Northern Spy somewhat in colour.

Elmer.—Fruit medium in size, roundish; predominate colour deep crimson; flesh yellowish, crisp, tender, juicy; flavour subacid, sprightly, pleasant; quality good; season January to late winter. Looks and tastes somewhat like Northern Spy, though a smaller apple.

Emilia.—Fruit medium to above medium in size, roundish conical; predominate colour, crimson; flesh dull white, crisp, tender, juicy; flavour briskly subacid, pleasant; quality good to very good; season December to April. Resembles Northern Spy in colour, shape, flesh and flavour. One of the best, also one of the latest to come into bearing.

Niobe.—Fruit above medium size, roundish, regular; predominate colour, rather dull crimson; flesh yellowish, crisp, tender, moderately juicy; flavour mildly subacid, but sprightly, pleasant; quality good to very good; season, December to late winter. Resembles Northern Spy a little in outward appearance and considerably in flavour. Very popular with most who try it. One of the first to come into bearing, but tree is not as hardy as some of the others.

Sparta.—Fruit medium in size, roundish; predominate colour crimson; flesh yellowish, crisp, juicy; flavour briskly subacid, pleasant; quality good; season December to late winter. Resembles Northern Spy somewhat in flesh and flavour.

Spiotta.—Fruit medium to large, oblate to roundish conic; predominate colour crimson; flesh dull white or yellowish, crisp, tender, juicy; flavour briskly subacid, pleasant; quality good; season November to February or later. Resembles Northern Spy considerably in colour, flesh and flavour.

Spiro.—Fruit medium in size, oblate to roundish; predominate colour deep crimson; flesh yellowish, crisp, tender, juicy; flavour subacid, sprightly, pleasant; quality good; season November to March or later. Resembles Northern Spy considerably in flesh and flavour.

Spiza.—Fruit medium to large size, roundish; predominate colour carmine approaching crimson; flesh yellowish, crisp, tender, juicy; flavour briskly subacid, not high but pleasant; quality good; season November to February or March. Flesh considerably like Northern Spy. Flavour a little like Northern Spy. Shape and colour considerably like Northern Spy.

Wilgar.—Fruit above medium to large, roundish conical; predominate colour crimson; flesh yellowish, tender, juicy; flavour subacid, pleasant, though not high; quality good; season December to March. Resembles Northern Spy considerably in outward appearance, colour, shape, flesh and flavour.

SOME OTHER PROMISING LATE-KEEPING VARIETIES OF APPLES

Lawfam (*Lawver x Fameuse*).—The Lawfam apple is one of the most promising winter apples originated at Ottawa. It is deep crimson in colour and of good quality, the flavour being suggestive of Fameuse. It keeps, however, longer than either McIntosh or Fameuse and should prove very valuable on this account.

Stonetosh (*Stone x McIntosh*).—A promising winter variety, above medium to large in size, deep red in colour and with a spicy or aromatic flavour which is quite distinct from that of other sorts. Promising as a better keeper than McIntosh.

Maclaw (*McIntosh x Lawver*).—This is another promising, late-keeping sort, resembling McIntosh considerably in colour of skin and a blend of both parents in other respects. It is of good quality and keeps until spring.

Spimil (*Northern Spy x Milwaukee*).—An apple of good quality, resembling Northern Spy considerably in outward appearance. It is better in quality than Milwaukee and a later keeper.

Bethanis (*Bethel x Anis*).—The Bethanis is suggestive of its parent, the Bethel, in colour of skin and in flavour, but is better in quality. It is a late keeping variety.

AWARDS RECEIVED FOR NEW VARIETIES OF APPLES

As an indication of the value of the new varieties of apples originated in the Horticultural Division, it may be stated that six silver Wilder medals have been awarded the Central Experimental Farm, through the Dominion Horticulturist, for promising fruits.

The silver Wilder medal is the highest award made for meritorious fruits by the American Pomological Society, founded in 1848, the oldest horticultural body in America. The awards to the Central Experimental Farm have been as follows:—

1907—Jamestown Exhibition, Norfolk, Va.
For Hybrid Apples and Selected Seedlings.

1909—St. Catharines, Ont.
For Northern-grown Fruit, including Hybrid Apples.

1913—Washington, D.C.
For New Varieties of Hardy Apples.

1917—Boston, Mass.
For Display of Seedling Apples.

1920—Columbus, Ohio.
For Collection of New and Promising Winter Apples.

1923—New York, N.Y.
For the Lobo Apple.

Method of Introducing New Apples of Merit.

For many years, trees of new varieties of fruits were sent to experimenters free, for test, but it was found that this was a slow method of getting them grown on a commercial scale and getting fruit of these new and better sorts available in large quantities, hence a new method has recently been adopted. This is to propagate these varieties in fairly large quantities for sale, so that a sufficient number may be purchased by one individual to ensure his having, later on, a large quantity of fruit. As soon as nurserymen have trees of each variety in sufficiently large quantities to supply the demand for them, the Division of Horticulture will discontinue selling them. In this way it is believed that these new sorts will soon become popular.

Length of Time Required to Originate Fruit and Popularize a New Apple of Merit.

It takes nearly a lifetime to bring a new fruit to the point where it can be obtained in large quantities, if it is started from the seed. Most of the varieties now being grown commercially were chance seedlings, but systematic effort is now being made to obtain new sorts by combining the qualities of two known varieties in one.

	Years
From sowing seed to planting seedling trees in fruiting rows	3
From planting to bearing	5
From bearing to confirming characteristics of fruit	5
From propagation to planting in orchard	3
From propagation to setting in orchard to fruiting of same	6
If approved by nurserymen, time for nurserymen to build up stock for sale	3
From time of sale until trees are in full bearing in fruit growers' orchards	10
To popularize fruit after it is available	5
Total	40

New Varieties of Plums.

There is a very wide area in Canada where the season is not long enough for the plums which are now in commerce to mature. Many seedlings have been grown, but those from a native plum which ripens during the last week of July to the first week of August at Ottawa, but which itself is not quite large enough, have proved the best. These are much larger than the parent and better in quality, and ripen early in August, before the plums from the great plum districts of Canada are on the market. Hence prices obtained for these very early plums are good. The most promising of these have been called Ottawa, Carleton, Carson and Rideau. There would seem to be a very large market for these early plums.

New Varieties of Currants.

The Division of Horticulture has thoroughly tested the varieties of black currants originated by the late Dr. William Saunders, formerly Director of Experimental Farms, and some of these have proved more productive than other varieties in commerce. The Kerry has proved the most productive in most districts where tested, while, in some places, Magnus, Climax, Saunders, Topsy and Eagle have been among the best. If all the black currants in Canada could be replaced by these, the value of the crop would be very much increased.

New Varieties of Gooseberries.

One of the leading commercial varieties of gooseberries in Canada is the Red Jacket or Josselyn, originated by the late Dr. Saunders and thoroughly tested in the Horticultural Division. Three other new sorts, by the same originator, are even more productive than Josselyn and will, no doubt, be much planted in the future. These are Mabel, Charles and Silvia. The Charles, particularly, combines the large size of the English varieties with the disease resistance of the American.

New Varieties of Raspberries.

A hardy, early variety of raspberry is very desirable in Canada, as the early crop is usually the most profitable. The Count, Brighton and Sir John are three sorts which, if generally grown, would add much to the value of the raspberry crop. These are being propagated for sale by the Division of Horticulture.

New Varieties of Strawberries.

Many new varieties of strawberries have been originated in the Horticultural Division, but five of the most outstanding are Portia, Cassandra, Hermia, Lavinia and Mariana. The Portia strawberry has proved an exceptionally good canning berry and is fast becoming very popular, both in Canada and the United States. It is handsome in appearance and good in quality, and the plant is vigorous and productive.

Test of Varieties

The testing of varieties has always been an important part of the work of the Horticultural Division, as it is desirable that those best suited to a district should be known as soon as possible. When the first orchard was planted at the Central Experimental Farm in 1888, it was not known what were the best varieties of fruits to grow, but during the past thirty-four years, thousands of varieties have been tested and reliable lists have been published, both at the Central and branch Farms, which apply to nearly everywhere in Canada where the apple can be grown.

Effect of Very Cold Winters

Since 1887 there have been exceptionally cold winters, in 1895-6, 1903-4 and 1917-18, and this has resulted in obtaining very valuable data on the relative hardiness of varieties. Thousands of trees of many varieties were killed by these winters, but afterwards it was possible to recommend varieties that were proven to be hardy. One example may be given to show the advantage of having many varieties in an experimental orchard, under the same conditions. After the severe winter of 1903-4, it was found that the McIntosh apple tree was much hardier than the Fameuse, and fruit growers were urged to plant this instead of the Fameuse in the colder sections. This was again clearly proven by the severe winter of 1917-18, which killed off a large proportion of the Fameuse, while a relatively small proportion of McIntosh was affected. Many thousand trees of McIntosh must have been planted because of advice given by the Horticultural Division. On the other hand, the proving at some of the Branch Stations that there are practically no apples hardy enough to stand the severest climate in Canada must have prevented the loss of many thousands of dollars by people who would otherwise have purchased trees.

Top-Grafting Tender Varieties of Apples on Hardy Stocks

It was believed at one time that the top-grafting of tender varieties of apples on hardy stocks would make them sufficiently hardy to be grown successfully where they could not in the ordinary way. Experiments conducted on the Central Farm have shown that this is not so.

In 1898, and later, ninety-two varieties were top-grafted, but the winter of 1903-4 killed practically all of them back to the stock. This definite information must have saved growers many thousands of dollars as a warning not to depend on top-grafting to make tender varieties hardy. It is true that, in some cases, a variety top-grafted will live longer than if grown as a standard tree, and a top-graft will usually bear sooner, but as a method for making tender varieties hardy it is not recommended.

Importance of Hardy Root Stocks for the Colder Parts of Canada

During the past thirty-four years, much experience has been gained in regard to root stocks for various fruits, and the great losses which can be avoided by the use of hardy stocks has been well demonstrated in the Horticultural Division.

Apple trees obtained from nurserymen are usually propagated on roots not selected for hardiness, with the result that, in winters when conditions are favourable for root killing, many trees die from this cause. It has been shown by the Horticultural Division that by using crab apple roots for stocks, this root killing can be avoided, and if nurserymen would propagate all their trees on such stock much loss would be avoided.

Very hardy fruits, such as the *Americana* plums, have been propagated on peach roots by some nurserymen. It has been shown by test in the Horticultural Division that roots of the peach, and other stocks often used, are winter killed, resulting in the dying of a hardy tree. Pears which are propagated on quince, to dwarf them, have been shown to be of no value at Ottawa, as the quince roots are winter-killed and the pear tree dies.

Records of Yields from Individual Trees

There are few records available in America, or, in fact, in any part of the world, where the yields from trees have been kept continuously for a long period, thus enabling a grower, or one who desires to begin to grow fruit, to get a good idea of what trees will bear each year from the time they come into bearing.

Since 1898, or for the past twenty-three years, the yields from each bearing tree of each variety of fruit have been recorded each year in the Horticultural Division at Ottawa, so that it is possible to show what each tree has borne for that length of time. Thus, if a prospective grower of Duchess, Wealthy or McIntosh, desires to know what trees of these varieties are likely to bear in a certain number of years, the figures can be given him, and he is then able to plan much better than he otherwise would.

Furthermore, it has been shown that some trees of the same variety of fruit planted at the same time and growing under apparently similar conditions, will bear twice as much, or more, fruit over a period of years than will another tree. It is not yet certain whether, in the fruits grown here, this is due to bud variation or not, but apple trees propagated from heavy and from light bearing trees have, so far, shown approximately the same relation, so far as bearing is concerned, as the trees from which they were propagated. Some time yet is required to settle this question.

Spraying

During the past thirty years, experiments in spraying have been an important part of the work of the Horticultural Division. Many tests of different kinds of insecticides and fungicides to control many kinds of injurious insects and diseases have been made and the results have been published in reports, bulletins and spray calendars during that period. The recommendations made based on this experimental work, have been of great value to fruit and vegetable growers.

Cover Crops

In the winter of 1895-6, there was much root-killing in orchards in eastern Ontario, due to the soil being bare. Up to that time, little was known about cover crops in Canada, but, beginning in 1896, experiments were started and have been continued ever since, or for the past twenty-six years, and the information given from the results of these experiments must have been of very great value to orchardists. The main uses of cover crops are to hold the snow in winter and thus afford greater protection to the roots of trees; to prevent the thawing and freezing of the ground; to lessen the depth to which the frost will go in the soil; to furnish vegetable matter in the spring for the purpose of obtaining humus and nitrogen; and to act as a catch crop in autumn to prevent the leaching of plant food made available in the summer. Among the experiments which were tried in co-operation with the Division of Chemistry was the determination of moisture in the soil under different cover crops, as sometimes it is desirable to have the cover crop reduce the soil moisture as little as possible, while in other cases it is not a matter of much importance. The analyses showed that there was a marked difference in the amount of moisture transpired, and amount conserved by shading, by the different crops.

Identification of Varieties of Fruits

By no means the least important part of the work of the Division of Horticulture is the identification of varieties of fruit. The law requires that, when fruit is packed in closed packages, the name of the variety must be on the outside. There are hundreds of varieties being grown in Canada and, in many cases, the grower does not know the correct names of some that he has. Hence it has been the custom for many years to send specimens for identification to the Horticultural Division, not only of the kinds of fruit which are packed in closed packages, but of other fruits as well. It can readily be understood that it is only by long experience that one becomes sufficiently expert in varieties of apples, pears, plums, cherries, grapes, raspberries, gooseberries, currants and strawberries to be able to name correctly the many sorts that are sent in for test; hence the value of growers having the Horticultural Division to which to send specimens for name. Here there is a large collection of fruits with which to compare those sent in and, because of travelling all over Canada, the chief officers of the division become familiar with the many varieties as grown in different sections. Furthermore, detailed descriptions are made in the Horticultural Division of the varieties of the different kinds of fruit, so that these can be referred to, for confirmation, in naming a variety. The value to fruit growers of having this source of information must be very great.

VEGETABLE GARDENING

That part of the work relating to vegetable gardening includes the testing of varieties of vegetables for comparison of their relative merits as regards season, yield, quality, etc., the origination of new varieties, the comparison of different strains of the same variety, cultural methods and spraying, and the study of commercial methods. Some 106 main experimental projects are now under way at Ottawa in this work.

Many experiments have been carried on with vegetables during the past thirty-four years in the Horticultural Division, and the value of the information from the results of these experiments must be very great. It is in the breeding of new and better varieties, however, that the greatest value to the largest number lies.

Origination of New Varieties of Vegetables

There is such a vast area in Canada where the seasons are relatively short, that it is of the utmost importance that there should be earlier and better vegetables, hence breeding has been carried on with corn, tomatoes, beans, peas, onions, celery, beets, carrots and other vegetables. Perhaps the greatest progress has been made with sweet corn, one of the most popular and widely-grown vegetables in Canada.

Corn

Early Malcolm. This variety, which was developed in the Horticultural Division, was introduced to the trade some years ago and has proved a very popular variety and profitable to market gardeners. It is a very early sweet corn of good quality and is in season about ten days before the Golden Bantam.

Sweet Squaw. The Squaw corn is a variety which develops on the prairies at a lower temperature than any other variety tested, but it is not a sweet corn, hence does not compare favourably with sweet varieties for table use. This was crossed in 1913 with the Early Malakoff sweet corn, a very early Russian variety, in the hope of obtaining a sweet corn that would develop in a comparatively cool temperature. An early sweet corn was obtained from this cross which has become very popular in Manitoba and other parts of Canada. It also is about ten days earlier than Golden Bantam, the popular main crop variety.

Pickaninny. Perhaps the most remarkable corn developed in the Horticultural Division is, however, the Pickaninny. The variety which was one of its parents, and from which it got its extreme earliness, was obtained from New Brunswick and may be an old Indian sort. It was crossed in 1918 with the Sweet Squaw and from this cross came the Pickaninny, named thus because of the dwarf habit of the plant and black kernels of the ear. The Pickaninny has proven a great acquisition to those parts of the prairie provinces where, previous to its introduction, sweet corn could not be brought to condition for eating. It is also invaluable for gardeners all over Canada because it is earlier than any other sweet corn known, with the exception of the New Brunswick sort previously mentioned. It is earlier than either Early Malcolm or Sweet Squaw.

Banting. The Golden Bantam corn is the most popular variety of garden corn in America to-day because of its fine flavour and long season in condition for eating. Efforts have been made in the Horticultural Division to originate a yellow variety which would be equal to Bantam in quality, but earlier in season so as still further to lengthen the season of the Bantam type. Such a variety has been obtained in the Banting, which was named in 1923. This is a cross between Pickaninny and Howe's Bantam, the latter being a yellow flint variety. The Banting is a very early variety.

Tomatoes

Alacrity. The Alacrity tomato is the result of twenty-one years' work in the Horticultural Division for the purpose of obtaining a variety that would give the largest crop of early fruit. It has been on the market for several years and has proved of great value in the cooler parts of Canada where the crop of ripe fruit is usually rather small. This is being selected each year for greater smoothness of fruit, combined with extreme earliness.

Peas

Much work has been done with peas and a strain of the English Wonder, developed in the Horticultural Division, has proved a very valuable sort. Other varieties with larger pods, not yet named, are very promising.

Rhubarb

Ruby. This is a very fine variety of rhubarb, originated in the Horticultural Division. The stalks of this rhubarb are very red, both inside and out, and it is milder and better in flavour than most other sorts. This promises to be a very popular variety. It is a seedling of Victoria.

Home Grown Vegetable Seed

During the war, much attention was paid to experiments with home-grown vegetable seeds and very useful information was obtained in regard to methods of growing seed crops. It was also shown that the quality of home-grown seed was as good as, or better than, imported seed. Special attention was paid to selection from individual plants and, as a result, very good strains were obtained of beets, cabbage, carrots, parsnips, onions, beans and other vegetables, seed of which was sent for test to many experimenters, who found it of excellent quality. Pamphlets were published giving the results in the Horticultural Division, and describing methods of growing the seed. This work must have proved very valuable to farmers and people in towns having gardens, as showing how readily they could grow much of their own seed.

Test of Varieties

The comparison of varieties offered for sale during the past thirty-four years, by testing them side by side in the field and later on publishing the results in the annual reports, must have proved of great value to the public who, without going to the expense of testing untried varieties themselves, were able to learn from the printed tables what varieties would be desirable for them to plant from the stand-point of season, yield or quality.

Cultural Experiments

Space will not permit of dealing with many of the numerous cultural experiments with vegetables that have been conducted during the past thirty-four years, but reference may be made to some of the results which have seemed to be of greatest value.

Potatoes.—With potatoes alone, the cultural experiments have been very numerous, but the information obtained by experiment on the value of good seed is, perhaps, of the greatest importance. It was shown as far back as 1907 that a change of seed potatoes was most important, under certain conditions, in order to obtain maximum yields. Some seed which looked as good as other seed yielded practically nothing as compared with from three to four hundred bushels per acre from the best seed. The Horticultural Division was, it is believed, the first organization in America to point out the importance of good seed, based on experimental work.

The time of planting, distance of planting, depth of planting, kind of sets, and kinds of spray mixtures, have been some of the other experiments conducted, the results from each of which, no doubt, meaning much to potato growers.

Results of cultural experiments with onions, tomatoes, cabbage, cauliflower, peas, beans, celery, carrots, beets, parsnips and other vegetables will be found in the annual reports, and from each one of them vegetable growers have been able to get useful information.

ORNAMENTAL GARDENING

The culture of ornamental trees, shrubs and herbaceous plants (involving some 39 main projects) is an important part of the work of the Division of Horticulture. This includes the study of their individual characteristics, such as height, form, colouring and season of bloom, so that information will be available to Canadians to enable them to plant their places in such a way that the trees, shrubs and herbaceous plants will blend, or be contrasted with one another, to form pleasing landscape effects. The education of the people by lectures and bulletins on ornamental gardening, and the encouragement of the beautifying of home surroundings, so much needed in Canada, are also a part of ornamental gardening. Forest belts are included in this part of the work, as they are ornamental as well as useful.

Collections of Plants for Study

Collections of the best varieties of hardy plants, such as roses, lilacs, irises, phloxes, paeonies, gladioli, and geraniums have been got together and are grown each year at the Central Farm. They have, in past years, not only been available for inspection by the public, but were made the basis for recommendation of best varieties to those who desire such information.

Ornamental Grounds

The planting of the ornamental grounds of the Central Farm must have meant much in the way of inspiration and encouragement to those who visit it, as the many pleasing landscape effects are suggestive to persons planning their own grounds.

New Varieties of Ornamental Plants Originated at Ottawa

New varieties of ornamental plants which are distinct acquisitions have been originated. Some of those which may be mentioned are the Mary Arnott and Agnes roses, the J. R. Booth chrysanthemum and new geraniums which have been called after Ministers of Agriculture, Carling, Montague, Angers, Fisher, Crerar, Burrell, Tolmie and Motherwell, and also the Elspeth, Sir Douglas Haig and Logsdail geraniums, all of which are exceptionally good varieties and valuable additions to the list of good ornamental plants. The introduction of the caragana and the Russian poplar by the Experimental Farms has meant much to the Prairie Provinces.

GREENHOUSE WORK

The greenhouses of the Horticultural Division have been built only a few years, but during that time much valuable information has been obtained on special greenhouse crops, such as tomatoes, cucumbers, lettuce, radish, asparagus, beans and melons among vegetables, and chrysanthemums, geraniums, cyclamen, schizanthus, primula and cineraria among ornamental plants. The definite information gained is especially valuable to men beginning to grow greenhouse crops. As an example of the usefulness of this work may be mentioned the lettuce experiments, as a result of which it has been demonstrated that one variety of head lettuce, the Early Paris Market, out of many which have been tried, is entirely suitable for forcing in cold climates where the loose leaf kind is usually grown. Thirty-eight experimental projects are now under way in the greenhouse work.

PAINTING AND HERBARIUM

There is now in the Horticultural Division a growing collection of water-colour paintings, of fruit, painted in the division, which are very useful for reference, or when it is desired to show anyone what a variety looks like, when the fresh fruit is not available. For similar uses, there is also a growing collection of dried specimens of the many beautiful ornamental plants.

LITERATURE PREPARED IN THE HORTICULTURAL DIVISION

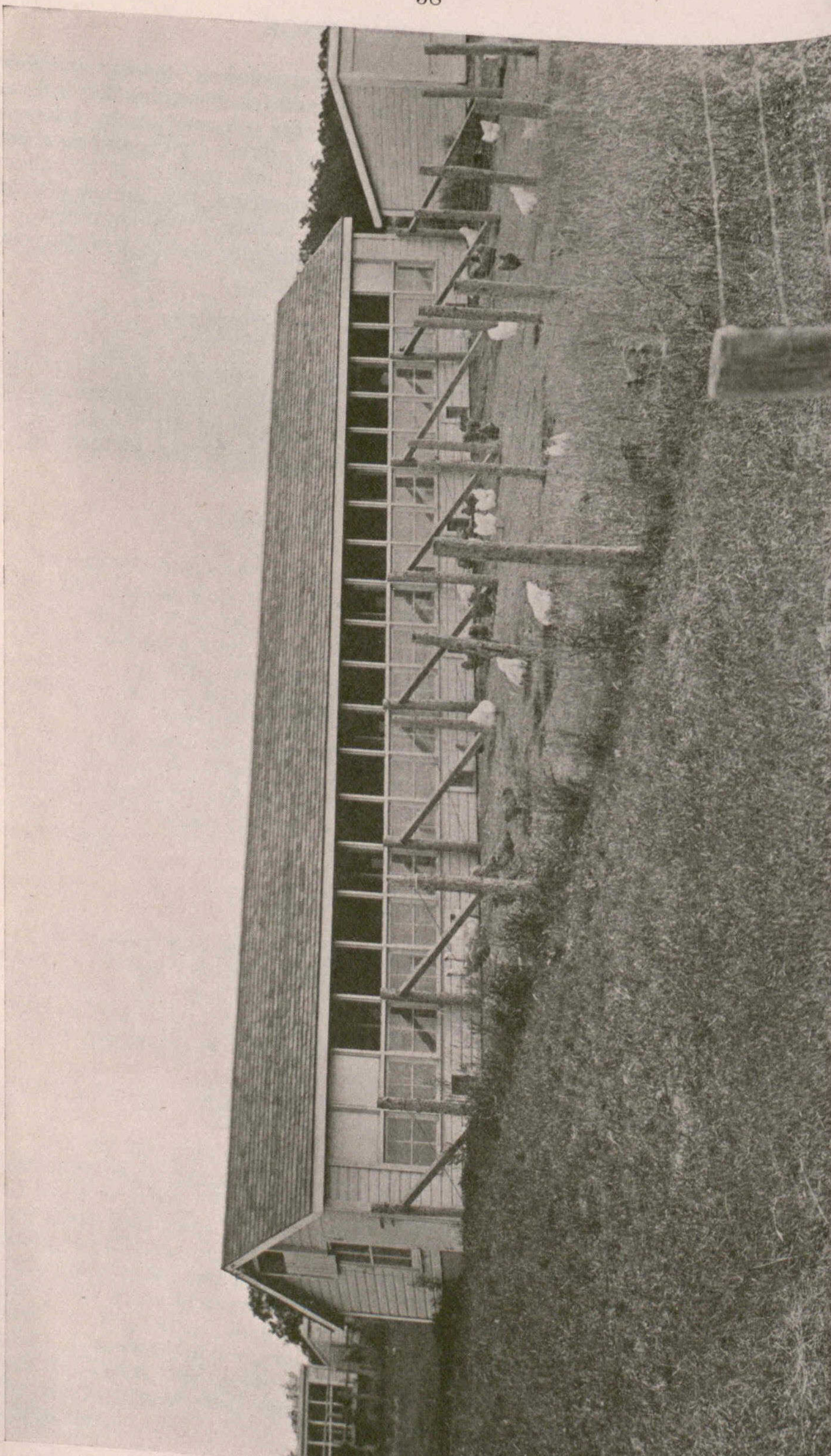
During the past thirty-five years, much material has been written in the Horticultural Division, for annual reports, bulletins, pamphlets, circulars, lectures and press articles. The amount of information furnished in this way has been very great, and must have proved very valuable to many people. Some of the principal bulletins which have been prepared and issued are those of the apple, plum, bush fruits, strawberries, cranberries, potatoes and roses; new and revised editions of some of these have been brought out. Many pamphlets have been issued on vegetables, including asparagus, cabbage, cauliflower, celery, melons, onions, tomatoes, and on mushrooms and ginseng. Several special pamphlets were published, during the war, on home vegetable gardening and seed growing. The horticultural staff has also rendered much service at meetings and at exhibitions.

CORRESPONDENCE

The correspondence of the Horticultural division has steadily increased, notwithstanding the many other agencies in Canada for disseminating information, and it is now very large. People who ask for information by letter are those who are most likely to put into practice the advice given, and as a large proportion of the correspondents require technical information, it is believed much aid has been rendered those interested in horticulture throughout Canada. As this correspondence comes from all parts of the country, it is necessary to be familiar with the conditions from north to south and from east to west throughout the Dominion.

BRANCH FARMS AND STATIONS

The superintendents of the branch Farms and Stations, in co-operation with the Dominion Horticulturist, carry on many horticultural experiments each year, the results from which are especially valuable for the parts of Canada that each Farm or Station serves, and are made available to the farmers of the district through annual reports and bulletins.



Type of Breeding House Used.

POULTRY DIVISION, EXPERIMENTAL FARM

F. C. Elford, *Dominion Poultry Husbandman.*

History and Early Work

The establishment of the Poultry Division at the Central Farm in the year 1887 marked the first step taken in Canada in investigational work with poultry carried on under government auspices. Of this newly created division, Mr. A. G. Gilbert, a well known local expert poultry keeper, was appointed manager.

For a number of years after the establishment of this division, it remained the only government poultry plant in the Dominion, and consequently it may truly be said that the pioneer work of this division has probably meant more to the advancement of poultry keeping in Canada than have the efforts of any other, or in fact all other, government agencies up to about the year 1900, at which time the experimental work with poultry established under the auspices of several provincial departments added assistance.

In the light of the more recent development of poultry knowledge, it is interesting to look back over the reports made by Mr. Gilbert covering the early years of his work on the Central Farm. He first started work with the following breeds: Buff Cochin, Andalusians, Black Breasted Red Game, Barred Rocks, White Wyandottes, White Leghorns, Silver Pencilled and Black Hamburgs, Bearded Golden Polands, Houdans, Langshans, Minorcas, Indian Games, Red Caps, Dirigos, Coloured Dorkings and Black Javas, and the average number of eggs laid during the first calendar year, for the sixty-eight pullets he reported on, was forty-seven. Mr. Gilbert recommended the second year of the life of a bird as its best year for egg production.

In November, 1888, the first section of the long poultry house at the Central Farm, which will be remembered by many today, was built. This was finished later as it remained until torn down in 1913. In 1902 an open scratch shed type house was built but was not found satisfactory, and two years later a scratching shed type (closed) was constructed which was used until 1911, when it was remodelled to the open front style.

The cotton front colony house was designed and built in 1907. This type was used in milder sections prior to this, but the use of it at Ottawa did much to introduce it into colder climates, and today it is one of the popular styles of construction, even in the most northerly sections.

Hatching. During these early years, all the hatching was done after the middle of May, and no pullet laid before December 24. On May 8, 1897, a "Bessey" incubator was set with 100 eggs, and 28 chicks hatched. "In the spring of 1889 there was such a demand for broody hens that as high as one dollar apiece was asked and actually paid for a hen that would 'set' ".

Diseases. Roup was reported to be troublesome as early as 1889. The remedy suggested was coal oil with five drops of carbolic acid, syringed into the nostrils. In 1890, tuberculosis was reported from a number of farmers in Quebec. About this time trouble broke out with turkeys, and though no name is given to the disease the symptoms point to blackhead.

In 1895, the English market was first mentioned, and Canadian prices for eggs given. In January of that year eggs were bringing in Toronto, 35 cents; London, 25 cents; Manitoba, and West, 35 cents to 50 cents; ,Montreal, 60 cents for special customers. In 1903, Mr. Victor Fortier of St. Jerome, Que., was appointed assistant to the poultry manager, Mr. A. G. Gilbert. In 1910, the report gives the account of the formation of the Poultry Producers' Association at MacDonald College, and also its recommended grading for eggs and poultry.

Present Organization

In 1913, Prof. Gilbert, after spending twenty-six years of faithful service in the division, ceased active work and was superannuated. On April 1, the status of the poultry work was raised to that of a major division of the Experimental Farms system and its work was extended to the branch Farms throughout the Dominion.

Owing to the extension of the experimental work with poultry to most of the branch Farms and Stations and to the much wider field of work covered, a greater degree of specialization on the part of the officers in charge was found necessary and, since 1913, a number of additions have been made to the staff of the division, including an officer having special charge over the pedigree and breeding work, one in charge of laying contests throughout the Dominion, and one in charge of the survey and extension work with poultry, especially in the province of Quebec. It has also been found necessary to appoint several poultry inspectors for the examination of flocks in connection with their entry to the Laying Contests. Through co-operation with the Health of Animals Branch of the Department of Agriculture, it has been found possible to secure a qualified veterinarian of that branch to carry on investigations in diseases of poultry, and a special officer of the Division of Chemistry of the Farms Branch devotes his time to the study of chemical problems connected with poultry keeping.

During the first year that the division was extended, the old permanent buildings on the plant at Ottawa were demolished, the plant rearranged for better convenience, a number of new poultry houses, a pipe brooder house, and a feed house were constructed, and the number of breeds was reduced to three or four popular varieties, in order to have larger flocks of uniform birds with which to work. In 1914 additional ground, which has been used by the Health of Animals Branch for turkey disease investigation, was turned over to the Poultry Division, and about twelve acres of rough land on the edge of the canal was fenced in and made available for turkeys, geese and ducks.

Branch Farms. In 1913, poultry work on ten branch Farms was commenced. These Farms are situated at Charlottetown, P.E.I., Nappan, N.S., Cap Rouge, Que., Brandon, Man., Indian Head, Sask., Lacombe, Alta., Agassiz, B.C., and Invermere, B.C. In 1914, Lethbridge, Alta., was added and in 1915, Sidney, B.C., and Ste. Anne de la Pocatière, Que. In 1917, Summerland, B.C., and Scott, Sask., in '18 Lennoxville, Que., and Rosthern, Sask., in '20 Morden, Man., and La Ferme, Que., in 1921, Kapuskasing, Ont., and in 1922 Swift Current, Sask., and Beaverlodge, Alta., were started, making a total of twenty-two branch Farms upon which poultry work has been conducted in 1923. On those Farms where local conditions permit, work is also being done with turkeys and ducks.

Present Activities

The present lines of activity and of investigation of the division fall under the main heads of incubation, brooding, rearing, study of feeds and feeding, both for the newly hatched chicks, growing stock, laying birds, and fattening rations, poultry houses and housing, flock management, the study of poultry diseases, their prevention and cure, and the problems connected with breeds and breeding.

Incubation. Some eight experimental projects are now under way, involving tests of various makes and sizes of incubators, humidity during the hatching period, testing and culling of eggs, egg fertility, etc., etc.

Brooding. Three projects are under way, comparing various styles and types of brooder, as compared with natural brooding. Satisfactory results have been obtained from the coal stove brooder, which permits the chicks to select the degree of heat which they prefer. The problems of rearing are divided into six experimental projects, including trials of different types of brooder house.

Feeding. The experimental problems of feeds and feeding are divided into nine projects, and those of fattening and finishing into two. This work covers a very wide field, including comparative tests of feeds, both commercial and home grown, for all stages of the chick's development, and during its laying period, as well as for stock being finished for market. An interesting section of this work is the comparative results from feeding by hand, including the use of wet mashes, as compared with hopper feeding of dry feeds.

Culling. Divided into four projects, this is a very important part of the work, and is worthy of much closer attention than is usually given it in the average farm flock. The problems of egg production, divided into four experiments, are, of course, some of the most important carried on by the division. Profitable egg production depends upon a combination of many factors, such as breed and strain, housing, feeding and management. Two rather interesting experiments in this connection are those comparing the electric lighting of poultry houses in the morning and the evening of short winter days vs. no artificial lighting, and the feeding of pituitary glands substance to the laying and breeding stock.

Housing. Possibly no line of experiment has been more important than the work, continued over a long period of years, in the study of types of poultry house suitable for the various climatic conditions throughout Canada. The history of this work is that of gradual evolution from the old style, tightly closed, heated poultry house to the house without artificial heat and with ample ventilation, but no draughts. The styles of poultry houses tested and recommended by the Poultry Division are now in very general use throughout all parts of Canada.

Breeding. The work with breeding, involving four experiments, is, of course, one of the essentials of poultry work. It has for its object, not so much the creation of any new breeds as the formation of high egg-producing strains within the breeds now commonly kept. This work involves a great amount of the most careful, trained supervision, and knowledge of the principles of breeding. The success so far has been very marked indeed on the poultry plants at the Central Farm and branch Farms. Taking the average number of eggs laid per hen per year throughout Canada as seventy-five, which is about correct, it is easily seen what an enormous increase in production and national wealth would result if this average were raised, say, to one hundred eggs per bird. On the Experimental Stations, as a result of careful breeding and selection in the farm flocks, this latter figure has been very much exceeded, and is being bettered each year so far. For instance, at Lennoxville, during the poultry year, November 1, 1919, to October 31, 1920, the average of 139 pullets was 121 eggs each. From 170 pullets during the following twelve months the average production was 170 eggs, and in the year 1921-22 the figure was raised to 178 eggs, being an increase in production for the three years of 47·1 per cent. This lowered the average cost of feed to produce one dozen eggs from 31·4 cents to 13 cents.

Another good instance was a pen of White Leghorns, bred at the Central Farm, and placed in last year's Canadian Egg Laying contest. This pen of ten pullets averaged 241 eggs each. They came from mothers which averaged only 160 eggs each in their pullet year. Numerous other instances might be cited of marked increase in egg production in the Farm flocks, these not being exceptional cases, but being the averages of various sized flocks and showing consistently better performance from year to year.

In connection with the breeding work an important point brought out has been the fact that high egg yielding abilities are transmitted through the male side, which has offered the Poultry Division an excellent opportunity, fully taken advantage of, to distribute cockerels from bred-to-lay strains to the farmers and poultry keepers throughout the country. The demand for these is much greater than can be supplied.

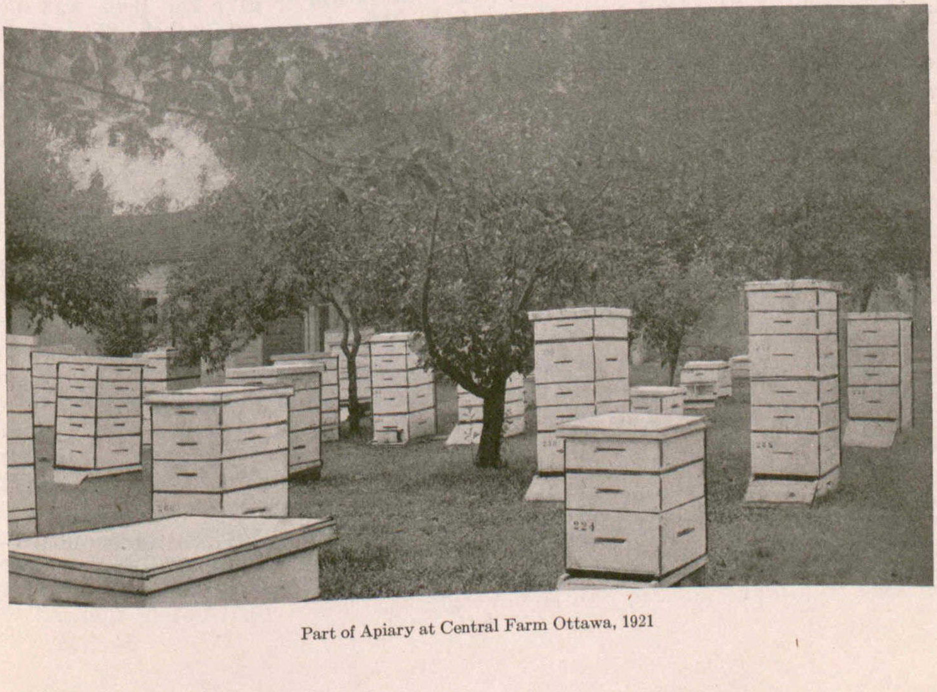
Laying Contests. This work started several years ago, and has proved an excellent medium of arousing interest in the keeping of better poultry. The work was commenced on the Experimental Station, Charlottetown, in 1918, and has since extended until a poultry contest is being conducted on at least one branch Farm in each province of the Dominion, while at the Central Farm a Canadian Egg Laying contest, open to the whole Dominion, is also carried on. The good results of these contests are already shown by the higher production of the pens entered. It may be said that Canada is the first country to standardize these contests, and it is also the first country to introduce the registration of poultry based on production records made in the egg laying contests.

Diseases of Poultry. Through co-operation with the Health of Animals Branch of the Department of Agriculture, an animal pathologist has been allotted to the study of poultry diseases, and considerable progress has been made in this work, both in research and in the identification of diseases affecting certain flocks from which specimens are sent in for examination and the indicating of treatment for the disease, etc.

Exhibition and Survey Work. Work with poultry offers an excellent opportunity for spreading the information gained by means of poultry exhibits, surveys of farm flocks, illustrated lectures, etc., and full advantage of this has been taken by the Poultry Division. The demand for special poultry exhibits is steadily increasing, and the poultry section is one of the outstanding ones in the Experimental Farms exhibits made each year.

The survey work, comprising the examination of farm flocks in certain districts, arranging for the keeping of records of cost of production, the giving of advice and assistance by specialists of the Division in the breeding, feeding, housing and management of the flocks, has resulted in marked increase of production in the districts so covered.

Apiary at Central Farm, Ottawa, 1900



Part of Apiary at Central Farm Ottawa, 1921

THE BEE DIVISION

C. B. Gooderham, B.S.A., *Dominion Apiarist.*

History and Early Work

The first apiary of the Experimental Farms system was established at Brandon, Man., in 1891, but it was not until the fall of 1893 that it was decided to establish an apiary at the Central Farm at Ottawa. A few colonies of black bees were purchased. They were placed in charge of the Division of Entomology, of which the late Dr. Jas. Fletcher was the chief, and were under the direct supervision of Mr. John Fixter, then farm foreman.

During the summer of 1894, two pure-bred Italian queens were obtained from the apiary of Mr. R. F. Holterman, Brantford, Ont., and were safely introduced by Mr. Fixter. Mr. Holterman suggested a number of experiments that would be of interest and value to private beekeepers, if carried out. The main experiment conducted during the first three years after the apiary was started was to make a thorough test of the various weights and brands of foundations then in use among beekeepers. This experiment was conducted in conjunction with the Division of Chemistry under the supervision of Dr. Frank T. Shutt. The object of this experiment was to find out, as nearly as possible, which foundation would give the most economical gains. As it takes about 15 pounds of honey to produce 1 pound of wax, it would, therefore, follow that if the right amount of wax could be given to the bees, more honey would be produced. This experiment was conducted for a period of three years, using various brands of foundation then in general use among beekeepers. A given portion of each brand was weighed at the beginning of each season. At the end of the season a like portion of comb drawn from the foundation was carefully taken, the honey extracted and the comb carefully dried and weighed. The results of this experiment indicated that the most economical foundation to give the bees was one containing about 7½ to 8 feet to the pound. This is approximately the weight that is used by most beekeepers today, namely a foundation running eight sheets or 7½ square feet to the pound. It was also found that wax milled at a certain temperature was more readily worked on by the bees and that the wax of this foundation was used in building the walls of the cell, also, that dark foundation gave an unsightly midrib and made the comb much darker, which is undesirable in comb honey production. It was also noted that more wax was added to the foundation when it was drawn out during the honey flow from buckwheat than was the case during the flow from clover.

During the first two years, all the bees were wintered in the cellar beneath the farm foreman's house, with fairly good results. In the fall of 1895, however, it was decided to try wintering two colonies outside by packing them in cases and placing four inches of chaff around each hive. This first attempt at outside wintering was a failure as both colonies died the following spring. This experiment was not tried again till the fall of 1902, when the colonies were treated by a different method. This time a layer of building paper was tacked around each hive and this was covered by a layer of oiled paper. For extra protection a large box was placed over each colony allowing about 6 inches space all around. The following spring the cases were removed on March 21. One colony was very weak and died shortly after, the other was found to be in a fair condition but did not build up very well during that season. The following winter, 1903-4, four colonies were placed in a large packing case, allowing 6 inches of cut straw on the bottom, 6 inches between each hive and 12 inches all around the outside and on top. The colonies were apparently quiet during the winter and on March 22, took their first good flight. The bees were removed from the case on April 22 and found to be in excellent condition. No more outside wintering was attempted until the winter of 1913-14 when twelve colonies were packed in three quadruple cases. In these cases the hives were placed close to one another so as to conserve heat. Each case allowed for 4 inches of packing on the bottom and all four sides and 10 inches on top, with a dead-air space above. One set of four hives was packed in cut straw, another in clover chaff and the third set in planer shavings. Entrances were made in the cases opposite to each colony and arranged so they could be reduced during the cold weather. In the spring the bees had their first flight on March 11 and 12. When taken out of the cases during the early part of June they were all found to be in excellent condition, in fact, far better than those wintered in the cellar. Four colonies died in the cellar and none outside. Shavings proved to be a better insulator than either cut straw or clover chaff. Sixteen to twenty-four colonies have been wintered outside in quadruple cases every year since 1913-14. In some years the loss in bees has been slightly heavier outside than where wintered in the cellar; in others the loss has been lighter. Owing to the extra protection given early in the fall and again later in the spring, the colonies that have lived through in the winter cases have always been in a much better condition for the honey flow than those wintered in the cellar. During the winter of 1921-22, a number of two-colony and single colony cases were tried for the first time. The double cases have proved very satisfactory but the single cases do not appear to give sufficient protection, the colonies in most cases being weak in the spring. At the time of writing, forty colonies are being wintered outside in quadruple cases, six in double cases and four in single cases.

In 1896-97 two colonies were buried in a pit covered with straw and about one foot of soil. This experiment was continued for three years and, with the exception of one year when mice and water entered the pit, proved to be a cheap and successful method of wintering bees. Experiments with wintering in the house apiary were unsuccessful and wintering in the root cellar gave unsatisfactory results, most of the bees dying, or coming out in the spring in a very weakened condition.

The house apiary, however, proved highly satisfactory for spring protection. The bees built up much more rapidly when given this protection from the cold winds after coming out of the cellar than did those placed directly on their summer stands in the open.

In 1898, an experiment was started to ascertain the most economical size of foundation to use in sections for comb honey production. This experiment was carried on over a period of three years. The results obtained were the same for every year, namely that full sheets of foundation are worked on more readily by the bees and that more uniform and better sections are produced. Where smaller sizes of foundation were used, the sections were very irregular, containing too many holes and not being attached on all sides. This fact is fully recognized by all comb honey producers at the present time. The same experiments were also carried out with regard to foundation used in brood chambers. Full sheets here proved the best, as they gave straight, well-built combs of worker cells; half sheets of foundation gave too much drone comb on the lower half where there was no foundation, and where 2-inch starters were used, the combs were usually built crosswise of the frames and contained a large proportion of drone comb.

In 1901, owing to many complaints received from fruit growers that bees were damaging the fruit by puncturing the skin and sucking the juices, an important experiment was commenced to ascertain if it was possible for bees to damage sound fruit. For this experiment, four strong colonies of bees were chosen; from two of them all the honey was removed; the other two had some honey left. No nectar was coming in from the fields during the time this experiment was being carried on. On September 7, four kinds of ripe fruit were chosen, viz., peaches, pears, plums and grapes, care being taken that all the fruit chosen was sound. This fruit was exposed where it was easily accessible to the bees, namely inside the hive, on trees in the apiary and in the honey house. An empty super was placed on each of the four colonies, some of the frames were removed from the brood chamber and three frames in which were suspended whole specimens of fruit, were placed in the brood chamber. The supers were divided into two compartments; in one whole specimens of fruit dipped in honey were hung, while in the other compartment fruit that had been punctured with a sharp penknife was placed. The bees began to work at once upon the dipped and punctured fruit and the former was cleaned thoroughly during the first night; upon the punctured fruit the bees clustered thickly, sucking the juices through the punctures as long as they could obtain any liquid. At the end of seven days all the fruit was carefully examined. The sound fruit in the brood chamber was still uninjured but polished and shiny as though the bees had travelled all over it in search of an opening through the skin. The dipped fruit was also uninjured but every vestige of honey had disappeared. The punctured fruit was badly mutilated and worthless; beneath each puncture was a cavity, and in some instances decay had set in. The experiment was continued for another week, the sound fruit being left in the brood chamber, the dipped fruit again coated with honey and a fresh supply of punctured fruit was substituted for that which had been destroyed. At the end of the second week the condition of the fruit was entirely similar to that of the first lot. For the third week fresh samples of all fruits were given, as some of the first lot had begun to decay but was not punctured. The results at the end of the third week were identical with those obtained during the first two weeks.

After the third week, the bees belonging to the two hives which had been deprived of their honey appeared to be sluggish and there were many dead bees at the entrances. These colonies had lived for three weeks on the juices of the punctured fruit and the honey from the dipped fruit. As there was no nectar coming in at this time, the bees had died of starvation notwithstanding the close proximity of ripe, juicy fruit and only a thin skin, which apparently they could not puncture, standing between them and the juice.

Dipped and punctured fruit was also hung on trees in the apiary and the bees worked on this in exactly the same manner as they did in the hives. Dipped and punctured fruit was also exposed in the honey house, and although the bees did not work on it so freely as in the other two experiments the results were the same in every case.

These experiments were continued in 1902, using the same kinds of fruit as in 1901 with the addition of strawberries and raspberries. The fruit was all treated in the same manner as in the previous year and exposed in the same positions namely, in the hive, in the apiary and in the honey house. The same number of colonies were used and treated as in 1901. The experiment was continued for three weeks with the same results. The sound fruit was untouched, the dipped was cleaned, while the punctured fruit was sucked as long as any juice could be obtained.

On July 2, ripe fruit of four varieties of strawberries was used for the experiment and was treated the same as the other fruits. The bees clustered on all the fruit but did not appear to get, or even try to get, any subsistence from them although they cleaned the honey from the dipped fruit. The fruit exposed on the trees was not even visited by the bees and soon dried up and decayed, as also did that in the hives. On July 29, some raspberries were placed in the hives exactly in the same position as the strawberries. Considerable nectar was coming in at this time, so the bees left the raspberries untouched. The above experiments proved conclusively that bees do not injure sound fruit under any conditions but that they will gather juices from ripe fruit that has been injured by some other means such as by other insects or by birds. The experiment also confirms the conclusion arrived at some time previous by other investigators in the United States.

In 1900, an experiment was started to test the value of sugar syrup as winter stores for the bees. Many complaints had been received from various beekeepers that their bees suffered considerably from dysentery, thought to be caused by honey or honey-dew gathered in the fall. Four colonies were chosen for this experiment and in September all natural stores were removed from these colonies. Enough sugar syrup, made of two parts granulated sugar to one part of water, was given to bring the colonies up to a required weight. The colonies were very quiet, showed no signs of dysentery during the winter and in the spring came out in excellent condition. This experiment was continued in 1901 with eight colonies; the same results were obtained as in the previous year. In 1904, all stores were removed from eight colonies and four of them were fed pure extracted honey; the other four were given sugar syrup made of two parts granulated sugar to one part water. During the winter there was no sign of uneasiness in any of the colonies. In the spring they were taken from their winter quarters in good condition and built up rapidly for the honey flow. The amount of stores consumed during the winter was heavier in those colonies fed on sugar syrup, being an average of 1 pound 13 ounces more than in those fed on extracted honey. These experiments proved that sugar syrup is a satisfactory food for bees during the winter months.

Owing to many inquiries being received asking whether bees could be wintered safely in damp cellars, an experiment was conducted during the winters of 1902-3 and 1903-4 to ascertain whether excessive moisture was really injurious to bees. During the first winter, three colonies of bees were placed directly over four pails of water in the cellar and allowed to stand over them all winter. During the second winter six colonies were placed directly over seven pails of water. Six others were also placed over seven pails of water in addition to having sand strewn over the floor beneath the hives. This sand was kept wet at all times during the winter. The bees remained quiet all winter and came out in excellent condition the following spring. The success of the experiment was considered due to good ventilation in the bee cellar. The air was moist at all times but the excess moisture was carried off. In cellars that are damp and have not sufficient ventilation, moisture will accumulate in the hives and cause moulding of the combs.

In May, 1896, four colonies of Italian bees were purchased; two of them were sent to Brandon, Man., one to Indian Head, Sask., and one to Agassiz, B.C. With the exception of Brandon, this was the first attempt to keep bees at any of the branch Farms. In 1897 an apiary was started at Nappan, N.S. Very little experimental work was carried out at these Farms during the first years. The bees at Brandon did very well and produced good crops which stimulated the keeping of bees throughout the province of Manitoba. In 1903, several colonies were sold from this Farm to local men who had become interested in beekeeping. In 1904, these new beekeepers reported good success and many more colonies were sold. In 1903, sweet clover and borage were grown at Brandon to test their value as honey producing plants. It was found that both plants yielded considerable nectar, that the bees worked on them most actively and that honey of a good quality was secured. In 1909, Nappan carried on experiments in the value of sugar syrup vs. honey for winter stores for the bees, with the results that sugar syrup gave better colonies and less dysentery.

Mr. Fixter relinquished his task of looking after the bees in 1907. The work was then taken up by Mr. D. D. Gray, assisted by Mr. C. A. Burnside. Mr. J. I. Beaulne next had charge of the apiary for 1911 and 1912. No experimental work was done in the apiary from 1908 to 1913, other than to produce honey and continue testing out cellar wintering.

In 1910 the late Dr. C. Gordon Hewitt took charge of the Entomological Division of the Farms Branch and, seeing the possibilities of honey production in Canada, recommended that an experienced beekeeper be engaged to take over the apicultural work. The result was that the late Mr. F. W. L. Sladen was appointed in 1913, as Assistant Entomologist for Apiculture. In 1915, when the Entomological Division became a separate branch and moved its offices into the city of Ottawa, the bee work was separated from that branch and became a Experimental Farm Division in itself, with Mr. Sladen as apiarist in charge. A new apicultural building was erected during 1915-16 and was occupied February 11, 1916. In 1917 a permanent assistant was appointed. Three years later, Mr. Sladen was promoted to Dominion Apiarist. In 1921 he died of heart failure while engaged in scientific research work in queen breeding.

Extension of Work on Branch Farms

One of the first things Mr. Sladen did after taking charge was to organize beekeeping on the branch Farms. Apiaries were established to carry on investigational work in beekeeping under the various climatic conditions existing in the different provinces. Bees were established at the following Farms in 1913: Charlottetown, P.E.I.; Kentville, N.S.; Nappan, N.S.; Ste. Anne de la Pocatière, Que.; Cap Rouge, Que.; Brandon, Man.; Indian Head, Sask.; Lacombe, Alta.; Invermere, B.C.; Agassiz, B.C.; Sidney, B.C.; Later on, apiaries were established at other Farms till, at the time of writing, bees are kept at Charlottetown, P.E.I.; Nappan, N.S.; Kentville, N.S.; Fredericton, N.B.; Ste. Anne de la Pocatière, Que.; Lennoxville, Que.; La Ferme, Que.; Kapuskasing, Ont.; Morden, Man.; Rosthern, Sask.; Scott, Sask.; Lacombe, Alta.; Lethbridge, Alta.; Beaverlodge, Alta.; Fort Vermilion, Alta.; Summerland, B.C.; Agassiz, B.C.; Invermere, B.C.; Sidney, B.C.; and at the Central Experimental Farm, Ottawa, Ont. All are doing valuable work in demonstrating modern methods of beekeeping in the different provinces. These Farms, besides doing other important work with bees, since 1913 have made a thorough investigation of the sources of honey in their localities and the time, length, and density of the honey flow from each source. This is ascertained by keeping one or more colonies of bees on scales throughout the active season and carefully recording the daily gains or losses made. In conjunction with this, daily meteorological observations have been made in order to ascertain the effect of climatic conditions on the secretion of nectar. It has been found that heavy precipitation during the autumn and a winter of heavy snow fall tend to produce a heavy secretion of nectar the following summer. Also that cool nights, followed by hot, sunny days, were conducive to maximum nectar secretion, especially just after showers of rain.

Recent and Present Work

Another line of work started by Mr. Sladen in 1913 was a thorough investigation of honey-producing plants all over Canada and of the conditions of climate under which they produce the most nectar. Special attention has been given to alsike clover, white clover and fireweed, and it has been found that, under certain conditions, these plants are the greatest honey producers we have. Basswood also yields heavily under certain conditions, in some seasons. Sweet clover is also a heavy producer. A number of other honey plants have been discovered, identified and their range determined. For instance, experiments at Lethbridge have shown that the region in which alfalfa gives honey in commercial quantities extends north into southern Alberta. Certain species of golden rod and wild aster have been discovered to be plants of value under certain conditions. Among other honey plants that have been found to be of value are blueberries, wild radish, fall dandelion, sheep laurel, wolfberry, anise hyssop, and bearberry. This study has been continued and has given a fair knowledge of the most valuable places for the location of bees.

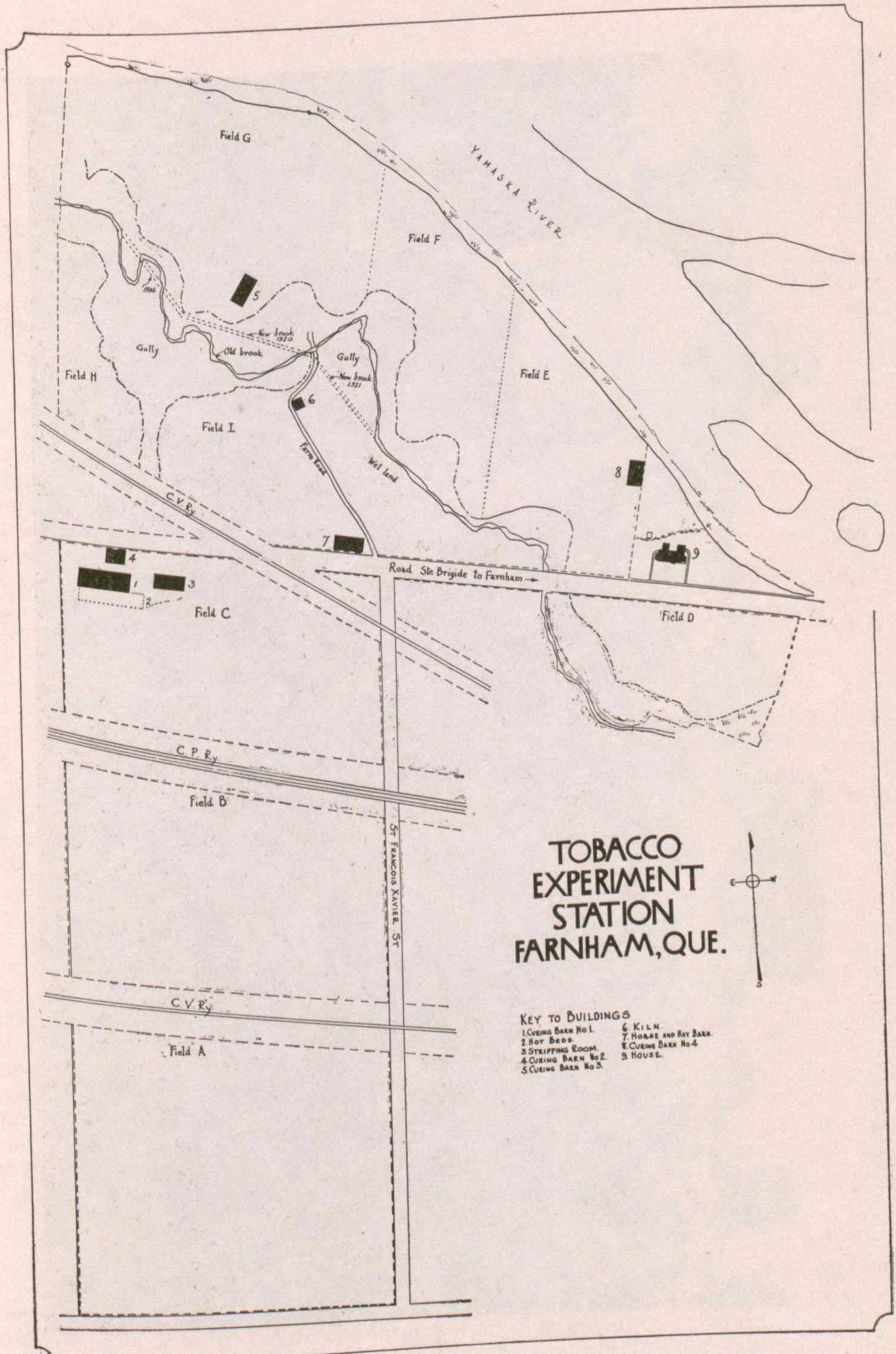
A study of swarm control has also been conducted over a number of years and from it has developed a system by which swarming is effectually controlled in certain localities, more bees are produced for the main honey flow and a surplus number of young queens can be safely wintered over. The method is as follows: At the time a colony shows preparations for swarming by having larvae in queen cells, the queen is removed from the hive and all queen cells are destroyed. Nine or ten days later, all queen cells are again destroyed; the brood is equally divided; a solid division board is inserted in the middle of the hive; a special portico is placed at the front of the hive to provide two entrances, and a young, mated queen is introduced to either side; this means there are two laying queens in one hive. The colony is treated in the same manner as one having only one queen; the bees are allowed to mix in the supers but not in the brood chamber. The two queens pass the winter successfully and in the spring, just before the first flow from dandelion and fruit bloom, the queen and all the bees from one side of the division board are moved into a hive placed close to the original hive. This effectually prevents swarming during the first flow, and gives two good colonies in time for the main honey flow. This system of dequeening and requeening for swarm control is well adapted to all colonies that show signs of swarming, whether only one or two queens are to be introduced to the colony.

Another method of making double colonies and wintering over a surplus of queens was first tried in 1921-22. Instead of uniting weak colonies in the usual manner, two weak colonies are brought together into one hive with a division board between them. This method is proving very successful and gives the beekeeper surplus queens in the spring to replace winter losses.

Queen breeding has also received a great deal of attention at Ottawa. The object is to produce a better strain of Italian bees that will have a greater resistance to European foul brood and to endeavour to breed out the natural swarming tendencies and still retain prolificacy and good honey-making qualities. For this purpose, several pure Italian queens were procured from reliable breeders and tested at Ottawa. From these, certain ones showing the desired characters were chosen and used as breeding stock. A temporary mating station was established in 1913 at Kazubazua, Que., about fifty miles north of Ottawa, where young queens and drones were taken for mating. The experiment was not a success, as many of the queens mated with black drones as was manifest from the fact that they produced hybrid workers. The work was continued the second year but the drones and queens were raised later in the season than in the previous year. This time, pure mating was secured but the queens were of very poor quality, unprolific, and not fit to use as breeders. In 1917, queens were again raised at Ottawa and taken to Kapuskasing in northern Ontario. Poor results were obtained there and the considerable swarming out of the baby nuclei boxes showed this station to be undesirable. In 1918, queens were taken to Lac St. Jean in Quebec, but the same results were obtained there as at Kapuskasing. In 1919 a mating station was established at Duck Island in the eastern end of lake Ontario, where several queens and drones of select parentage, reared at Ottawa, were taken for mating. The first year the attempt was a failure as many of the queens did not get mated while a few appeared to be only partly mated, as they produced a few worker bees and then developed into drone layers. The second year, however, was successful and queens were purely mated and introduced to the apiary at Ottawa. During the third year, about sixty-three queens were successfully mated; many of these were introduced to colonies in the Ottawa apiary, others at some of the branch Farms, while a few were sent out to private beekeeprs to be tested. Owing to the difficulty experienced in getting to Duck Island and the unreliability of the honey flow which in some years was a complete failure so that the bees required constant feeding, also to the fact that it was impossible to leave the bees and equipment on the island for the winter, it was decided to abandon this station and to establish the breeding yard at Kapuskasing, using large nuclei boxes to prevent swarming. During the past year, 1923, ninety-two queens were mated and distributed from this yard.

It is interesting to note that the average production per hive in the Ottawa apiary has been considerably increased during the past eight years. This we consider is mainly due to the larger-sized hives used, to the development of better methods of swarm control and to a more careful selection and breeding of queens, the latter tending to improve the strain of bees kept.

There are now under way in the Bee Division at Ottawa forty-five experimental projects.



TOBACCO EXPERIMENT STATION FARNHAM, QUE.
Yamaska River
Field G
Field F
Field E
Field H
Field I
Field C
Field D
Field B
Field A
Gully
Gully
Old brook
New brook 1920
New brook 1921
Farm Road
Wet land
C.V. Ry
C.P. Ry
C.V. Ry
Road Ste Brigide to Farnham
St Francois Xavier St
KEY TO BUILDINGS
1. Curing Barn No 1.
2. Hot Beds.
3. Stripping Room.
4. Curing Barn No 2.
5. Curing Barn No 3.
6. Kiln.
7. Horse and Hay Barn.
8. Curing Barn No 4.
9. House.

Growing Tobacco Seed—Central Farm.

THE TOBACCO DIVISION

F. Charlan, *Dominion Tobacco Husbandman*

Towards the close of the year 1905 the then Minister of Agriculture established in his department the Tobacco Branch, having for its duty the study and demonstration of correct methods of growing, curing and handling the tobacco crop with a view to increasing, as rapidly as possible, the use of tobaccos grown in Canada by our tobacco manufacturers. This work, carried on at first by only the one expert, gradually increased in extent until in 1908 two assistants, one for Ontario and the other for Quebec, were appointed.

In 1909 the Experimental Tobacco Stations at Harrow, Ont., and at St. Jacques l'Achigan and St. Cesaire, Que., were established. The main object of these Stations was to carry on experiments in tobacco culture, and they replaced the experimental fields which formerly had been conducted both in Ontario and Quebec in co-operation with good tobacco growers. This system had not always given the results hoped for. In 1912, the Station at Farnham, Que., was established as replacing that at St. Cesaire. The Farnham Station is of larger area and much better situated as to easy means of access and also as to obtaining without difficulty the labour required on the Station.

Late in 1912, the Tobacco Branch was attached to the Experimental Farms Branch of the Department of Agriculture, becoming a division thereof.

Early Investigations

These cover the work done by the single expert referred to above during the years 1906 to 1907. During this period an experiment was carried on in the fermentation of pipe tobaccos grown in the province of Quebec and of varieties of Seed Leaf grown in Ontario, in which province there was at the time a serious overproduction of White Burley. It was early recognized, especially if one based one's opinion upon the views expressed by those manufacturers who were interested in this experimental work, that it was better in Ontario to continue to specialize in the growing of White Burley, and to allow the province of Quebec to devote itself to the growing of tobaccos of the Seed Leaf type.

By setting out the plants at closer distances and harvesting the crop at an earlier stage of maturity it was found possible to obtain, especially in the Yamaska Valley, a leaf presenting all the characteristics of one suitable for cigar binders, and certain manufacturers became interested in the preparation of this product, following the methods used in the state of Connecticut. This was the beginning of the growing of cigar tobaccos in Canada. Some bulletins were published with a view to advising planters, in a general way, as to the best methods of sowing and curing the crop and also on the establishment and care of tobacco seed beds, one of the most important phases of the tobacco growing industry.

Tobacco Seed Beds

Speaking in a general way, and applicable both to Ontario and to Quebec, the production of tobacco seedlings was considered some fifteen years ago as a difficult enterprise, owing to the large percentage of failures therein.

At that time, in Ontario, methods were too closely followed which gave excellent results some hundreds of miles farther south, in the United States, but which had not been sufficiently modified to meet the different climatic conditions obtaining in Canada. In Quebec, on the other hand, the severe weather of spring and the necessity of planting early in order that the crop be harvested before autumn frosts, led the planters to make their hotbeds much too warm and not sufficiently aired, in which the seed was usually sown much too thickly.

The semi-hot bed under glass has replaced almost completely, in Ontario, the cold frame under canvas. In Quebec, on the other hand, the semi-hot bed under glass, but not containing a foundation of manure, has replaced the too-hot bed established on a foundation of fermenting manure, which the growers were always afraid would become chilled, and which consequently they did not air sufficiently. Failures have been much less frequent since; following the advice of the Tobacco Division, the seed beds in Ontario have been further protected and the temperatures of those in Quebec have been lowered.

The results of the investigations carried on by the Tobacco Division in its early years may, then, be summarized as follows:—

The semi-hot bed under glass has shown itself superior to all other systems of seed bed, with the possible exception of the expensive greenhouse.

The advisability has been demonstrated of establishing the seed bed on a foundation of straw, corn stalks or even tobacco stalks. This isolates the soil of the seed bed so that it chills less during the night.

Speaking generally, seed beds under glass furnish a much earlier plant than do those under canvas.

The use of dark-coloured soil, about an inch thick, on the surface of the seed bed is recommended.

The treatment of the soil of the seed bed by steam not only kills weed seeds and disease germs, but also stimulates growth. To be effective, this steam treatment should last for thirty minutes at a pressure of 100 pounds.

The sowing of dry seed is easier than sowing soaked seed, and generally gives better results.

Where tobacco growing is carried on upon a large scale, it is well to disinfect parts of the seed beds in the autumn, in order to save time in the spring.

The seed beds should be aired as much as possible. During germination of the seed a temperature of 80 degrees F. in the bed has been found the best. This should not be exceeded until the plants show six leaves, and afterward unless the frames have been to a great extent raised and the ventilation of the seed bed is abundant.

As to Quebec, special emphasis may be placed upon the necessity of making up the seed beds anew each year, in view of the tendency shown by some planters of simply preparing the surface of the bed as remaining from the previous year, leaving the soil in place in the frame. It is easy to thaw out the surface soil in the glass covered hotbed in a few days of spring sun, but the depth of the bed thaws more slowly, and this hinders the development of the roots and also occasions excessive moisture.

Bulletin No. 21, published in 1913, by the Tobacco Division, and entitled "Tobacco Seed Beds," treats at length all phases of the subject.

The most striking results of the experimental work as brought to the reader's attention in that bulletin are, (1) the use of the semi-hot bed without foundation of manure, a practice introduced by Mr. O. Chevalier of the Tobacco Division. This semi-hot bed has been recognized as satisfactory even in the most severe climates of the province of Quebec where tobacco is grown; (2) the demonstration of the very small quantity of seed necessary to sow 100 square feet of seed bed (from $\frac{1}{10}$ to ½ ounce only according to quality of seed); (3) the possibility of ventilating the seed bed at almost any time, and in all parts of Canada where tobacco is grown; (4) the ascertaining of the exact proportions in which chemical fertilizers may be applied in the preparation of the seed bed (about one ounce per square foot); (5) the strength of the nitrate of soda solution used to stimulate growth (about two and a quarter pounds per 45 gallons of water to be applied at the rate of two gallons to thirty-six square feet of bed)—this solution is useful when one desires to stimulate the growth of late plants.

The Plantation

In a general way, the Tobacco Division has encouraged early planting both in Ontario and in Quebec. Early in the spring the young plants find an abundant reserve of moisture in the soil; they can thus establish themselves thoroughly and later are in better condition to resist drought should such occur. Moreover, in no part of Canada where tobacco is grown is the season so long that one can afford to forget the danger of early autumn frost. Earlier sowing of the seed then, which is generally the most successful, also helps in advancing the date of transplanting in such a way that this operation coincides with the time of season when favourable weather conditions may be depended upon.

Fertility of Soil

Scarcely fifteen years ago, the yields in weight from tobacco plantations in Canada were, generally speaking, far from being satisfactory. In some cases these small yields were due simply to errors in cultivation, but they were generally caused by lack of fertility in the soil. As a rule, even in Ontario, the plants were placed at much too great distances apart, while in Quebec this practice was almost general.

A series of conferences was held during two winters, 1905-6, and 1906-7, and the above situation was rapidly improved thereby. At present the tobacco growers of Quebec know at what distances to plant the different types of tobacco which they grow, such as Large Seed Leafs, Medium Seed Leafs, and the small Canadian tobaccos. The yields have increased on the more closely planted fields of the two latter, and, moreover, the quality of leaf from the point of view of texture has improved.

In Ontario, also, the distances between plants have been reduced, especially as between plants in the same row. The experiments carried on on the Harrow Tobacco Station have shown that the best distances for planting the White Burley are:—

—	1918	1919	1920	1921
White Burley Broad Leaf	44" x 28"	44" x 28"	44" x 28"	44" x 28"
Resistant White Burley	44" x 28"	44" x 28"	44" x 28"	44" x 28"
White Burley Stand-Up	42" x 26"	42" x 26"	44" x 28"	44" x 26"

For the yellow tobaccos, the results of experiments in 1918-1920 have shown the distance of 36 inches by 34 inches to be the best, while those of 1921, showed the distance of 38 inches by 24 inches to be preferable.

As a rule, both in Quebec and in Ontario, the tobacco growing industry has developed in those districts where few live stock are kept and where, consequently, the amount of barnyard manure available is quite small. As a result, as soon as the growing of tobacco in these districts increased, the planters found themselves unable to supply the soil with sufficient barnyard manure to ensure profitable crops. During recent years especially, the use of chemical fertilizers has been resorted to to make up for this shortage of barnyard manure, and, consequently, special attention to the use of chemical fertilizers has been given by the Tobacco Division. The experiment carried on at Harrow, Ont., and at St. Jacques l'Achigan and Farnham, Que., with the object of showing the value of using chemical fertilizers in tobacco growing, both from the point of view of profitable returns and of quality of crops, and also in order to establish formulæ for the composition of the most suitable fertilizers, have given the following results:—

White Burley (Harrow, Ont.)

(a) Sulphate of ammonia....................320 lb. per acre
Superphosphate....................500 "
Sulphate of potash....................135 "

As supplementing an application of 10 to 12 tons of barnyard manure per acre the preceding autumn or

(b) Sulphate of ammonia....................400 lb. per acre
Superphosphate....................400 "
Sulphate of potash....................150 "

Where the tobacco crop follows a hoed crop such as Indian corn, for which manure has been applied.

Yellow Tobacco (*flue-cured*) (Harrow, Ont.)

(a) Sulphate of ammonia....................140 lb. per acre
Superphosphate....................500 "
Sulphate of potash....................200 "

or:

(b) Sulphate of ammonia....................50 lb. per acre
Dried blood....................85 "
Superphosphate....................600 "
Sulphate of potash....................200 "

The advantage of the last formula given is that the mixture does not cake, and is, consequently, much more easily spread.

It is recommended that the barnyard manure be not applied directly to the land reserved for the yellow tobacco crop. The necessary humus may be supplied by a crop of rye sown in the autumn and ploughed under early in the spring. Yellow tobaccos planted on clover sod ripen late and give too high a proportion of dark leaves. On soil where both corn and flue cured tobacco can be successfully grown the best practice is to manure the corn and follow it with tobacco using fertilizers on the latter.

Seed Leafs—Farnham, P.Q.

Sulphate of Ammonia....................300 lb. per acre
Superphosphate....................140 "
Sulphate of potash....................180 "

The above application of commercial fertilizer is supplementary to an application of barnyard manure at the rate of 12 to 15 tons per acre made in the autumn at the time of ploughing under the clover sod as furnished by the rotation tobacco, cereals, and clover. According to the indications shown by the tobacco crop of 1921 it would probably be an advantage to increase the quantity of superphosphate to 250 pounds per acre, in order to hasten maturity somewhat.

Emphasis has been placed upon the proper manner of using commercial fertilizers, and upon showing the planter the methods of preparing these fertilizers on the farm itself. There are, in commerce, excellent ready-mixed commercial fertilizers. However, those mixed upon the farm are generally cheaper, and, moreover, if the grower has been able to study his soil and knows of its needs or lack of certain fertilizing elements, he can vary the composition of his mixture accordingly. As a rule, the Tobacco Division recommend a mixture containing sulphate of ammonia, superphosphate and sulphate of potash. In certain mixtures tried, dried blood has given excellent results, but it has been found inadvisable to use nitrate of soda as a source of nitrogen. As to phosphoric acid, basic slag has so far not furnished as good results as superphosphate. Muriate or chloride of potash should above all be avoided, for almost always it affects unfavourably the burning qualities of the tobacco.

As to the method of applying chemical fertilizers, the experiments at Harrow indicate the advantage of applying it along the tobacco rows, both for White Burley and for the varieties of yellow tobaccos of Virginia type. Other experiments carried on in cooperation with Ontario growers have given less conclusive results. However, even when applied broadcast, which slightly lessens the cost of labour, the chemical fertilizer applied in the Ontario experiments has given an increase in yield worth from two to three times the total expense of the fertilizer.

In Quebec where those varieties only are grown which may be planted more closely together, applying the fertilizer broadcast or by drill is certainly the cheapest and best method. The division has constantly recommended its application in this way.

Preparation of Soil

The time of commencing preparation of the land for the tobacco crop is important. Experiments at Harrow, Ont, have shown that, even with light soils, it is better to manure and plough the land in the autumn where White Burley is to be grown. In the spring all that remains to be done are discing and harrowing. In every trial the yields both in weight and in quality have been superior when the land was prepared in the autumn. Moreover, fall ploughing done after October 1st assists greatly in the destruction of the larvæ of insects, such as the cutworm and the horn worm, thus reducing considerably the cost of control of these insects the next season.

For the yellow tobaccos, the procedure is the same, when barnyard manure is applied. When not used the rye which serves to cover the soil during the winter should be ploughed under early in the spring, so that, by frequent discing and harrowing, a perfect seed bed may be secured and as much moisture as possible stored.

In Quebec, the necessity of preparing the land in the autumn has been equally shown. This autumn preparation serves for ploughing under crops grown for green manure, which have thus more time to decompose, spring work is made more easy, and a better opportunity afforded to get the land in first-class shape for the young plants. The important cultural operations, both on the tobacco plantation, such as weeding, cultivation, etc., and those on the plants themselves, such as topping and suckering, have not been lost to view. Whenever the officers of the division come into touch with the tobacco growers, special attention is drawn not only to the usefulness of these operations, but to the necessity of performing them at the proper time. It may be said that topping is much more carefully and intelligently carried on both in Ontario and in Quebec than has been done in the past, and that a notable increase in the value of the product has resulted.

Harvesting operations have been given full attention from the beginning. These operations include not only the gathering of the tobacco in time to secure good and complete curing, but the work must be carried on without injury to the leaf, in order to reduce waste to a minimum, and it must also be carried on methodically to reduce cost as much as possible. At the present time, very few tobacco growers in Quebec are not the possessors of a special wagon for carrying the tobacco from the plantation to the curing barn, and the preliminary wilting on the plantation itself by means of movable scaffolds is frequently practised. This reduces considerably the space required in the curing barn itself.

It has been demonstrated on the Harrow Tobacco Station that in splitting the stem of the tobacco plant as far up as possible compatible with placing the plants on the racks, the duration of the curing process is considerably shortened, while at the same time it aids in the development of a clear coloured leaf, lessens the risk of damage, especially from moulds, towards the end of the curing period, and, moreover, this method of harvesting is considerably cheaper.

In Quebec, after a time when the use of laths furnished with nails was favoured, which seemed to economize labour at the time of harvest, there was a return to the use of the ordinary lath, passed through the base of the stem with the aid of a pointed piece of iron into the hollow end of which the lath fits. It has been shown on the Farnham Experimental Station that the lath with nails is difficult to keep in good condition and difficult to handle, and that it frequently causes tearing of the leaf, which is serious when one is harvesting tobaccos intended for cigar binders.

The general methods of curing and the description of the curing barn, including the method of curing by hot air, are treated in detail in Bulletins No. 25, 38 and 45 of the second series of Experimental Farms publications. In these bulletins, special attention is given to methods best suited to Canadian conditions of tobacco growing.

Rotations

The continuous growing of tobacco on the same piece of land, no matter what may be its fertility or its special suitability to that crop, cannot be recommended, in spite of examples which may be quoted where this system has apparently been successful. As a rule, and especially in the case of certain varieties susceptible to disease, White Burley for example, this practice incurs grave risk. Even in the case of varieties relatively resistant to disease, such as certain of the seed leafs like Comstock Spanish and Connecticut Havana, one cannot always escape loss when the crop is grown year by year upon the same piece of land. Suitable rotation permits of maximum production. It keeps the fertilizing elements of the soil in such due proportion that each successive crop takes the best advantage thereof, as long as the ordinary rules of good cultivation are followed.

The tendency among the tobacco growers of Quebec, although they generally work farms of a fairly large size, was to plant their tobacco always in the same field, on which they spread almost the whole of the manure produced on the farm, which was detrimental to their other crops and also to the general fertility of their land. On the recommendation of the Tobacco Division, the three-year rotation of tobacco, grain, clover, is spreading more and more in that part of Canada. It is the shortest rotation which one can advise, and on account of the nitrogen and humus supplied by the clover, it permits of reducing to the minimum the application of manure and places the soil in a favourable condition for the use of commercial fertilizer as a supplement to that manure.

In Ontario, the following rotations have been tried on the Harrow Tobacco Station:—

(1) Indian corn, tobacco, grain and pasture.
(2) Tobacco, Indian corn, grain and pasture.
(3) Tobacco, Indian corn, grain and pasture (two years), as well as a rotation of three years; tobacco, Indian corn, grain. The four-year rotation (1) and (2) are perfectly suitable for the growing of White Burley. In avoiding the use of a leguminous forage crop, such as clover, little chance is left for the disease "Root rot" to develop to a dangerous point. Where this is threatened, one may resort to a five-year rotation.

Where one is desirous of obtaining a finer texture and a higher colour in the tobacco leaf, it is preferable to commence the rotation with Indian corn, and to apply the barnyard manure to that crop. The tobacco following the Indian corn is treated with the commercial fertilizer, and coming after a hoed crop, like corn, the tobacco is given a soil better prepared and free from weeds.

For growing yellow tobaccos of the Virginia type, flue-cured, chemical fertilizers are mainly relied upon. Humus is introduced by a crop of fall rye ploughed under early in the spring. The ploughing under of the crop of clover, either in the spring or in the autumn, has not given good results. The tobaccos obtained on land so treated give a high yield in weight, but do not furnish a satisfactory proportion of light coloured leaves.

The Fight Against Insect Pests

From the time it appears above the surface in the seed bed until harvest, the tobacco plant is exposed to the attacks of numerous enemies, among the most serious of which is the cutworm, which attacks the plants mainly when recently transplanted into the field, cutting the tender stalks at the surface of the soil, and the tobacco horn worm, which attacks the leaves, and when numerous destroys almost entirely, and in a very short time, the whole tobacco harvest.

The most effective preventative measure is autumn ploughing, done late enough to expose the last generation of larvæ of the year, i.e. after the first week in October. All larvæ thoroughly exposed to frost are destroyed. As to the cutworm more particularly, the cheapest and most practical method is to clear the field intended for tobacco in the spring of all growth by the use of the disc or drag harrow, and then to scatter bran or grass poisoned with Paris green which is readily eaten by the hungry worms. On the Harrow Tobacco Station, satisfactory results have been obtained from the use of arsenate of lead at transplanting time. Before being taken up, the plants in the seed bed are sprinkled with a solution containing an ounce and a half of powdered arsenate of lead per gallon of water. Time is given for the solution to evaporate, leaving a white coat of arsenate of lead on the leaves and stems of the plants.

The tobacco horn worm seldom appears before the end of June; formerly it was combatted effectively enough by dusting with Paris green, but this has generally been replaced by arsenate of lead as being more effective and incurring less risk of burning the leaves, as long as it does not contain more than one per cent of free oxide of arsenic. The following proportions have been found to be fully effective. As long as the plants have not passed the middle stage of their normal development, a solution containing five pounds of arsenate of lead in powdered form to one hundred gallons of water may be sprinkled upon the leaves, taking care to reach, as far as possible, all parts of the plant. Later, when it becomes impossible to go through the plantation with machines, a dust-gun is employed, spreading a mixture of arsenate of lead in powdered form, and airslaked lime. In the latter case, the application should be made early in the morning before the dew has evaporated, so that the powder may adhere to the leaves as closely as possible. Five pounds of arsenate of lead per acre is sufficient to treat effectively a tobacco plantation which has reached its full growth.

Diseases of Tobacco

These are numerous, yet if one expects root rot, (*Thielavia Basicola*), it may be said that the tobacco plantations of Canada have so far been relatively little attacked. In the seed bed, the treatment indicated for the sterilization of the soil suffices to free it of the germs of damping off and of root rot, and in a general way of all the germs of fungi. On the plantation itself the struggle, especially against root rot, is more difficult. All the treatments with chemicals tried by officers of the divisions have been without result. For a time, success was hoped for from the use of chemical fertilizer with an acid reaction, like superphosphate, employed in heavy doses, but this treatment has not given the result hoped for.

It has been proved upon the Harrow Tobacco Station that the disinfection of the soil of the seed bed, together with the adoption of a rotation in which tobacco is not grown upon the same soil oftener than once in four years and where, further, the rotation has not included the growing of clover, or other leguminous crop, will, in a relatively short space of time, put in good condition land infected with root rot. Although this disease appeared on certain parts of the Tobacco Harrow Station in 1912 and seemed to be becoming serious in 1913 thanks to the above precaution the land has been completely freed from it.

Another means of combating root rot is the growing of tobaccos resistant to that disease. Certain varieties possessing this quality have been fixed by Mr. J. Johnson of the Wisconsin Experimental Station. They were introduced on the Harrow Tobacco Station in 1914 and from it have been propagated as rapidly as possible.

During recent years, special attention has been given at Harrow to the improvement of the form of resistant types of White Burley, in bringing them to resemble as closely as possible the ordinary White Burley, especially the Broad Leaf. These efforts have resulted in the establishment of a type derived from the "Johnson Resistants", of a form very little different from the White Burley Broad Leaf and giving a yield in weight almost equal to the latter. Further, the Pathologist of the Tobacco Division succeeded in establishing in 1920 another line of resistant burley very satisfactory in form, capable of furnishing an excellent material for replanting, he also made a selection of a tobacco suitable for snuff, which is equally resistant to the tobacco root rot.

The Selection, Fixation and Improvement of Varieties

Fifteen years ago one of the most easily noticed faults on Canadian tobacco plantations was their lack of uniformity.

The source of supply of seed, almost always uncertain, was sufficient to explain this unfortunate state of affairs. The Tobacco Division immediately gave attention to the question of introducing into Canada seed of known origin, of improved varieties and as fixed as possible, upon which one might depend for a good crop, true to type and as perfectly uniform as possible. For Ontario, the primary source of this supply was an excellent selection of White Burley, Broad Leaf obtained in 1907 from the Experimental Station at Lexington, Kentucky, and also a selection of the White Burley Stand Up from the same source. From year to year these have been subjected to a severe selection, and these two lines of White Burley may now be considered as "Canadian Standards". They are very popular among the growers of Ontario, and, in certain years, in spite of the special attention given to the growing of seed at Harrow, it has been difficult to supply the demand.

In Quebec certain selection of Comstock Spanish have been fixed. These are very similar to each other and are all superior from the point of view of yield in weight and of earliness to the Comstock which can be obtained from seed imported directly from Wisconsin. The same applies to certain selections of Connecticut Broad Leaf, General Grant, Little Havana and Canelle. Each year there are distributed in Quebec 3,000 to 5,000 samples of choice tobacco seed to say nothing of more or less large lots furnished to seed houses or to planters' associations.

As a rule, the plants coming from seed grown in Canada are ealier than those derived from imported and non-acclimatized seed. In certain years this quality makes all the difference between a tobacco harvest saved in time and a harvest damaged by frost.

After a series of experiments, the Tobacco Division has demonstrated to the grower the steps to take in order to obtain in Canada tobacco seed of first-class quality without danger from hybridization.

In the seed production work it was found that the use of paper bags until a sufficient number of seed capsules is formed and then the removal of these allowing the capsules to ripen in the open air until about two-thirds of the later have taken on the characteristic brown colour, permits the gathering of the seed some days earlier, and gives much better results, than if the seeds are allowed to ripen completely under the bags.

It might be added that before the seed is distributed or handed over to seedsmen for sale, it is cleaned by use of a special separator, which eliminates not only impurities but light seed. The result of this careful cleaning is a much more uniform growth in the seed bed, a more vigorous plant in the plantation and a better crop.

Fermentation of Tobacco

The first experiment in the fermentation of the Canadian Seed Leafs, tobaccos suitable for pipe or cigar use, was carried on by the Tobacco Division during the winter of 1905-06 in warehouses placed at our disposal by a Montreal manufacturer. An opportunity was thus afforded to take notes on the aroma of these tobaccos, and although the tobacco was put under experiment in far too moist a condition, no damage was caused thereby. The tobaccos were sold to a small manufacturer who used them entirely for cigars.

Bulk Fermentation.

The fermentation was carried on in bulks in rooms where the temperature varied according to the hour of day or night from 60 to 75 degrees Fahrenheit. The average humidity was that generally kept up in work rooms where the tobacco is kept from becoming brittle. After three successive fermentations, interrupted by turning over the bulks and shaking, the tobaccos were finally packed into cases, Wisconsin type and allowed to mature during the next summer. The above experiment was the beginning of the cigar tobacco industry in Canada.

Two years later, convinced by our experiment that this industry had a future in Canada, independent manufacturers installed sorting and fermentation warehouses.

The Tobacco Division recommenced these experiments in the course of the winter 1911-12, as soon as a suitable place was available on the Central Experimental Farm at Ottawa.

Bulk fermentation, such as is carried on in certain tobacco factories of Connecticut, was found rather too expensive. The products are liable to take on a sort of sweet taste, (plug smell), which tobacco manufacturers object to. This occurs whenever the bulks are too compact, or when the shaking process carried on with the object of airing the tobacco and cooling it down, is not carried on with sufficient care.

In all cases, the practice of building up a compact bulk upon which the workmen stood was found defective and recourse was had to the use of moveable frames, which would mould the form and contour of the hulk, and around which the workmen stood. The frame is gradually raised as the bulk grows higher. In this way the tobaccos are bulked down under their own weight only, a bulk which has been rapidly built up seven feet settling after some days to a height of about five and a half feet. Fermentation establishes itself rapidly, but not too abruptly, and generally any sweet odour is avoided.

Although in most of the tobacco factories where bulk fermentation is carried on, the bulks are wrapped in woollen cloths to avoid chilling, the Tobacco Division has preferred to keep its fermentation room at an average temperature of from 70 to 75 degrees Fahrenheit and at an average humidity of 75 to 80 per cent, and leave the bulks uncovered. In practice, suitable humidity is indicated by the condition of the tobacco leaves on the outside of the bulk. These, without being brittle, should be barely flexible. In no case should there develop moulds on the butts of the hands, which would indicate a too high degree of humidity in view of the temperature of the room.

Forced Sweat, in Cases

For binder tobaccos the cheapest and most practical method under Canadian conditions, is the forced sweat in cases, in rooms kept at a temperature of 95 to 105 degrees Fahrenheit and in an atmosphere practically saturated, that is, about 90 per cent humidity. In these hot rooms, the tobaccos are rapidly modified, a strong sweat takes place from the beginning, preventing the development of any germs of mould which the product may possibly have contained when put in the cases. At the end of about six weeks the operation is practically finished, the final colour has been acquired, the texture of the leaf is modified, the aroma is developed, yet the tobacco remains supple and may be considerably refined in the course of the next summer, provided it contains sufficient moisture to sweat once more during the hot weather. As a rule, tobaccos which, when brought out of the hot room, have sometimes a sweat smell, free themselves of this during the maturing period, that is to say, from June to September. However, this change takes place very slowly, and sometimes incompletely when the tobacco is too dry when taken from the sweating room.

Natural Sweat in Cases

By this method, as soon as the tobacco is sorted into its varying lengths and qualities, it is packed in boxes of the usual style, and left to itself in a room unheated, where it is subjected to all the variations of temperature and humidity which may occur. Under these conditions, there is only a very light sweat at first, the real sweat not taking place until the hot summer weather. In certain tobacco growing centres in the United States, this method gives, as a rule, excellent results, but these results depend entirely upon the temperatures to which the tobacco is subjected during the summer. This method has been tried for two successive years at Ottawa, and it was found necessary to give it up. With it, although the light leaves sweated sufficiently to be placed upon the market the following September or October, it was necessary to sweat again the leaves of a medium or rather thick texture, the first sweating of which was entirely insufficient. This is a costly operation and is always a delicate one, on account of the danger of tearing the leaves.

Special Sweating Processes

In view of the full flavour characteristic of some of the Canadian tobaccos used for cigar manufacture, an attempt was made to subject certain filler tobaccos to a method of sweating used in Ohio for the treatment of Zimmer Spanish. The experiment was made during the winter of 1915-16, being tried first upon waste tobacco, and then upon a lot of Brazils. The later lot was considerably improved in all ways by this process. Its strength had been reduced, the aroma had been preserved and refined, and the texture was undamaged.

A lot of binder tobacco of the 1914 harvest was also treated by this method. Although the colour was considerably darkened by the treatment, the result was quite satisfactory. The tobaccos were freed of the sweet smell which they possessed before the experiment and took on that characteristic and ammoniacal odour which is so much desired, in addition to aroma, in a cigar tobacco.

In short, under Canadian climatic conditions, the best methods of fermenting cigar tobaccos of the Seed Leaf type, would seem to be the following:—

(a) Tobaccos for cigar binders: Forced sweating in a hot room during about six weeks, the temperature being kept at from 95 to 105 degrees Fahrenheit, with a humidity of from 85 to 95 per cent, followed by a maturing process in a room of moderate temperature of about 80 degrees Fahrenheit, the atmosphere being kept humid enough so that the tobacco will not dry out quickly, that is, about 85 per cent. This maturing process goes on mainly during the hot weather of the summer which follows the time of treating the tobacco in a hot room. Under these conditions the tobaccos are ready to put on the market, or at least to sample, in September.

(b) Tobaccos for cigar fillers, generally represented by the thicker leaves coming from the tops of the plant: Forced fermentation in the hot room, under the same temperature and humidity conditions as indicated above, for binder tobaccos. In this case, however, the period of maturing following fermentation, properly so-called, is much longer. These tobaccos improve considerably with age and will gain by not being put upon the market, or at least by not being used, for a year and a half or two years.

Excellent results have been obtained by the following method tried with a lot of Yamaska, and which is a slight variation of the Ohio method.

The tobacco was left in the bales, such as these are generally delivered by growers, until the month of October of the following year, being thus given a light, natural fermentation. At this time it was sprinkled freely enough to give it a humidity of about thirty-five per cent and was then put into cases. The tobacco was lightly pressed by hand in the cases, which were then put in a hot room and subjected to a temperature of 100 degrees Fahrenheit. The tobacco was aired and shaken twice at intervals of from eight to ten days, after which when it was thought it had sufficiently dried, it was finally packed, subjected to ordinary pressure, and put back in the hot room for about four weeks. By this method there was obtained a very light filler of a delicate agreeable odour, and ready for use as such as soon as taken out of the hot room. Since, as a rule, Canadian filler tobaccos are refermented at one time or another, the economy of this process would seem to recommend it, since delay at the time of the delivery of the crop is avoided, thus saving work at a busy season, and the proper fermentation may be undertaken later on when help is abundant.

For all cigar tobaccos, the natural sweating in cases, such as is practised in certain parts of the United States, is not sufficiently sure. 'The Canadian summer is short and, occasionally, the period of great heat is not sufficiently long to effect the desired modification in the packed tobaccos.

Bulk sweating is not necessary for binder tobaccos. It is more expensive than forced fermentation in the hot room. This latter method gives excellent results when the tobacco has been packed in a sufficiently supple condition.

For the filler tobaccos, these may be sweated in bulk before being finally packed, but the tobaccos should be vigorously shaken and well aired when the bulks are being turned to be built up again, and the bulks themselves should not be too compact. If these precautions are not taken a sweet smell is likely to be induced. This odour may be removed by a supplementary fermentation; this latter process, however, is generally practised just before the tobacco is to be made up in cigars.

As to pipe tobaccos of the Seed Leaf type, they may be treated by any of the methods indicated above. The natural tendency, however, is to reduce the cost of handling these medium-priced tobaccos to the very lowest minimum.

If they are baled on the farm without containing too much moisture they may make an excellent fermentation in that condition. This process should, however, be watched and the pile of bales should be taken down from time to time in such a way as to place in the centre of the new pile those which were formerly on the outside. It would appear dangerous to make these piles more than four bales high, and speaking generally, unless one is sure of the state of humidity of the tobacco when baled, the safest method is to resort to ordinary bulk fermentation in rooms where the temperature may vary from 60 to 75 degrees Fahrenheit.

Use of Alkaline Solutions in the Suppling of Green Tobaccos

Although, speaking generally, one avoids moistening green tobaccos before sweating, confining oneself to rendering them supple by natural means, that is, either by exposing them to the humidity of the atmosphere or, in extreme cases, using vapor from water at a low temperature, it was decided to try direct moistening with a lot of tobacco of the 1922 harvest, delivered at Ottawa in too dry a condition from one of the Experimental Stations.

As a measure of precaution against the possible development of mold, and in order to facilitate the ammoniacal sweating, the water used to render these tobaccos supple was made alkaline by the use of carbonate of potash at the rate of 2 ounces of carbonate to 10 gallons of water or in about the proportion of 1 to 1,000.

When taken out of the hot room, after six weeks of sweating, these tobaccos were found to be in perfectly good condition. Even in those hands which at the time of bulking had been thought to have received too great an amount of liquid, in no case was there noted that cooked odour, but on the contrary there was a very agreeable, fruity odour, slightly ammoniacal.

The use of an alkaline solution in the moistening of another lot of tobacco already sweated and showing white spots due to the presence of bacteria, after this lot had been submitted to an energetic re-sweating, seemed to remove from it any trace of bacteria and rendered it again saleable.

Tests of Varieties

We have already spoken of the work accomplished by the Tobacco Division in the endeavour to improve the varieties of tobacco forming the principal crop of the various tobacco growing districts of Canada.

In addition, a great number of varieties have been tried to determine their possibilities in this country, and to see whether some of them may not give a better product than those varieties at present grown, either in Ontario or in Quebec.

On the Harrow Tobacco Station the variety experiments have been carried on with the following:—

(*a*) Burleys, air-cured. Broad Leaf Stand Up; Hope's Stand Up; Halley's; Hullett's; Kelley's; Yellow Burley; Red Burley, etc.

(*b*) Yellow Tobaccos, flue cured. Long leaf Gooch; Conqueror; Adcock; White Stem Orinoco; Virginia Gold Leaf; Hester; Critcher; Flannagan; Gopher Skin, etc.

Although certain of the above have furnished a very interesting product none has proved sufficiently good to replace the varieties which at the present time furnish the great bulk of the tobacco produced in Ontario, that is, Warne and Hickory Prior as representing the yellow flue-cured tobaccos, and, for the burleys, the acclimatized selection of White Burley Broad Leaf, White Burley Stand Up, and Johnson's Resistant Burley.

In addition to the varieties mentioned above, one may cite that of a special White Burley originated by the Tobacco Division by crossing Kentucky Broad Leaf and Gold Leaf and tested for some years at Ottawa and at Harrow. This new variety, on account of its finer texture and greater elasticity than those of the ordinary White Burley, seems to have some future as a cigarette tobacco.

In Quebec, after having made sure that the Division had secured a type of binder tobacco giving satisfaction to the manufacturer, special attention was given to the possibility of establishing varieties of good aroma, which might be used as cigar fillers. The main point to decide was whether the aroma would persist, and if so, for how long. The most important varieties experimented with were Zimmer Spanish, Little Dutch, Long Leaf Obourg, the Cuban tobaccos, the Brazils and the Philippines. Special mention should be made of the Aurora variety, one grown for many years in Ohio, but apparently disappearing there.

The Zimmer Spanish furnishes in the northern districts of Quebec, as well as in the Rouville district, a leaf of good texture, of medium development, with a yield of about 1,200 pounds per acre in a good season. The aroma is very delicate and the strength less than that of the Zimmer Spanish tobaccos obtained in Ohio.

The Canadian Zimmer Spanish, or at least that of Quebec, does not require a strong fermentation, such as similar Ohio tobaccos need. This tobacco has been fermented in bulk in a room at about 75 degrees Fahrenheit. After three fermentations, and a maturing period of four weeks in a hot room, following the packing of the tobacco in cases, the whole process was considered finished, with the exception, of course, of such improvement as might be expected with the ageing of the tobacco.

Speaking generally, the aroma of the Canadian Little Dutch was found too pronounced by the manufacturers who tried it. As to the Long leaf Obourg (a Belgian variety), opinion was divided, certain manufacturers found it too aromatic, others favoured it highly.

The Brazils grown in the province of Quebec keep their aroma until at least the third generation. However, although we have succeeded in obtaining a yield somewhat higher than that of the first Canadian generation, the weight per acre is too low to enable this variety to establish itself in competition with other varieties of fair yield. Moreover, the Brazils seem difficult to acclimatize, judging by the number of plants, not destroyed by insects, which it is necessary to replace just after transplanting.

The Cuban tobacco (Vuelta de Abajo) furnishes in certain parts of Quebec an aromatic leaf until at least the third generation.

The division has succeeded in obtaining a selection of Cuban furnishing a yield of some 1,200 pounds per acre, which is sufficient to allow this variety to compete with other cigar and pipe tobaccos. The problem of aroma has been settled, since we have delivered the Cuban tobacco coming from the Experimental fields of the division to manufacturers of good reputation, who have admitted that these tobaccos may be employed not only when mixed with imported Cuban tobaccos, but even alone, in the manufacture of excellent cigars.

The varieties of Philippine tobaccos tried at Ottawa have also reproduced the characteristic odour of the Manilla tobacco. Some seem difficult to acclimatize in Canada on account of their great susceptibility to those low temperatures which sometimes occur early in the season. However, the variety Havana is an exception and would appear to have some future in the province of Quebec as a cigar tobacco. One lot of Havana, the sweating of which was finished in the course of the winter of 1921-22 in the warehouse at the Central Experimental Farm, showed quite exceptional qualities. As to aroma, it greatly resembled that of the Cuban tobaccos and the texture of the middle leaves was sufficiently fine that a large proportion of them could be used as cigar binders and wrappers.

Under these conditions, all the tobacco derived from a successful harvest of Havana could be employed in cigar manufacture, while even with the best harvests of Comstock Spanish one would consider as waste, or at least as an inferior product, everything which could be used as a cigar binder.

The Aurora, also known in Ohio under the name of Mexican, is a variety with a petiolate leaf, of rather heavy texture. Although it has furnished in Canada a thinner leaf than the Ohio, yet it is the most full flavoured of all the binder tobaccos which so far have been tested here. It is the sole variety which should be subjected to the strong fermentation which is practised in Ohio. Under these conditions it furnishes a filler of medium strength and of a special aroma, perhaps a little too loud, but considered as very agreeable by certain manufacturers.

At the present time, the Tobacco Division, in addition to carrying on work with the improved and acclimatized varieties mainly grown in Ontario, are working with a number of acclimatized selections for cigar binders and fillers, without speaking of the experimental work with Connecticuts and tobaccos of the General Grant type, varieties largely used as plug tobacco and grown extensively in Quebec. In the improvement of these, the Tobacco Division has contributed largely.

Making a Cross on Wheat—Central Farm.

DIVISION OF CEREALS

L. H. Newman, B.S.A., *Dominion Cerealist.*

The function of the Cereal Division of the Experimental Farms Branch is to discover or to produce new varieties of cereals, peas, beans buckwheat and flax of superior merit for the different districts throughout Canada. Since the Dominion comprises regions varying, to a marked extent, both in soil and climatic conditions, it is obvious that, for the most successful cereal husbandry, varieties differing in characteristics and in adaptability to those varying conditions must be produced.

History and Early Work

When the Experimental Farms were established, the most pressing problem seemed to be that of securing more suitable varieties of wheat for the great wheat-producing areas of Western Canada. The sort generally cultivated at that time, Red Fife, required too long a season to mature and heavy losses from early autumn frosts were frequent. The director, Dr. William Saunders, who was a keen experimentalist, took direct personal charge of this branch of the work and in a short time succeeded in bringing together for trial, under Canadian conditions, a very large collection of varieties from different parts of the world. Naturally, those countries occupying a northern position were looked to as the most likely source from which to obtain varieties suited to our northwestern prairies. Among these countries, northern Russia supplied the most valuable material. Of the many sorts there obtained, a variety called Ladoga gave best results and was introduecd in very considerable quantities. Seed was distributed widely among western farmers for test and, on the whole, seemed to give reasonably satisfactory returns. The new wheat was earlier than Red Fife and gave a very good yield; but when a sufficient quantity was available for a milling and baking test, it was found that the flour produced from it was of a yellowish colour, too dark to suit the public taste, while the bread also lacked in lightness and whiteness.

After the above discovery was made, Ladoga was not recommended as, it was realized that this variety could not be grown generally if the high reputation of Canadian wheat on English and foreign markets was to be maintained.

Following the renunciation of Ladoga, the director decided that the best wheats for Canada might be expected from cross-breeding. He therefore devoted much time and energy to this phase of the work. Ladoga, on account of its earliness, was used as one of the parents in several crosses which were made. Red Fife and White Fife, on account of their high quality, were also used extensively in this crossing work. Several very promising wheats resulted from crosses made between Ladoga and the Fifes, especially Red Fife. From the Ladoga-Red Fife crosses, four new sorts were introduced under the names Huron, Percy, Stanley and Preston. These varieties inherited a considerable proportion of the earliness of Ladoga and a fair amount of the good baking qualities of Red Fife. Unfortunately, however, the baking qualities of these new wheats could not compare with the high quality of the famous Fife. Their earliness, however, was such a boon in certain districts where the production of the later-maturing Fife was always a more or less precarious undertaking, that they soon came to be grown on a very considerable scale in spite of the objections raised by the miller. As time passed, these varieties became almost entirely replaced in the West by Marquis described below, although in certain parts one occasionally comes across these varieties grown on single farms to-day. In Eastern Canada, on the other hand, Huron has gradually won in popularity and at the present time this is the variety recommended most highly for use in eastern Ontario, Quebec and the Maritime Provinces. It is certainly one of the most vigourous and productive wheats known and is capable of thriving to better advantage on light soils and under unfavourable weather conditions than other sorts. It is not recommended for Western Canada on account of the superiority of Marquis for that part of the Dominion.

Of the many new varieties of cereals originated by Dr. William Saunders and his assistants, a few, in addition to Huron wheat, are well known to-day; thus we have the Arthur pea, a productive, early and attractive yellow pea, and we also have the Mackay variety of pea, giving a remarkably high yield but somewhat late in ripening. Taking Canada as a whole, there is probably no pea which has stood out so prominently as has the Mackay in comparative trials.

While the above varieties are, in themselves, of immense importance to Canada, yet even greater credit is due Director Saunders for laying the foundation for future work the results of which have proven so extremely valuable to Canadian agriculture.

Varieties of Wheat

In 1903, Dr. Chas. Saunders was appointed Dominion Ceralist, which position he held with great credit to himself and honour to his country until ill health forced him to retire in 1922. When he took up the work, he came into possession of a very large amount of unfixed material which had descended from the crosses made by the director and his assistants during the earlier years. This material was very carefully worked over and reselected according to approved modern methods and yielded several very good varieties. The most promising of these were propagated and subjected to a careful milling and baking test. Those standing highest in these tests were sent on to the branch Farms for further trial. Of all the varieties discovered and developed from among the above mass of material, none compares in importance with Marquis, now considered the standard wheat of Western Canada. This is a cross between Red Fife and a wheat obtained in India called Hard Red Calcutta. The kernel is hard and dark red in colour, ripening about a week before Red Fife and giving a very high yield. By reason of its early maturing qualities, Marquis has extended very greatly the area where wheat may be grown with a reasonable degree of safety. This variety is also particularly strong in the straw, which is a point of enormous importance. Formerly, Red Fife, especially when grown on summer-fallow, was disposed to lodge, thereby adding to the cost and difficulty of harvesting. The head of Marquis is non-shattering (a most valuable characteristic for the great wind-swept plains of the West) and yields flour of high quality, and baking strength. In the first trials made on the prairie branch Farms, Marquis outyielded all other sorts to such an astonishing extent that it at once attracted wide attention. The variety was distributed in 1909 to farmers for further trial and quickly demonstrated its adaptability for large areas on the central plains. The single plant which grew at Ottawa in 1903 increased at an enormous rate until to-day (1923) it is estimated that at least 90 per cent. of the total spring wheat area in Western Canada is producing Marquis. Even in the United States, Marquis has attained a very wide distribution and is to be found in almost every state of the Union. American statisticians estimated the area devoted to Marquis in the United States in 1919 to be almost twelve million acres. Since that time it is known to have occupied a still greater proportion of the wheat producing areas; in fact, it is believed that at least 70 per cent. of the spring wheat acreage of the United States in 1923 was devoted to the above variety. Various statisticians have endeavoured to compute the increased value of the western wheat crop due to the introduction of Marquis and, while the computations submitted vary considerably, yet all are agreed that the wealth of Canada is increased annually by many millions of dollars. A comparison of the yields obtained from Marquis and from Red Fife which it has so largely displaced, is probably the best means of measuring the merits of the former. According to figures obtained from our widely scattered branch Farms, it is shown that Marquis has outyielded Red Fife on the average of the past five years, taking all stations together, by approximately four bushels per acre. According to the estimates of the Bureau of Statistics, 21,665,535 acres were devoted, in Western Canada, to the production of spring wheat in 1923. Allowing for the fact that the yield obtained on the Experimental Farms is usually considerably greater than that obtained throughout the country, and hence assuming that, on the average, Marquis outyields Red Fife by only two bushels per acre instead of four, the amount of wheat produced in the West in 1923 was greater by almost 39 million bushels than it would have been had Marquis not been grown. This is assuming that 90 per cent. of the total spring wheat area was devoted to Marquis in 1923. At the Experimental Farm at Brandon in 1923 Marquis outyielded Red Fife by 18 bushels per acre.

It should also be noted in this connection that owing to the degree to which Marquis is grown successfully in districts where heretofore wheat growing would either not have been attempted or carried on with very indifferent success, it is safe to assume that the wheat growing area is much greater than it would have been had Marquis not been introduced.

While Marquis wheat attracts the greatest attention and deservedly so, yet other valuable varieties have been produced within recent years. Some of these have not been tested long enough to justify more than an opinion as to their probable value. Others have already demonstrated their fitness for propagation under special conditions or for special purposes. Thus, where particularly early sorts are needed, such varieties as Prelude Ottawa 135, Ruby Ottawa 623, and Garnet Ottawa 652 are proving valuable. Prelude Ottawa 135 is now grown to a considerable extent in districts where formerly wheat was seldom attempted and always grown at great risk. It matures, on the average, almost two weeks ahead of Marquis. This variety gives a fair yield and has an exceptionally high weight per measured bushel. It produces flour of high baking strength.

Ruby Ottawa 623 usually ripens about a week ahead of Marquis but is not a high yielder.

Garnet Ottawa 652 ripens still earlier than Ruby and in tests conducted so far promises to be a higher yielding variety than the latter. It has straw of fair strength while the baking strength and colour of the flour are also good.

From the old standard, commercial Red Fife, many pure-line selections have been made. One of these proved particularly distinct and noteworthy on account of its earliness. It matures about a week earlier than Red Fife, and also has larger kernels and a somewhat blunt or square type of head instead of the sharp pointed head of Red Fife. It has the fine baking and milling qualities of the original Red Fife and has proved quite valuable in certain districts where Red Fife thrives but where it may be too late in ripening. This new selection has been given the name "Early Red Fife Ottawa 16." On account of its susceptibility to stem rust, this sort is not recommended in districts where rust is liable to occur.

New Oat Varieties

Among the new varieties of oats produced by the division, the two hulless varieties called Liberty Ottawa 480 and Laurel Ottawa 477 have attracted the greatest attention. Both of these varieties are cross-bred sorts, one of the parents in each case being the Chinese Naked. These varieties have not been grown on a very extensive scale as yet, although for certain purposes and for certain districts they may be recommended. The absence of hull surrounding the kernel makes these varieties particularly attractive to the poultryman and to the feeder of young growing stock, especially pigs. Liberty ripens earlier than such varieties as Banner, while Laurel ripens about the same time as does Banner. Both Liberty and Laurel produce a fair yield of grain, especially when one takes into consideration the absence of hull. An outstanding feature of both varieties is their superior strength of straw.

Banner Ottawa 49, a pure line selection out of ordinary Banner, has excelled the latter in comparative trial tests where such have been made.

Other promising oat varieties produced by the division are Columbian Ottawa 78, Longfellow Ottawa 478 and Prolific Ottawa 477.

New Barley Varieties

Among the many new varieties of barley produced by the division, the following four deserve special mention: Chinese Ottawa 60, Bearer Ottawa 475, Duckbill Ottawa 57, and Charlottetown 80.

Bearer is a six-rowed variety possessing a strong straw of fair length. It is somewhat late in ripening and has proven very productive at most of the branch Farms as well as at the Central Farm.

Chinese Ottawa 60 is another six-rowed sort, selected out of a commercial barley supposed to be of Asiatic origin and grown under the name of Mensury. At Ottawa, this variety, in an eleven-year average, has yielded considerably more than either Manchurian or O.A.C. 21.

Duckbill is a late-maturing, two-rowed sort of very attractive appearance. Unlike most two-rowed sorts, this variety is usually quite strong in the straw which is also of fair length. It is giving excellent yields and, in fact, is one of the very best. Although not tested for a sufficient length of time in combination with late oat varieties, it may be said that this sort promises to be very suitable for growing in a mixture with such oats as Banner and Victory.

Charlottetown 80 is a selection made at the Experimental Station at Charlottetown, P.E.I., from an old two-rowed variety of the Chevalier type. This variety is recommended for use in the Maritime Provinces, particularly where comparative trials have indicated its superior yielding power. Its introduction is of undoubted value to Maritime agriculture.

New Varieties of Peas

Several excellent new varieties of peas have been produced at Ottawa, among which should be mentioned especially the following: Mackay Ottawa 25, Chancellor Ottawa 26, Arthur Ottawa 18, and Cartier Ottawa 19.

Mackay is a cross between Mummy and Black Eyed Marrowfat. The peas are rather darker than most sorts and possess a black *hilum* (eye). This is a very productive sort as already mentioned.

Chancellor is an early variety selected out of an old sort known under the same name. The seeds are small and yellow. It is considered very valuable, especially in districts where early varieties are needed.

Arthur is a pure line selection from the original Arthur which, in turn, was a cross between Mummy and Multiplier. The seed is yellow and of medium to large size. This sort ripens rather early and usually gives a good yield.

Cartier is a cross between Mackay and Arthur. The seed is yellow and of medium size. The variety ripens at about the same time as Arthur, but has proven rather more productive at Ottawa.

New Varieties of Flax

Some very valuable work has been done by the division in connection with the production of new varieties of flax. Varieties excelling both in seed production and in production of fibre have been sought. The variety named Novelty Ottawa 53 has proven a high seed producer. The most valuable fibre-producing variety evolved to date bears the name Longstem Ottawa 52. This is a pure line selection taken from some seed obtained from Ireland. This variety is exceptionally tall and has given excellent results for fibre purposes. It is considered a specially valuable introduction.

New Varieties of Field Beans

Work in connection with the production of new varieties of beans has been rewarded by several new sorts of special value. Among these might be mentioned Beauty Ottawa 712, Navy Ottawa 711, and Norwegian Ottawa 710.

Beauty is a pure line selection from a natural cross found at Ottawa. The bean is rather small in size but has proven quite productive and is among the earliest-maturing sorts. For Western Canada it is considered very valuable.

Navy is a rather late-maturing bean and is very productive. The beans are white and medium, or below medium, in size.

Norwegian is a pure line selection from a variety received many years ago from Norway. This is a very early bean, making it of particular interest to the Prairie Provinces. The yield is usually large. The seed is yellowish brown in colour and of medium size.

Methods of Distribution

New varieties which have proven their superiority over other existing sorts are distributed according to a definite plan. It is realized that seed sent out indiscriminately may very quickly lose its identity through becoming mixed with other sorts. A substantial quantity of what is known as "Elite Stock Seed" is therefore propagated by, or under the direct supervision of, the Farm and this, in turn, is either sold to, or grown under contract by specially chosen growers. In the case of absolutely new sorts, the Farm retains control of the seed so that no grower is allowed to corner the supply. Members of the Canadian Seed Growers' Association cooperate in this undertaking. These men are experienced seed growers who realize the importance of maintaining purity and the care which is necessary to attain this. These growers, furthermore, work under a form of supervision and direction with a view to having their product officially registered. Since no variety can be accepted for registration until it has been approved by at least two separate Experimental Stations, no registered seed is available except that which belongs to accredited varieties.

During the experimental stages, it is necessary, of course, to have new productions tested locally in order to determine their adaptability for different districts. This, however, is a separate phase of the problem but an essential part of it.

Projects Under Way

The various projects under way in the Cereal Division at Ottawa and on the branch Farms total ninety-four. These include not only the producing and testing of all classes of cereal grains, peas, beans, flax and buckwheat, but also embrace studies in methods, field and laboratory technique, and milling and baking.

An outstanding strain of Kentucky Blue Grass isolated at the Central Experimental Farm.

THE DIVISION OF FORAGE PLANTS

G. P. McRostie, B.S.A., Ph.D., *Dominion Agrostologist*

The settlement of new agricultural areas, or the development of older settled districts, is always associated with the occurrence of new agricultural problems. It has been the object of the Dominion Experimental Farms Branch since its origin in 1886 to assist in solving these problems that continue to arise in the natural growth of Canadian agriculture.

By nineteen hundred and eleven, the various problems relating to forage crops had reached such proportions that it was considered advisable to create a separate division to look after this phase of experimental work.

Subjects of Research

The function of the Forage Crop Division thus created was to carry on with, and enlarge upon, the task of determining the most satisfactory forage crops for the various agricultural areas of Canada and to breed improved varieties or strains of such crops.

The crops coming under the scope of the activities of the Forage Crop Division include hay and pasture grasses of various kinds, alfalfa and clovers, field roots, corn and sunflowers, and miscellaneous forage crops as soybeans, horse beans, rape, etc. Because of the fact that the greater part of the corn, sunflowers and soybeans grown in Canada are produced for forage purposes, practically all of the breeding and improvement work with these crops is carried on by the Forage Crop Division.

One of the chief difficulties lying in the way of the improvement of our forage crops is the fact that they are practically all open fertilized either by wind or by insects. This open fertilization means that plants of different type and yielding capacity are constantly being intercrossed. It is obvious that any mixed population is likely to be composed of both desirable and undesirable individuals. Forage crops are no exception to this rule. The presence of low-yielding and otherwise undesirable individuals is holding down the average yield of our various fodder crops. To increase the yield of such crops it is necessary to get rid of the low-yielding plants.

This can, with the majority of forage plants, most efficiently be done by inbreeding. The process of inbreeding is carried out by protecting the plants to be inbred from cross pollenation. Cages of various type are used for this purpose. For plants like alfalfa and other legumes that are cross pollenated through the instrumentality of insects, a cage made of an insect-proof wire cloth is commonly used. For the self-fertilization of plants like our various grasses which are crossed by wind-carried pollen, cages made of some pollen-proof cotton material are quite satisfactory. The Forage Crop Division has experimented with various grades of materials and methods of construction for the manufacture of satisfactory isolation cages, and have finally perfected several that, under the climatic conditions at the Central Farm at Ottawa, give excellent isolation coupled with good sets of seed with the plants on which they are used. From five to seven successive generations of self fertilization will separate the great majority of our commercial forage crop mixtures into their component true breeding strains.

This separation of our commercial mixtures into their component strains was one of the first procedures of the Forage Crop Division in the attempt to breed superior types of forage plants for our Canadian conditions.

The breeding of improved strains of various forage crops is obviously a somewhat slow procedure; however, considerable has been accomplished since the division was first organized as a separate unit.

Reference to the improvement work with the forage crops as groups will best serve our purpose.

Hay and Pasture Grasses

Timothy is the most important grass as a hay plant throughout a large portion of Canada. As a consequence, it was one of the first plants on which improvement was begun. In 1910 and 1911, a large number of apparently different types of Timothy were collected. These were purified by selection and inbreeding until the undesirable types could be distinguished and discarded. About twenty-four desirable types remained. Seed from these was mixed together and tested against the best grades of commercial timothy seed. This mixture of desirable types, which is now being distributed under the name of Boon timothy, has never failed, in our comparative tests at the Central Farm, to give at least fifteen per cent. increased yield over the commercial mixtures.

The strains of which the Boon timothy is composed are being kept pure and are being tested against Boon timothy and commercial mixtures, in the best timothy-growing sections.

In Western Canada, Awnless Brome grass and Western Rye grass have been found to be the most satisfactory. Improved strains of each of these grasses are being bred. The discovery was made that Western Rye grass was not open-fertilized like most other grasses but was self-fertilized like oats, wheat and barley. As a consequence, it was only necessary to collect seed from desirable plants and keep the resulting progeny separate in succeeding generations in order to establish pure strains. A great many desirable strains were isolated in this way. Some of these are out-yielding commercial mixtures by a very profitable margin.

Improved strains of Orchard grass, Meadow Fescue, Red Fescue, Tall Fescue, Tall Oat grass, Kentucky Blue grass and Red Top are also being developed. Some eighty-nine main projects are under way in the study of hay and pasture grasses, alfalfas and clovers.

Alfalfas and Clovers

Hay and pasture types of alfalfa are being isolated and purified. Some of these types are proving their worth by the yield of good quality hay and an abundant seed crop. The extreme pasture types, however, have not as yet produced any progeny that set seed at all abundantly.

A strain of red clover has been isolated that shows a decided perennial tendency and which promises to be a valuable addition to the improved varieties already on the market. Improvement work is also being carried on with the various sweet clovers, and with alsike and white dutch clovers.

Field Roots

This work includes breeding and improvement of mangels and sugar beets, fall and swede turnips and field carrots. With each of these crops the object has been to ascertain, first of all, which class of crop is the most suitable for the various agricultural areas of Canada or if any of them can be profitably grown. After having determined the peculiar requirements of any district with regard to the different root crops, the various types of the most desirable root crop to grow are tested out. As soon as the superiority of any particular type has been established, breeding of improved strains of that selected type is begun.

In the following-out of this policy, an improved strain of Yellow Intermediate mangel has been developed at Ottawa. Improved strains of the Long Red mangel are being developed at Lennoxville, Que., improved strains of Half Sugar mangel at Ste. Anne de la Pocatière, Que., and at Charlottetown, P.E.I., and of Globe mangel at Sidney, B.C. A club-root-resistant strain of Bangholm swede turnip is being propagated for the club-root infested areas of New Brunswick, Nova Scotia and Prince Edward Island. Improved strains of swede turnips are being developed at Cap Rouge and at Ottawa, and an improved strain of Half Long white carrot is also being developed at Ottawa. Thirty-five experimental projects are comprised in the work with roots.

Corn and Sunflowers

The low cost per ton of dry matter secured by growing corn and sunflowers has led to a very considerable increase in the acreage of these crops grown in many parts of Canada.

Because of this increased interest in the crops in question, a considerable amount of breeding work has been begun with both corn and sunflowers. With both of these crops, the isolation of pure lines by inbreeding is always accompanied for a few generations by a considerable decrease in the vegetative growth of the crop inbred. Therefore, the isolation of pure strains of these crops must be followed by the recombination of the most desirable strains in order to regain the natural hybrid vigour possessed by the ordinary commercial mixture from which the pure strains were isolated. The mixture resulting from the recombination of the most desirable strains is, however, much superior to the commercial variety in that the poor yielding and otherwise undesirable individuals have been recognized and eliminated during the process of inbreeding.

It has been found that the crossing of unlike varieties of corn will give hybrid plants that, in the first generation, possess many of the desirable characteristics of both parents. For example, a cross between one of our early maturing, but light yielding, flint corns and one of our later-maturing and heavier-yielding dents will give first generation plants that are almost as early maturing as the flint and yet almost as heavy yielding as the dent parent. The first generation behaviour of crosses between unlike types can be utilized to good advantage to extend the area in which corn can be grown profitably.

A large number of desirable sunflower strains have been isolated by four generations of inbreeding that has been carried on at the Central Experimental Farm at Ottawa. After a very few additional generations of inbreeding, desirable strains which will continue to breed true to type will be available instead of the badly mixed commercial varieties now on the market.

Extensive work in corn breeding has been begun at the Experimental Station at Harrow, Ont. Some of the best commercial varieties and pure strains have been secured from the corn growing sections of Canada and the United States. At this Station, improved strains and varieties will be originated and disseminated as rapidly as possible to the various agricultural zones for which the variety tests which have been conducted for years in these zones indicate that the new strains or varieties would be best suited. The work with corn is divided into ten main experimental projects.

Annual Hays

In a great many sections, hay failures are common, either because of failure to secure a good germination of the seed sown or because of the drying-up or winter-killing of what would otherwise have been profitable stands. Where such failures occur, it is usually necessary to make good the deficiency of hay by planting some type of annual fodder crop. In a few sections, biennial or perennial hay plants are very seldom profitably grown and in such areas annual hays become a regular part of the crop rotation.

To meet this need for information concerning suitable hay crops, tests of a considerable number of different annual crops, alone and in combination, have been made. In the tests of oat varieties as annual hays it has been found that the variety that gives the highest yield of grain in any locality is not often the same variety that produces the largest tonnage of dry hay. In connection with these, experiments are being conducted to determine the stage of maturity of the oats at which they give the largest amount of digestible nutrients per acre, the whole work being divided into 9 projects.

Various varieties of millets, Sudan grass, sorghums, Teff grass, sweet clovers, both annual and biennial, and various mixtures of these, as well as a number of less commonly grown plants, are being tested out as annual hays. Results are available indicating which of the various plants or combinations of plants under test is the most satisfactory for the different agricultural areas of the country.

Hay and Pasture Mixtures.

Wherever live stock of any kind is kept the cost of its maintenance is largely dependent on the abundance of the hay and pasture crops in the agricultural district in which it is located. One of the most important considerations in connection with these crops, is therefore, the determination of the particular fodder plant or combination of fodder plants that will best meet the peculiar needs of each section. To obtain reliable information concerning this extensive tests are being carried out at the Central Experimental Farm and at the various branch Farms throughout the country, with a great many grasses and clovers, sown alone and in varying combinations. For many districts, information is already available as to what will best meet its hay and pasture requirements.

In conjunction with the work on pasture mixtures, some investigations have been started to determine what single grass or combination of grasses and clovers will give the most permanent and satisfactory sod for golf greens and fairways.

Botanical Investigations and Collections

A representative collection has been made of the native and introduced forage plants of Canada, including a particularly comprehensive collection of native grasses, amounting to several thousand specimens, secured from every province of the Dominion. All of these are being mounted and classified so that there will soon be available at the Central Experimental Farm an excellent herbarium of Canadian forage plants. This will afford a good opportunity for the intensive study of our fodder plants and will also be of great assistance in the identification of specimens which are frequently sent in for determination.

A survey of the vegetation occurring on the extensive areas of salt marshes in the provinces of New Brunswick and Nova Scotia has been made and reported on. The object of this survey was to determine what plants made up the bulk of the existing vegetation and if other species could be substituted for, or added to, the present mixture to the betterment of the resulting yield and quality of cured hay obtained from the areas in question.

Methods of Conducting Experimental Work

In co-operation with the majority of Canadian provincial agricultural colleges and experiment stations, there is being started a series of experiments by the Central and branch Experimental Farms to gain additional information as to the best technique for obtaining accurate experimental data.

It is obviously desirable that experimental work be carried on in such a manner that the results obtained be as accurate as possible and also that the results be obtained as quickly as is consistent with accuracy. The previously mentioned series of experiments is an attempt on the part of the agricultural investigators of the country to secure information that will enable them to give the people whom they serve more accurate results in the shortest possible time.

THE DIVISION OF ECONOMIC FIBRE PRODUCTION

R. J. Hutchinson, *Chief*

History

In compiling any complete chronicle of the work of the Fibre Division, the fact must not be lost sight of—more especially when making comparisons with experimental and research work conducted in other spheres of agricultural effort—that the growing economic necessity for the inauguration of a special government division to pursue experimental work with fibre plants reached its culminating point at a moment when the necessity was also forced upon us to stimulate the output of flax products after the sources of raw material had been abruptly cut off elsewhere. In other words the outbreak of the European war was, incidentally, the determining factor in the inception of a Flax Division, the need for which had already been keenly felt. To offset this, however, the very exigency of the war rendered it essential that the early efforts of this division should be devoted almost entirely to higher production at the expense of a temporary postponement of purely experimental work.

The situation with respect to the linen industry in 1915—the year in which this division was founded—was briefly as follows: Belgium and Northern France, both producers of large quantities of flax fibre, were in Germany's possession.

Linen, on account of its great strength in proportion to its weight, was recognized as the best known material for the manufacture of aeroplane wings. The increasing importance of the air service as the war advanced was evident to military authorities, hence each year brought more and more flying machines into action, thus creating a greater demand for linen. Large quantities of flax were also needed for the manufacture of lanyards, ropes and canvases of various kinds, used for war purposes. Linen manufacturers, in the face of this unprecedent demand, were confronted by a tremendous shortage of raw material, hence efforts were made to grow flax in countries that had never before attempted to produce it on a commercial scale. Attempts were made to grow it in British East Africa, in parts of Australia, New Zealand and in Canada. Of all the new fields tried, none gave more promising results than Canada. Yet the production in Canada at the outbreak of the war only amounted to some 4,000 acres. The Chief of the Fibre Division, realizing as he did, the extent of the demand for flax fibre and the possibility of Canadian farmers supplying a part of that demand, considered that the greatest service he could render was to encourage, in every way possible, the greater production of flax throughout this country. With this object in view, a war circular was published setting forth the great need for linen as a war material and urging the farmers of Canada to assist the empire by producing more flax. Numerous illustrated lectures were given to flax growers, showing the best methods of handling the crop up to the stage in which it is sold to the spinning mills. In the year 1919, the Fibre Division co-operated with the Ontario Department of Agriculture in the growing of 100 acres of flax at Willowdale, the object being to arouse interest among the farmers of that locality in the growing of flax. It was gratifying to note, that, as a result of these various efforts, the area of flax produced in Canada increased from 4,000 acres in 1914 to 20,000 acres in 1918.

In addition to the assistance given to flax growers, the Fibre Division undertook to secure for the farmers the best possible price for the product when it was ready for marketing. This was very necessary since practically none of

75617—7½

the Canadian flax growers had any idea of the spinning value of the fibre they produced, hence they were not aware of its true market value. In order to acquaint the European spinners with the nature and value of Canadian flax, the Chief of the Fibre Division had a quantity of flax shipped to Europe in order to have a spinning test made. He himself supervised this test in the interest of Canadian growers. The division undertook the sale of practically all the flax grown in Canada from the year 1917 to 1920. The major portion of this fibre war marketed in Europe, the balance was sold to American spinners.

Since practically all the flax produced in Ireland is grown from seed imported from Belgium, Holland and Russia, the invasion of Belgium and the revolution in Russia cut off almost completely Ireland's suppply of flax seed. In view of this shortage, the Chief of the Fibre Division shipped a quantity of seed that had been grown in Canada from imported seed to the Department of Agriculture in Ireland and asked that department to test its value. This the Irish Department undertook, and the results were most gratifying. It was found that when seed was imported into Canada and grown on Canadian soil for one year, the resulting seed gave better results in Ireland than did any other seed imported into that country. Irish farmers were quick to take advantage of this new source of seed supply, and, in the year 1919, 60,000 bushels of Canadian fibre flax seed were shipped to Ireland for sowing on Irish farms. The saving of seed has proved most profitable to Canadian flax growers, especially during the years 1919 and 1920, when the price received was $10 per bushel.

Naturally when such a demand for seed existed and when enormous profits were being realized by the sale of it, there were some exporters who were not ambitious for the maintaining of the standard of excellence of Canadian seed abroad, but were rather desirous of securing what profit they might while they had the opportunity. Unfortunately, then, some seed was sent to Ireland for fibre production which was not a fibre but an oil producing strain. Furthermore, some of the fibre seed exported was not as carefully cleaned and graded as it should have been. Had this practice of exporting an inferior quality of seed continued, Canadian seed would soon have lost the reputation it had so recently gained in Ireland. It was, therefore, deemed advisable to have a rigorous government inspection of fibre flax seed exported from Canada for seeding purposes. With this end in view, the Fibre Division, in co-operation with the Seed Branch, outlined a standard to which all fibre flax seed for export should conform and this standard was embodied in the Seed Control Act.

During the war period, the attention of this division was largely devoted to work the nature of which has already been described. However, it had always been felt that a great deal of experimental work would have to be conducted before optimum results could be obtained in the growing and handling of fibre crops in this country. Such important questions as the following were repeatedly being asked:—

In what localities in Canada can flax be most profitably produced?
Which are the best varieties to grow?
Which methods of cultivation are best?
How much fertilizer and which kinds should be applied to give best results?
Which methods of cultivation are best?
How much fertilizer and which kinds should be applied to give best results?
Which are the best methods of retting?
How can cost of labour be reduced?

With this object in view, an up-to-date flax mill was built at Ottawa in 1917 and a number of experiments were commenced at the Experimental Farm, Ottawa, and also at the branch Farms. The plan was to ship the flax straw grown at these various places to Ottawa where it could be retted and scutched, and the results of the different tests prepared for publication.

Unfortunately, many of the results of the work commenced at this time were afterwards lost when the flax mill at Ottawa was burned in the fall of 1920.

In spite of the handicap to experimental work conducted so far, the Fibre Division has been able to secure a great deal of information about the growing and handling of flax in Canada that has been of much assistance to flax producers. In the trials mentioned above satisfactory returns of Grade 1 scutched fibre were obtained on the Experimental Farms at Agassiz, B.C., Cap Rouge, Que., Fredricton, N.B., Kentville, N.S., and Charlottetown, P.E.I., as well as on the Central Farm and at other Ontario points.

A limited amount of variety testing work has been done, the results so far indicating the great possibilities of improving yield and quality of fibre by careful selection work in the varieties of seed used.

Retting Experiments

A large quantity of flax was retted for commercial purposes, in concrete tanks, between April and October. It was found that a temperature range of from 72° F. to 82° F. gives the quickest results, and is also the best for the fibre, when the flax is retted by the above method. It was also found that the yield of number one grade fibre from tank-retted flax is 7½ per cent higher than that of the yield of fibre produced from dew-retted flax.

During the season of 1922, careful records were kept of the weight from eleven different plots of flax after each operation from deseeding to scutching. It was found that deseeding caused a loss in weight of 34·43 per cent; retting, 16·23; and breaking and scutching 36·68 per cent; the percentage of tow remaining being 4·46 and of long fibre 8·2.

Binder Twine Experiments

Binder twine was manufactured experimentally at Kitchener, Ont., on instructions from this division, from linseed flax straw grown in Western Canada, and consignments of the finished product were despatched to all the branch Farms, to be tested with a view to ascertaining whether it would compare favourably with manila or sisal. This twine was tried on several types of binder, and the reports sent in, while not encouraging, were at least positive. Twine thus manufactured was found to lack several of the qualities essential to a binder twine. For instance, it lacks uniformity; it is too soft; and its average breaking point is not sufficiently high. It is, however, very suitable for garden work, where a stiff twine is not essential, but is rather a drawback.

Tests of Flax Machinery

The amount of arduous hand labour required in the harvesting and handling of flax up to the stage when it enters the spinning mill is well known to anyone possessing even the slightest knowledge of flax growing. Although flax has been grown and used extensively since the earliest ages, very little effort has been made, in comparison with that applied to other crops, to eliminate or reduce the old, laborious methods of preparing this plant up to the stage when it is sold to the spinning factory. Perhaps this is due to the fact that, until recently, flax was grown in countries where labour was cheap and there was little incentive to reduce the cost of production, but now conditions have changed. The country where great quantities of cheap flax were formerly grown is no longer able to supply anything like its pre-war quantity, and indeed, there is every indication that this shortage may exist for several years to come. The linen industry is still confronted by an abnormally low supply of flax fibre. What is needed more than anything else to bring prosperity to this industry is a plentiful supply of cheap fibre flax.

Those interested in the linen industry realize the new situation in which they are placed, and in recent years more strenuous efforts have been put forth with the object of lowering the cost of production than have ever before been attempted in the whole history of flax production. Every country where flax is grown commercially is engaged in trying to find a means of lowering the cost of producing the raw material. Until very recent years it was believed impossible to harvest flax by any other means than by hand pulling, but now there are three or four different makes of flax puller on the market. A large-capacity deseeding machine has been invented, various scutching devices are being tried and the inventor of the flax puller has practically completed a machine for lifting flax from the spread field.

In Canada, where labour is high in cost, but where there is an abundance of cheap land capable of growing a good quality of flax, the introduction of labour-saving machinery may be the means of enabling Canadian growers to compete successfully with any other flax producing country. For this reason, the Fibre Division has always welcomed any mechanical invention that had for its aim the cheapening of the cost of flax production. The suitability of any such device to Canadian conditions has been carefully studied and practical tests under Canadian conditions have been made when it was deemed advisable.

Tests with Boby Scutching Machine

The method of scutching flax which is most generally in use at present consists in submitting handfuls of the broken straw to the beating action of a set of wooden or iron blades attached radially to a revolving shaft. The disadvantages of this method are many. It requires skilled labour, it is wasteful of the fibre, it is expensive and somewhat dangerous. Recently, however, considerable effort has been put forth by inventors with the object of evolving a machine that would overcome the many disadvantages of the present method of scutching flax. The result is that there are now a number of machines on the market, which, according to their makers, are a decided improvement on the old method.

During the spring of 1921, the writer had the privilege of seeing one of these machines—the Boby—in operation in Belfast, Ireland, and was most favourably impressed by its work. The flax which was used in this demonstration was water-retted and the machine certainly did all that its inventor claimed for it.

Arrangements were made with the manufacturers of this machine to have one of them shipped to Canada, in order to carry on further trials in this country. The first Canadian demonstration of the Boby scutching machine was given at Linwood, Ont. Water-retted flax was again used in this trial. The result was most satisfactory. The fibre scutched by this machine was well cleaned and the quality was superior to that which had been scutched by hand, in that the fibre was not broken or abused. Furthermore, there was a slightly higher yield of scutched fibre from the same amount of flax straw than there was with the old method of scutching. The output in both cases was about the same. Another great advantage in favour of the Boby machine is that no skilled labour is required to operate it.

Trials with Dew-retted Flax

A further trial of the Boby flax scutching machine was conducted at Clinton. This time, dew-retted flax straw was used. Before giving the results of this trial, it is well to be familiar with the quality of flax straw that has been dew-retted as compared with the water-retted. In the case of water-retting, the whole plant is immersed and the retting process goes on uniformly upon every part of the plant. With dew-retting, however, this is not the case. The flax which is spread upon a grass field is not subject to such uniform conditions as is the case in water-retting, consequently, there are some parts of the plant that are more thoroughly retted than are others.

It was found upon trial that this machine did not scutch satisfactorily flax straw that was dew-retted. The difficulty lay in getting the machine to clean it thoroughly. This defect was pointed out to the manufacturers and a new model has since been tested at Ottawa which scutched both dew and water-retted flax successfully.

Trials with the Vessot Flax Puller

Flax for fibre has always been harvested by hand pulling. It has been proved conclusively that cutting this crop by the ordinary grain harvester injures very materially the quality of the fibre and reduces the yield. It has always been considered until recently that any mechanical device for pulling the plants from the soil would injure the fibre and be impracticable.

In recent years a clergyman—Mr. H. C. Vessot—conceived the idea that a machine could be made to pull flax successfully. The importance to the flax industry in Canada of the invention of such a mechanism was fully appreciated by the Fibre Division. The principle of Mr. Vessot's machine was carefully examined and it gave sufficient promise to warrant the co-operation of the division with Mr. Vessot in aiding him to carry out his ideas and construct a machine. A number of preliminary trials were made at Ottawa, until at length, in the year 1920, it was felt that the machine had reached a stage of perfection when a public demonstration could be given. A machine was shipped to Glen St. Mary's, Florida, during the winter, so that a test could be held there and, if it proved successful, a number of machines could be built in time to assist the harvesting of the Canadian crop the next year.

Trials at Glen St. Mary's, Florida.

The field upon which this trial was made was comparatively level and contained about 20 acres of flax which was rather thinly sown, uneven in length and contained, occasionally, patches of quack grass. The soil was very dry and hard, which made pulling rather difficult. The test was about as rigorous a one as would generally be encountered under average Canadian conditions. The result was very encouraging. There were numerous interruptions on account of some minor adjustments, but everyone present at the demonstration agreed that the principle of the machine was sound, and that the old prejudice against the feasibility of a mechanical puller had been defeated. It was found that the machine when working full capacity, could replace about 25 hand pullers.

After this trial, a pulling machine was purchased by this Division and used to pull part of the 1921 and 1922 season's crop at Clinton, Ontario. Our experience with this machine has proved that it does very good work where the flax is standing, but in places where it is badly lodged, hand pulling still has to be resorted to, in order to get best results.

Tests with the Van Allen Deseeding Machine

One method of removing the seed from fibre flax is "rippling" *i.e.* drawing a handful of the straw over a comb-like arrangement which tears off the seed bolls. The flax is then bound up in bundles again and taken to the retting field. The seed bolls are broken and the chaff removed by a cleaning machine. This operation is very slow and expensive, as it entails a great deal of hand labour.

Another method which is an improvement on the first consists in using what is known as a whipper. This consists of two pairs of metal pulleys set close together. The head of the sheaf is opened out and passed three or four times between the pulleys, which rotate inward. In this way the seed bolls are mostly all broken and the seed drops out. While this method is much quicker than rippling, it is not rapid enough where a large acreage of flax has to be deseeded, besides, some of the seed is injured by this process.

A new method of deseeding flax has been invented by Mr. Van Allen. The manner in which his machine operates is as follows: The attendant places a bundle of flax on a conveyor-belt, which carries the sheaf forward into the thresher. The stems of the flax are held firmly between belts and the heads are left free to be dealt with by the deseeding mechanism. This consists of a series of rollers, which crush the seed bolls. The pressure of these rollers is so regulated that none of the seed is injured when the flax is passed through the deseeding device. The straw is afterwards neatly tied and kicked out.

A number of trials were made with this machine before it was finally decided to purchase one to be used by this division. This machine has been in operation for one season at Clinton, and has given excellent satisfaction. It deseeds the straw perfectly without in any way injuring the fibre, it also cleans the seed in a manner suitable for export, all in one operation. Only two men are required to attend it. It has a capacity of ten tons of straw per day, but we find that it is a physica impossibility for the attendant to feed it with that quantity. Six tons per day was the average amount deseeded at Clinton during the season of 1922. This deseeder is portable, and can be moved from one field to another in the same manner as an ordinary grain separator.

Tests with Flax Lifting Machine

The latest labour-saving device which has been receiving the attention of this Division is a machine for lifting flax from the spread field. Mr. Vessot, who is its inventor, has given it a number of trials upon flax spread at the Central Experimental Farm, Ottawa. Although this machine has not as yet reached the stage where a rigorous test can be made, there is no doubt that the principle of the machine is sound. There is good reason to believe that before the conclusion of another season, Mr. Vessot will have perfected this mechanism, which will aid materially in lowering further the cost of producing flax fibre.

Grading

During the great boom in the linen industry caused by the demand for this material for war purposes, very little difficulty was experienced in marketing flax fibre, even of an inferior quality, but in the spring of 1920, when the manufacturing of linen was considerably curtailed because of the consumers' refusal to pay such extremely high prices for it, the flax spinners became more and more fastidious in the purchase of raw material and there was very little demand for inferior fibre, even at considerably reduced prices. Unfortunately, many Canadian flax growers retained part of the 1920 season's crop and some of them retained it all, with the hope of an improvement in price. On account of the unfavourable prospect, the amount of flax planted in 1921 was considerably below the acreage of the previous year. Still, some growers took the venture and planted another crop, still hoping that prices would improve, but the expected increased price did not come. Under pressure of heavy interest charges and insurance payments, the flax growers felt that something should be done to try to secure a market for their flax. At a meeting of the Canadian Flax Growers' Association held at Hensall on the 15th of August, 1922, practically all the members agreed to sell their flax at its present market value. An agent was appointed to act as salesman and the Fibre Division undertook to select representative samples from each producers stock of flax. These samples were sent to a central warehouse, where they could be inspected by interested purchasers. This method proved very satisfactory and most of the 1920 and 1921 season's flax has since been sold.

The actual grading of such a large quantity of flax would have been a most costly and tedious undertaking, because, to grade flax satisfactorily, the operation should commence at the time of harvesting, and with all this flax no attempt had been made, at any time in its processing, to sort it according to its value. Still, the sample sent from each producer with an approximation of the amount of each grade that was for sale, gave the purchaser a good idea of the quality of the bulk from which it was chosen. The experience gained in marketing this flax has proved that, in order to dispose of a Canadian crop of flax to the advantage of the producer and the satisfaction of the purchaser, it must be carefully graded. At present a competent grader is employed by this Division whose duty is to visit the scutch mills and supervise this work.

Outline of Work Undertaken in 1923

In the fall of 1922, the flax mill at Ottawa was rebuilt, and in the spring of 1923 a more elaborate set of experiments was commenced than had hitherto been attempted.

Variety Tests. Tests are being made with eleven different varieties of fibre flax, four of which were imported from Europe, one from the United States, and one from Japan; the others were originated by the Cereal Division at Ottawa.

Seeding Tests. It has always been the practice to sow fibre flax broadcast. The reason offered for doing so is that straw of greater length and of more uniform diameter is obtained. This year an experiment is being conducted at Ottawa to determine the difference between the two methods of seeding. Judging from field conditions, the plots that were sown broadcast were less subject to lodging after heavy rains. The straw was slightly longer and it was about two days later in ripening than that which was sown in drills. Tests were also made with sowing different amounts of seed per acre and with sowing at different dates.

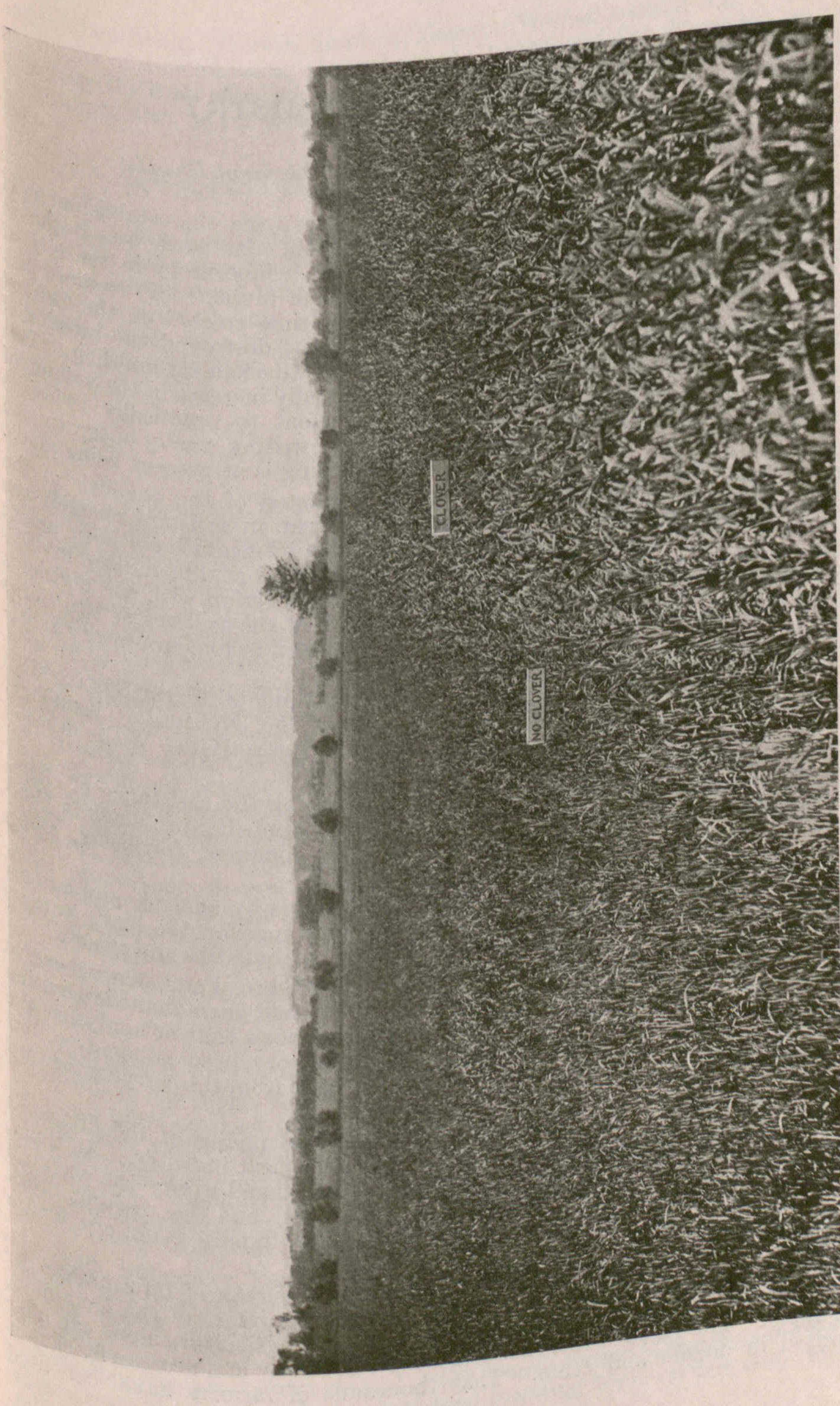
Harvesting at Different Dates.—The stage of maturity at which flax should be harvested is important from the Canadian flax growers' standpoint, because he is interested in both the seed and the fibre. It is known that the riper a crop becomes the better the yield and quality of the seed, but this does not apply to the fibre. It is, therefore, useful to know the stage of maturity at which it is most economical to harvest flax when both the fibre and seed are considered. This year an experiment is being conducted to determine the results of harvesting flax at different stages of maturity and the returns from the application of artificial fertilizers.

Influence of Soil on Flax Fibre. An effort is being made this year to decide which types of soil are most suitable for producing flax. Soil samples were taken from a field at Clinton, Ont., which contained a number of distinct types of soil. These soils are being analysed by the Division of Chemistry. A definite series of samples of flax straw was taken from the same area as the soil samples. These will be deseeded, retted and scutched and the results compared.

Retting Tests. Further tests are being undertaken this year with retting at different temperatures. This division is also co-operating with the Division of Bacteriology in testing the effectiveness of different bacteria in the retting process.

EXTENSION WORK. Judging from samples of flax obtained from the provinces of Quebec and the Maritime Provinces, it appears that this portion of the Dominion is very suitable for the production of fibre flax. For many years the settlers in some parts of these provinces have been engaged in growing flax and manufacturing it into home-spun linen. Their methods throughout are very primitive and entail a great deal of hand labour. Furthermore, the quality of fibre produced could be much improved by sowing better seed and by more careful retting of the straw. It was with the object in view of demonstrating better methods of handling flax that a small plant was installed at Caraquet, N.B., this year. The season in this locality was exceptionally dry and, therefore, a bad one for flax. Part of the crop has been scutched and although the fibre is very short, it is of excellent quality. The demonstration has created considerable interest in that community.

In addition to the work undertaken with flax, a series of experiments with hemp have been conducted at Ottawa, the object of these being to determine the most suitable varieties, the best date of seeding and the proper amount of seed to sow. Samples of hemp seed were also sent to eleven branch Farms, in order to discover the suitability of these different places for producing this fibre.



Fertilizing Value of Clover, Oat Crop after Clover (right); oat crop after grass (left).—Central Farm

THE DIVISION OF CHEMISTRY

Frank T. Shutt, M.A., D.Sc., F.I.C., *Dominion Chemist*

The history of the Divison of Chemistry dates from the establishment of the Dominion Experimental Farm System in 1886. Its work was begun in the autumn of 1887 in a small room equipped as a laboratory in the city of Ottawa, to be removed at the end of a year and half (June, 1889) to more permanent quarters in the "Main building" by that time erected on the Central Farm. A disastrous fire, the result of an accident, destroyed the interior of this laboratory and it was decided to erect a separate chemical building. This was ready for occupation in June, 1896, and the steady increase in the volume of laboratory work rendered necessary its enlargement to practically twice its original size in 1913. The work has, at the date of writing, vastly outgrown the accommodation and a further extension of the building is at present being made.

The staff of the division at the outset consisted of the chemist of the Experimental Farms. At the end of the second year an assistant chemist was appointed. As the work increased so further appointments have been made; to-day, the strictly technical staff engaged in chemical work, routine and investigatory, numbers fourteen. The clerical work in connection with the division's varied activities has for some years past necessitated the services of two clerks and the preparation of samples, etc., gives employment to two laboratory assistants.

The Act of Parliament establishing the Experimental Farm System does not state, in any detail, the functions and work of the Division of Chemistry, but from the very first it has been quite clear that the activities of the division should comprise and include:

1. Experimental and investigatory work requiring the assistance of chemistry, undertaken with a view to the solution of present-day problems in Canadian agriculture—in matters pertaining to soils, manures, fertilizers, crops, live stock, etc. and,

2. To render all assistance possible to the farmers by analysis and advice, information through direct correspondence with the man on the land, lectures and addresses and through the publication of circulars, bulletins and reports.

There has been a constant effort to keep these two broad and comprehensive lines of endeavour well in mind throughout the thirty-odd years that the Division of Chemistry has been in existence, and retrospect shows that not only has the policy laid down in early days of the division's history been adhered to, but that much benefit has accrued to Canadian agriculture from the carrying forward and development of both these branches of work.

It is perhaps difficult to say which of these two phases of the division's activities has been the most valuable to the agricultural industry. At times, as for instance during the great world war, the educational work—the chemical service—has undoubtedly been the most important, but the research work has placed on record results of immense value, not only to present but also future generations of farmers.

The division has, therefore, become, in part, a bureau of information to which farmers, in ever-increasing numbers, in every province of the Dominion, are appealing for the assistance that the chemistry of agriculture alone can offer and supply. The value of this chemical service naturally and necessarily cannot be stated in dollars and cents. That thousands of farmers have benefited and are benefiting, there is ample evidence. We feel assured that it has been the means of disseminating throughout the length and breadth of the country, in perhaps the most effective way, those fundamental truths of agriculture which, put into practice, go far towards making farming a rational and profitable vocation.

INVESTIGATORY AND EXPERIMENTAL WORK

In the space available herein it will be only possible to give an account of some of the more important phases of the experimental and investigatory work, and this account must, of necessity, be brief. It has been a matter of some difficulty to make the selection, owing to the varied character of the work and the many fields in which it is prosecuted. It is hoped, however, that this sketch of the activities of the division may prove of interest and serve to emphasize the value of chemistry applied to the problems of Canadian agriculture.

Soils

Virgin (uncropped, unmanured) Soils. Our work on the virgin soils of Canada has been largely, but not entirely, confined to the examination—chemical and physical—of certain types of prairie soils as found in the provinces of Manitoba, Saskatchewan and Alberta.

The analytical work has included the determination of the total and available plant food present and, further, has been applied to the solution of problems relating to northwestern agriculture, *e.g.* methods of culture as affecting conservation of soil moisture and nitrification; rotations as affecting the maintenance of soil fertility; exhaustion of fertility through continuous grain growing; effect of irrigation on the plant food content of the soil.

Although there are many types of soil in these western provinces varying in character and fertility, our investigation has shown a general uniformity over large areas in respect to fertility not observed in other parts of Canada. These prairie soils are, for the most part, very rich in plant food, more especially in nitrogen, and their favourable physical condition is due undoubtedly to the large proportion of semi-decayed vegetable matter they contain. They are characterized by a high lime content, a feature of unquestionable value alike from the physical and the chemical point of view.

As opportunity permits, this work in connection with Canadian virgin soils is being extended, and useful data are accumulating from the agricultural areas of eastern Canada and British Columbia, which are proving serviceable in indicating economic methods of soil management.

Influence of Cropping and Rotations on Fertility. Our study of this problem has shown that the outstanding differences between the rich virgin soils and those cropped for a number of years is found in their relative content of vegetable matter with its concomitant nitrogen, which, through continuous grain-growing and frequent summer-fallowing, have been dissipated from the cropped soil. Similarly, the worn, exhausted soils occurring in eastern Canada and resulting from irrational farming methods are almost invariably characterized by meagre amounts of these important constituents.

Soil Fertility Projects. A large number of projects relating to soil fertility and crop production have been undertaken in the past. Those projects of this nature at present engaging the attention of this division include the following:—

Investigational work at several of the branch Farms of the Prairie Provinces to ascertain the loss or gain of plant food resulting from various crop rotations followed.

An investigation to ascertain the loss of plant food over period of fifteen and thirty years on soil that has been cropped and summerfallowed but which has received no manure.

Examination of Prince Edward Island soils as a preliminary step in a soil survey of that province.

Investigational work on soils of recently settled areas in the Peace River District.

Investigational work on the soils of British Columbia in the vicinity of Prince George, Bulkley Valley, McBride, Vanderhoof and Francois lake.

Investigational work on the soils of northern Ontario, along the line of the Grand Trunk Pacific Railroad, with a view to their economic improvement.

The Classification of Irrigable Lands in Southern Alberta and Southwestern Saskatchewan. This work was undertaken in 1915 at the instance of the Reclamation Service (formerly the Irrigation Branch) of the Department of the Interior. It has rapidly increased in volume and now forms a large and important phase of the division's activities.

Its object is to supplement the reports of the field engineer on the topography and physical features of the irrigable lands by a pronouncement, from the stand-point of alkali content, as to the suitability and safety for cultivation under irrigation of the areas in question. To this end, all surveyed and irrigable lands are now carefully tested to a depth of five feet in the field by the electric bridge, and all soil groups concerning which there may be any doubt in respect to the nature or concentration of their alkali content, are forwarded to the Experimental Farms laboratories for detailed analysis. No quarter section is released for cultivation under irrigation unless the evidence, from the bridge or chemical analysis, as regards saline content is satisfactory, *i.e.* that the impregnation with "alkali" is either nil or negligible.

From the foregoing, the purpose of this work will be evident. It not only protects the purchaser of irrigable lands and ensures him, under rational conditions of irrigation and drainage, against "rise of alkali", but it has a national aspect, for it prevents the destruction of whole areas which, as they stand, are capable of being successfully cultivated under dry farming methods. The application of irrigation water, without efficient drainage, to soils seriously impregnated with alkali salts has ruined hundreds of thousands of acres in other countries; it is confidently expected that this preventive work will in a very large measure protect Canada from such a disastrous experience.

Incidental to this classificatory work and for the purpose of correctly interpreting the chemical and physical data, certain special investigations have been made necessary. These include "The Influence of Irrigation on the Vertical Movement of Alkali in heavy Clay Soils", "The Alkali Content of Soils as related to Crop Growth" and "The Nature of Burn-outs", apparently eroded areas which characterize large tracts in the semi-arid belt. The problems are many and difficult but successful progress towards the solution of some of the more important of them can be recorded.

Assistance is also being given to the Reclamation Service in connection with their purely drainage projects. This work was begun in 1918. While it includes an examination for alkali, it is chiefly concerned with determining the character and quality of the land involved in the drainage-scheme. The estimated cost of effective drainage in many of these projects is very large and our reports as to the agricultural possibilities of the area involved, based upon the physical and chemical data from the examination of the soils, are proving of the greatest assistance in reaching a decision with respect to whether the enterprise will warrant the expenditure.

The projects at present being carried on in this branch of work have as their objects the following:—

To determine the agricultural value and reclamation of soils in Northern Alberta under drainage.

To ascertain the alkali content of soils as related to crop growth.

To determine the suitability of soils for farming under irrigation, principally from the standpoint of their "alkali" content, in southern Alberta and southwestern Saskatchewan.

To determine the influence of irrigation on the vertical movement of alkali in heavy clay soils.

The tabulation of data resulting from the analysis of materials such as waters, deposits, cements, etc., which are related to the special investigations.

The nature of burn-outs.

Examination of Soils for Farmers. The increasingly large number of samples submitted for examination testifies to the importance of this service which, through additions to its staff of analysts, the Division of Chemistry is now enabled to render with greater dispatch than was formerly possible.

Samples are received from every province of the Dominion—from the delta of the Fraser river, from the irrigated orchards of the Okanagan, from the homestead on the virgin prairie, as well as from the older farm lands of Ontario, Quebec and the Maritime Provinces.

The nature and extent of the examination vary somewhat, in accordance with the information sought by the sender, but includes both chemical and physical determinations.

The data thus obtained and studied in the light of whatever further description of the area involved the sender may furnish, are then usually easy of interpretation and form a basis for imparting reliable advice as to the suitability of the soil for general or specific purposes and recommendations for its treatment.

It is significant to note that most of the samples received are accompanied by requests for advice as to suitable fertilizer treatment for the areas of which they are representative. The correspondence in connection with the use of fertilizers is now very large; it may be regarded as a sure indication of the growing interest manifested by farmers throughout the older provinces of the Dominion in this important matter.

Barnyard Manure

Apart from a study of the influence of manure in the soil—a phase of soil fertility investigations—the Division of Chemistry has devoted a considerable amount of attention to the analytical examination of manures. This has been done with the object of ascertaining primarily, the influence of food, of litter, and of methods of handling and storage, on the composition of manure. Valuable instructions, based on the data obtained from these investigations, have, from time to time, been issued to the farmers of the Dominion, who are thus advised of means to be employed for the prevention of losses by leaching and fermentation from the manure. Since these losses of fertility may be said to set in before the manure leaves the stable, it follows that manure is never more valuable than at the time of its production. Consequently, the sooner it is drawn to the field the less will be the loss of plant food substance therefrom.

Experiments undertaken by this division have shown that manure piled loosely in the yard, suffers very considerable losses, chiefly through leaching away of soluble nitrogen and potash compounds but partly through fermentation and consequent destruction of the organic matter with its nitrogen. In the course of a few weeks these losses may amount to more than one-third of the initial value of the manure.

It was shown, further, that manure in large heaps—whether in yard or field—heated rapidly, even in the coldest weather. In the course of three months—January to March—manure so piled lost, chiefly through excessive fermentation, 60 per cent of its original organic matter and nearly 30 per cent of its nitrogen.

But heaps of 400 pounds each put on the field, fresh from the barn and stable, showed no signs of heating throughout the course of the experiment. For the great part of the period these small heaps were frozen through, and careful analyses, made immediately before scattering them in the spring, proved that they had sustained no loss either of organic matter or of plant food substances.

Clover as a Fertilizer

One of the most important investigations undertaken by this division is undoubtedly that which demonstrated the fertilizing value of clover—a value invested chiefly in the ability of clover to absorb nitrogen from the soil atmosphere and to render mineral plant food more readily available in the soil, apart from its physical influence as a source of humus and conserver of moisture.

The investigations revealed the fact that a vigorous crop of clover will contain, in its foliage and roots, approximately:

100 to 150 pounds of nitrogen per acre.
30 to 45 pounds of phosphoric acid per acre.
85 to 115 pounds of potash per acre.

A single crop of clover turned under would, thus, furnish the soil with an amount of nitrogen no less than would be supplied in 10 tons of manure per acre.

Further experiments proved the practical value and influence of clover, ploughed down, on the yields of subsequent crops. Thus, the yields of grain grown after clover were, in the first year, 28 per cent greater and, in the second year, 29 per cent greater, than those from adjoining plots on which clover had not been grown and turned under. The difference in the yields of straw was even more decidedly favourable to the clover plots.

Similarly, clover, as green-manure, increased the yield of Indian corn by nearly 3 tons per acre and of potatoes by 40 to 50 bushels per acre.

The instances quoted may serve to convey some idea of the benefits which the dissemination of the data from these experiments have conferred on Canadian agriculture.

Investgiations with Fertilizers

Since the inception of the Dominion Experimental Farms System, and more especially within the last decade, the Division of Chemistry has carried out many field, greenhouse and laboratory tests with commercial fertilizers and obtained much valuable data therefrom.

In the earlier years of its activities, this division devoted itself in this connection particularly to the practical application in Canada of theories respecting soil fertility problems, evolved from long experience in the older European countries.

It was found that, while the response by crops to fertilizers (in Canada as compared with Europe) was modified by differences in soil and climatic conditions it varied only in degreee, and that the results obtained conformed to established principles.

Employing, in the earlier investigations, chiefly the more popular "mineral" fertilizers, such as nitrate of soda, sulphate of ammonia, superphosphate, basic slag and muriate of potash, the Division of Chemistry sought to meet the growing need for information coincident with the development of the fertilizer industry and, as they came into use as fertilizers, experimented with such abattoir by-products as dried blood and tankage, fish scrap, etc.

Besides those mentioned, a host of other materials of problematical transitory or permanent importance in fertilizer economy have been submitted to the test of laboratory, greenhouse or field experiments.

The exclusion of European potash by the world war proved a stimulus to the product of substitutes, and during that period several of these "new" potassic fertilizers were placed on trial. Of these, ground nepheline syenite, a Canadian product, manifested, in pot and field experiments, a distinct fertilizing influence laboratory analyses having shown that a large proportion of its potash was soluble in a one per cent solution of citric acid.

In the year 1915, the Division of Chemistry itself undertook successfully the preparation of a nitro-potassic fertilizer from seaweed, the fertilizer being the product of drying and grinding processes performed on a large scale experimentally on the south shore of Nova Scotia. In the following year (1916) this seaweed fertilizer was submitted to over one hundred field tests in the Maritime Provinces, Quebec, and Ottawa. Its value as a nitro-potassic fertilizer was clearly demonstrated but, like many other emergency substitutes, its cost of manufacture excluded it from consideration as a permanent rival of the more highly concentrated European potash salts.

While devoting attention to tests with novel or untried substances for which fertilizing value is claimed, the more important problems in fertilizer economy are accorded priority of claim to consideration.

During the past decade fertilizer experiments planned on a systematic and economic basis and on a more elaborate and comprehensive scale than hitherto attempted, have been carried out on several of the Farms and Stations of the Dominion Experimental Farms System. Some of these in their scope embrace determination of the comparative economic use of fertilizers of varying kinds, proportions and quantities as measured by crop response throughout a rotation. Others provide comparisons of the effects produced on crop growth by a certain plant food substance—nitrogen phosphoric acid or potash—furnished in various forms, while yet others are designed with a view to ascertain at what stage of the season or of the plant's development or how frequently in the rotation the fertilizers may be applied with greatest effect and profit.

In several experiments, the records of three crop-rotations are now available and furnish data of very considerable interest and value. For instance, in one of these experiments bone meal as a source of phosphoric acid proved, in the first rotation, inferior to the more active superphosphate. But in the second rotation, the residual influence of the decomposing bone became manifest, and the bone meal plots gave yields equal to those from the superphosphate plots.

In another experiment where fertilizers are applied to the potato and grain crops in each three-year rotation, the records of nine years, or three complete rotations, show that while superphosphate has been consistently superior to basic slag as a source of phosphoric acid in the potato fertilizer; basic slag has exerted a considerably greater influence on the yields of grain and hay, particularly of clover hay.

Certain experiments have demonstrated the efficacy of an early spring application of nitrate nitrogen when liberal supplies of other fertilizers proved incapable of stimulating crop growth, in the absence of immediately available nitrogen. For the same reason apparently, superphosphate applied alone failed in seven out of eight experiments either to increase the yield or to hasten the ripening of cereal crops.

Experiments to ascertain the most profitable time at which to apply nitrate of soda to the potato crop in the early periods of growth, were carried on in both eastern and western Canada. The resulting data show that best results were obtained when all the nitrogen of soda was applied at the time of planting.

The results of our investigations have indicated the need for a relatively greater percentage of nitrogen and of potash than is customarily found even in so-called high-grade fertilizer mixtures. On account of their lower cost, there has been a tendency to employ unduly large proportions of phosphatic materials in the fertilizer mixture.

In general, our investigations have demonstrated, especially where a quick response is desired, that no sources of nitrogen, phosphoric acid and potash prove more effective and profitable than nitrate of soda, superphosphate and muriate of potash.

It has been found that the most profitable use of fertilizers is associated with an application of barnyard manure at least once in the rotation. But other experiments have demonstrated that in a three-year rotation of potatoes, grain and clover hay, soil fertility may be maintained through the judicious application of fertilizers and the ploughing-in of the clover aftermath in the third year.

The division has at present twenty-seven distinct experiments with fertilizers in progress, distributed throughout the various branch Farms and Stations of the Experimental Farms system.

The more important of these have as their objects the following:—

The comparison of nitrate of soda with sulphate of ammonia as a source of nitrogen.

To ascertain the relative values of burnt lime, ground limestone, oyster shell mud and basic slag as sources of lime.

To ascertain the value of fish scrap as a fertilizer.

To obtain data on the growing of potatoes with manure alone, fertilizers alone, and fertilizers in conjunction with manure, (1) continuously, (2) in rotations.

To ascertain the relative values of fortified slag, non-fortified slag and ground rock phosphate as sources of phosphoric acid.

To obtain data relative to the most suitable formulae and rate of application of a fertilizer mixture for the potato crop.

To ascertain the influence of various fertilizer treatments on the development of the apple tree and the yield of fruit.

To ascertain the relative values of various sources of nitrogen and phosphoric acid in a complete fertilizer with and without ground limestone.

To ascertain the most suitable rate of application for ground limestone.

To ascertain the influence chemically and botanically of basic slag on meadows and pastures.

To ascertain the influence of phosphoric acid on the yield and date of maturity of the wheat crop.

Feeding Stuffs and Fodders

A large and important phase of the work in connection with feeding stuffs is the analysis of samples sent in by farmers for a report as to purity, quality and nutritive value. This usually involves the determination of the protein, fat and fibre, but not infrequently necessitates further chemical work and microscopical examination. Several hundreds of such samples are submitted to analysis annually and they include the larger numbers of mill feeds, etc., on the market. This is a work of considerable practical value and one that is much appreciated, since it furnishes the intelligent and progressive farmer with the information that permits him to purchase economically his feeds and concentrates and use them rationally in the feeding of his stock.

Another branch of this work includes the critical examination of newly introduced fodder crops, such as sunflowers and sweet clover, which are at present the subject of an exhaustive research. Native and introduced grasses, corn, the various legumes and allied crops used as forage, silage or hay have received considerable attention. This work has also furnished valuable information with respect to the stage of growth at which these crops should be cut for hay or ensiled with the view of obtaining the largest amount of digestible matter per acre.

A further phase includes the examination of commercial feeding stuffs with a view of establishing standards of purity. In this useful work the division has just concluded the analysis of more than two hundred samples of bran, shorts, middlings and feed flour, representative of these products as milled throughout the Dominion.

The projects at present being carried on in this branch of work include the following:—

To determine the differences in composition in oats, peas, barley and wheat (grain) as resulting from irrigations of varying depths and frequencies.

An enquiry to ascertain the feeding value of oats and barley cut for hay at different stages of growth.

An investigation to determine the most valuable of the more commonly grown varieties of corn for silage purposes.

Investigations to determine the changes which occur in composition during the growth of the sunflower plant from the appearance of the bud to the ripening of the seed.

Investigations to determine the differences in moisture content between first and second cuttings of many varieties of hay.

An investigation to compare the value of clover crops from an area from which both first and second cuttings were cured as hay with that from an area where the first cutting was cured as hay and the second growth allowed to seed and then threshed.

A chemical and microscopical examination is being undertaken to ascertain the nature and value of the condimental foods and cattle tonics on the market.

In connection with the administration of the Feeding Stuffs Act and the establishment of standards, the analysis is being made of the various meat and bone packing-house products on the Canadian market.

Co-operation with, and assistance rendered to, the Division of Field Husbandry, the Division of Forage Plants, and the Cereal Division in the analysis of field crops with a view to determining chiefly the acre-value in nutrients of the various crops and of the same crops at different stages of growth, etc.

Sugar-Beets

For the past twenty years the more important factory varieties of sugar-beets have been grown on the larger number of the Experimental Farms and Stations and the product analysed as to sugar content and purity. This work has included the comparison of beets from imported and homegrown seed, with the result that satisfactory evidence has been obtained as to the high quality for sugar production of the beets from Canadian grown seed.

The results of this investigation have established the fact that climatic and soil conditions at widely distant points in the Dominion are quite satisfactory for the growth of beets suitable for profitable sugar extraction. Thus, the data for the past year, have shown that the average sugar content of three varieties under test at eighteen Farms and Stations throughout Canada, was 16·48 per cent; at four of the Stations the sugar content was between 18 and 20 per cent; at seven localities between 16 and 18 per cent; at five, between 15 and 16 per cent, and at only two points did the sugar fall below 15 per cent.

Farm Roots

The relative feeding value of the several varieties of farm roots measured by their dry matter and sugar content, has been determined. The work has included the analysis, year by year, of mangels, turnips and carrots grown under experiment on the Central Farm by the Division of Forage Plants. The data have clearly shown that large differences in respect to nutritive value exist, not only among the several classes of farm roots but also among varieties, or more properly speaking, reputed varieties, of the same class.

Thus in mangels (38 varieties) last year the range in dry matter was from 6·64 to 12·40 per cent and in sugar 2·46 to 7·17 per cent; in turnips (22 varieties) 10·09 to 14·0 per cent dry matter and in carrots (15 varieties) 7·53 to 11·22 per cent dry matter.

The influence of heredity in mangels has also been studied. For nineteen years, the Gate Post and Giant Yellow Globe, two well-known varieties, representing two very distinct types, have been grown side by side and analysed. Throughout the whole period, every year without exception, the Gate Post has proved the superior variety, the average results being as follows: Gate Post, dry matter 11·77 per cent, sugar 6·17 per cent; Giant Yellow Globe, dry matter 9·57 per cent, sugar 4·53 per cent.

The Influence of Environment on the Composition of Wheat

This is a careful and systematic study of the seasonal and soil factors which influence the gluten content, and hence the quality, of wheat.

This research has thrown considerable light on the cause of the high quality of our northwestern-grown wheats; it has shown that a rapid development and maturation of the seed tend to produce a grain of high protein content and excellent milling quality. Moisture and temperature conditions during the filling out of the grain may markedly affect its composition. If there is a sufficiency of moisture in the soil in the early part of the season to bring the crop to a good growth, then a fairly dry soil and high temperatures during the later weeks of the season hasten maturity and conduce to a hard berry with a high protein (gluten) content. It is thus clear that the high quality of the wheat of our prairie provinces is not merely a result of rich soil and of heredity but, in a very large measure to meteorological conditions which frequently characterize the growing and ripening season in the Western provinces.

The Fertilizing Value of Rain and Snow

The chief object of this investigation, now in its fifteenth year, is to determine the amount and character of the soluble nitrogen compounds in the precipitation, and which, it may well be supposed, serve to enrich the soil. Our work generally with soils, manures and fertilizers shows that nitrogen may be regarded as the dominant element of plant food, that is, crop growth is largely measured by the available nitrogenous food in the soil. The growth of ordinary farm crops, excepting the legumes, removes nitrogen and there is also a certain loss by bacterial activity, drainage and other processes consequent upon tillage. Hence this research affords data of considerable interest in connection with the study of the all-important problem of the up-keep of soil nitrogen. The determinations are made at Ottawa, but the results, no doubt, are more or less generally applicable throughout the Dominion.

The results for the fifteen-year period indicate a total amount of 98·68 pounds of nitrogen per acre furnished by rain and snow, 81·54 pounds being supplied by the former and 17·14 pounds by the latter. The average annual amount of nitrogen furnished per acre for the fifteen-year period is therefore 6·57 pounds, an amount equivalent to that in an application of 42 pounds of nitrate of soda.

Many points, both of practical and scientific interest, have been brought out by this investigation. Thus it has been shown that rain is decidedly richer in nitrogen compounds than snow. This, it has been proved, is due to the greater solvent action of the rain and not to any essential difference between the concentration of the combined nitrogen of the air in summer and in winter. The ratio of the total rainfall to that of snow, for the fifteen-year period, is approximately 5:2, while the ratio of the number of pounds of nitrogen per acre furnished by these, respectively, is approximately 5:1, from which it will be clear that rain is approximately twice as rich as snow.

Soft Pork: Its Character, Causes and Prevention

The export bacon trade is one of great and growing importance to Canada; the demand for first-class Canadian bacon in England is very large, involving a business of many millions of dollars annually; it is one which has not yet reached its limit. It is to be borne in mind, however, that the requirements of this large and remunerative market are several and that they must be understood and met if this export trade is to be carried on with profit. Only first-class bacon can be profitably exported to England.

Among the qualities necessary for first-class bacon for the English market, none is of greater importance than that of "firmness". A tendency to softness, tenderness or flabbiness is quite sufficient to rate the bacon at second-class prices and if this softness is at all pronounced, to make it altogether unsaleable at a profit.

A varying proportion of the pigs offered to packers has from time to time produced soft pork, and this detrimental character of softness has specially characterized the produce of swine from certain districts. This investigation to learn the nature and cause or causes of this softness and, if possible, suggest preventive measures, occupied three years and involved the feeding of more than 300 pigs, the fat of which was submitted to critical chemical examination.

As a result of this work we established that the fat of "soft" bacon contains a much larger proportion of olein than that of "firm" bacon, that in the former the ratio of palmitin and stearin (solid fats) to olein (fluid fat) was approximately 1:4 whereas in the latter it was about 1:1·75.

The scheme of the trial was such that information would be gained as to the effect upon the quality of the pork of the following possible factors:—

1. Character of food, (a) fed throughout life, and (b) fed during the initial and finishing periods, respectively.
2. Limited and unlimited supply of food.
3. Soaked or cooked grain as against dry or uncooked grain.
4. Age of animal when slaughtered.
5. Exercise and lack of exercise.
6. Locality or district where raised.

The more important conclusions from this investigation may be summarized as follows:—

1. That the one great controlling factor in the quality of the pork of finished pigs lies in the character of the food employed.

2. That Indian corn and beans tend to softness, i.e., to increase the percentage of olein in the fat. If these grains are used they must be fed judiciously if first-class, firm pork is to be produced. If fed in conjunction with skim milk, it has been shown that a considerable proportion of Indian corn may be used in the grain ration without injuring the quality of the pork.

3. That a grain ration consisting of a mixture of oats, peas and barley, in equal parts, gives a firm pork of excellent quality.

4. That skim milk not only tends to thriftiness and rapid growth but counteracts in a very marked manner any tendency to softness.

5. That rape, pumpkins, artichokes, sugar beets, turnips and mangels can be fed in conjunction with a good ration without injuring the quality of the pork.

6. That the fat of very young pigs and animals of unthrifty growth is softer than that of finished pigs that have increased steadily to the finishing weight.

Waters from Farm Homesteads

Pure water is as essential to good health as wholesome food—and an ample supply of pure water is assuredly one of the most valuable assets that a farm can possess. Impure water is always a menace; it is frequently the cause of diarrhoea, typhoid fever and allied diseases, it may seriously affect the thrift of live stock and the quality and wholesomeness of dairy products.

This division, since the earliest days of its history, has made the examination of well waters from farm homesteads a prominent feature of its work. We may safely conclude that our campaign for pure water on the farm, accompanied as it has been by the offer of assistance in the matter of analysis and advice has been the means of directly and indirectly improving the farm water supply throughout the country generally.

Our observations have shown that the chief cause of polluted water on the farm is the unfortunate location of the farm well in the barnyard or in the vicinity of some similar source of contamination. Safety has too often been sacrificed to convenience. It is pollution of an excretal character that is most to be feared and it is this danger that our farmers are urged to recognize when selecting a site for a new well.

During the thirty-six years of the division's existence, several thousands of samples of well water have been analysed; a general review of the results shows that these samples may be approximately classified as follows: pure and wholesome, 30 per cent; suspicious and probably dangerous, 35 per cent; and seriously polluted, 35 per cent.

Special attention has been given in recent years to the analysis of saline water from certain districts in the Prairie Provinces. These waters are frequently non-potable by reason of their high soluble mineral content and many of them are decidedly laxative. Purification by distillation has proven the only practical method of obtaining a potable supply from these highly impregnated waters—and for this purpose a household or domestic still is recommended.

Insecticides and Fungicides

As a first step towards desirable legislation controlling the sale of insecticides and fungicides, the examination of these materials now upon the Canadian market is being undertaken. The data obtained will be of service in not only insuring purity of the product in question but will very materially assist in determining their insecticidal and fungicidal value.

Investigational and Control Work for the Health of Animals Branch, Department of Agriculture

This work has been carried on in the laboratories of the Experimental Farm since 1908 and originally consisted in the chemical and microscopical examination of samples collected by inspectors of the Meat Inspection Division in the course of their duties under the Meat and Canned Foods Act at the various packing-houses and fruit and vegetable canneries throughout the Dominion.

In later years the scope of the work has broadened to include the examination of all materials entering into the composition of oleomargarine and, finally, the critical examination of imported canned food-stuffs of animal, vegetable or fruit origin in order to see that these materials conform to government standards. The object of this work is two-fold—protection of the health of the consumer, and protection of the Canadian packer and canner from unfair foreign competition, the latter applying more especially to foreign fruit products. There is no doubt that this control work has resulted in producing marked improvement in the quality of both imported and exported foodstuffs.

During the past four or five years, there has been very careful and extensive examination of evaporated and condensed milks and milk powders. This phase of our work was initiated at the instance of the British Ministry of Food during the war period and has been continued chiefly with the object of ensuring a steady and reliable market for these important dairy products; that Canadian canned milk may have a reputation second to none in Europe.

Recently, a large proportion of time has been devoted to a thorough examination of Canadian and imported fruit products, jams, jellies, marmalades, etc. Assisted by some of the larger Canadian jam manufacturers, investigations have been carried on to ascertain how far it is possible to determine the presence of added fruit juice in jams. Most of the work was carried out on strawberry products and, from the results which have been obtained up to the present, it is considered that adulteration to any considerable extent can be determined.

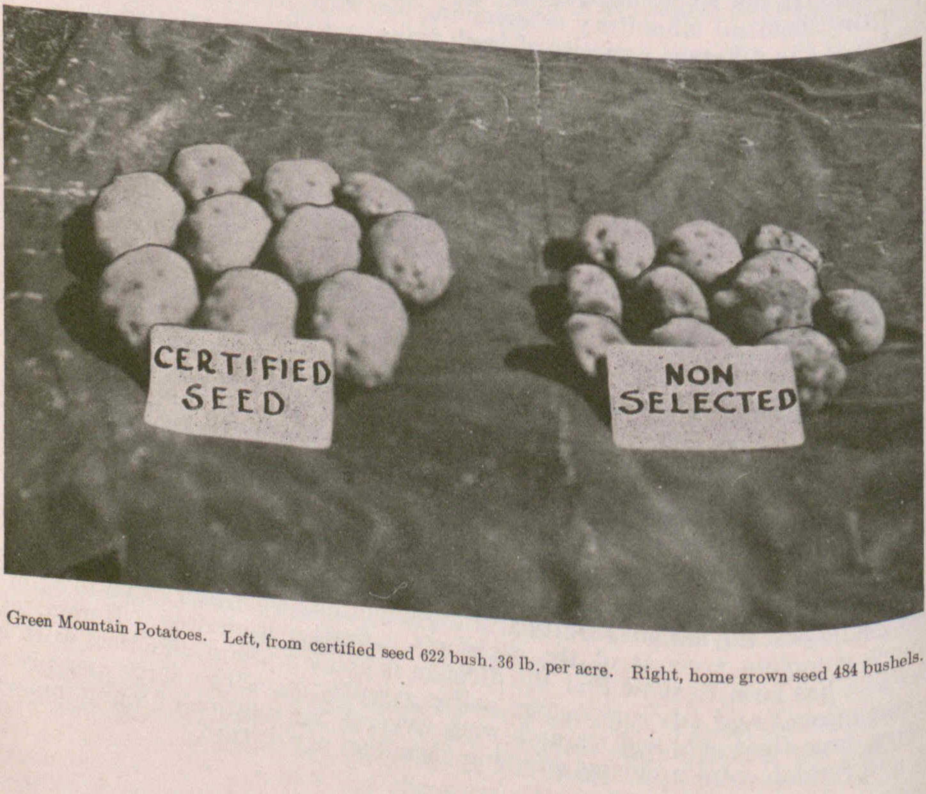
The Department of Agriculture has recently installed fruit and vegetable dehydrators at several points in the Dominion for experimental purposes and this year, in addition to other fruits, several varieties of plums and peaches were dehydrated at the Experimental Farm at Ottawa. Analyses have been carried out in the chemical laboratory determining the water content, total sugars and acidities of the different varieties of fresh fruits and also of the dri d fruits after undergoing various treatments. It is hoped thereby, after taking into consideration all factors, to determine which varieties of plums and peaches should be grown for dehydration purposes, and further to ascertain what treatment will insure for any one variety the best dehydrated product.

Special investigations have been carried on at various times at the instance of other departments of the Government service. Among these may be mentioned, the manufacture of a branding ink suitable for use in packing establishments. The ink we provided has been used with great success for the past ten years and has saved the department several thousand dollars. The Post Office Department requested us to examine the cancelling inks in use at that time. Our report indicated that the ink then in use was very unsuitable for the purpose and extremely costly. At their further request we determined specifications for a cancelling ink, which we considered suitable for the purpose and have been assured by the Post Office Department that our ink has met their requirements in full and has been the means of saving the department some thousands of dollars annually. At the request of the same department we have determined specifications for lubricating oils for use with motor vehicles, to their eminent satisfaction.

In the foregoing paragraphs the attempt has been made to sketch in outline some of the more important and practical phases of the division's work; recourse must be had to the annual reports and the bulletins issued from time to time if a more complete account of the division's activities is desired. Herein, our chief aim has been to show that the division is doing a useful, practical work as an educational and advisory centre and is carrying on, with a large measure of success, investigational and research work towards the solution of many important and fundamental problems affecting Canadian agriculture.

The major projects in progress in the Division of Chemistry are distributed as follows:—

Investigational work with soils	7
" fertilizers	27
" feeding stuffs and fodders	9
" insecticides and fungicides	1
" sugar beets	1
" farm roots	3
" for the Meat and Canned Foods Disivion Health of Animals Branch	6
" with respect to the fertilizing value of rain and snow	1
" with respect to the water supply for farm homesteads	1
" for the Reclamation Service of the Department of the Interior	5
Total	61



Green Mountain Potatoes. Left, from certified seed 622 bush. 36 lb. per acre. Right, home grown seed 484 bushels.

THE DIVISION OF BOTANY

H. T. GÜSSOW, *Dominion Botanist*

Early History of Division

Before discussing the present organization and scope of work of this division, it would seem fitting to pay tribute to the late Dr. James Fletcher, the indefatigable pioneer in Canada of agricultural botany. Most older readers will remember his genial personality and good fellowship, while the Experimental Farms owe Dr. Fletcher a deep debt of gratitude for his interest and activity in winning such a host of friends to the whole system. He organized, and for so many successful years guided, the work in entomology and botany as related to agriculture, which he took charge of from the commencement of the Experimental Farms in 1887. Until, and even beyond his death in 1908, Dr. Fletcher's name was pre-eminent in Canadian entomology as well as in systematic botany, in which he so deeply interested himself.

Owing to the progress which both these branches of science made under so successful an administrator, the late Dr. Wm. Saunders, C.M.G., first director and founder of the Experimental Farms, decided, in 1909, that it would no longer be possible for a single officer to do justice to both departments of science so long united under one head. In that year, then, the Division of Entomology and Botany was divided into two separate ones, Entomology and Botany. The increasing demand for advice on phases hitherto only passingly included in the work of the parent division, the increase in administrative work, as well as the growing demand for further development of both the above sciences, appeared to make such a division very necessary in the interest of the general public.

More Recent Developments

Thus in July, 1909, on the appointment of the officer at present in charge of the botanical work, it fell upon him, guided by the valuable advice of so experienced an officer as the late Dr. Saunders, to organize the work of the Division of Botany along such lines as appeared best calculated to meet the demands of the farming public of Canada.

At first, aided by a single assistant and a somewhat too limited appropriation for the time being, it was necessary to provide all the physical equipment for a central laboratory, in which it would be possible to take care of any investigational work that required attention. Almost from the start, the work of the division fell into two principal sections.

There existed the demand, ever-growing, for accurate information on weed eradication and for the determination of the native plants of Canada, so ably begun by the late Dr. Fletcher, whose herbarium formed a most useful nucleus for the present division's collection of Canadian plants. This section of the work included charge of the extensive arboretum of the Experimental Farm at Ottawa, as well as the work relating to the improvement of fodder plants.

PLANT PATHOLOGY

It was found necessary to place on a firm basis one of the phases of the work which, during Dr. Fletcher's administration, had not received adequate attention, perchance because his tendencies inclined him more towards the study of insect pests, viz., the study of the diseases of plants, now more commonly known as plant pathology.

Among the first problems which arose was the finding, by the officer in charge of the new division, of a potato disease new to the Continent of America, yet widely prevalent and seriously destructive in Europe, viz., potato canker or wart disease, which was found in specimens submitted from Red Island, Placentia Bay, Newfoundland, the neighbouring and oldest crown colony of the Empire. This discovery, and the paramount duty to keep the Dominion of Canada free from a possible, and indeed, probable invasion of the disease, owing to the then considerable potato importations from Europe, called for prompt and effective action, clearly indicating certain lines upon which the work of the new division might profitably develop.

The Destructive Insect and Pest Act

It was then, on discussion and in consultation with the officer of the new Division of Entomology, the late Dr. Charles Gordon Hewitt, whose association with the writer will always be remembered because of its most agreeable and profitable character and because of his generous attitude towards the closest co-operation between the two new divisions, that the then Director sought and gained the interest of the late Hon. Sydney Fisher, Minister of Agriculture, relative to safe-guarding Canada's present and future interests by the promulgation of the destructive Insect and Pest Act, to which royal assent was given on May 4, 1910. This Act aims at preventing the introduction into Canada of any insect pest or disease destructive to vegetation, and took immediate effect relative to the importation into Canada of potatoes from Europe, Newfoundland and neighbouring islands.

To this Act may be attributed Canada's present comparative freedom from a good many plant diseases and insect pests prevalent abroad. In early co-operation with kindred authorities in the United States of America, where subsequently a similar Act was passed, this continent is well protected by legislation from the invasion of foreign pests and diseases.

Plant Disease Investigations

For some time after the formation of the division, its work was confined largely to the recording annually of the plant diseases met with and to giving advice on treatment and prevention as far as was possible under the circumstances. Eventually as the new officer in charge of the division became familiar with Canadian conditions and local problems, which, in so vast a country, seemed to materially change every few hundred miles, the division was organized and equipped for investigational and research work in plant pathology.

The first two problems that most forcibly impressed us at the time, concerned the European blister rust of white pine and the cause and nature of the disease known as rust or crown gall. The former disease, it was believed in 1909, had probably reached this continent with imported white pines from Europe. Although at that time no evidence could be found that such was the fact, later developments showed that the disease had, previous to 1909, reached these shores and existed more or less sporadically until at last it gave cause for considerable anxiety. The crown gall disease is one of interest to nurserymen and growers of young fruit trees. At first it was held that the disease was not of a serious nature; years later the cause became understood, and to-day, while we have even yet no evidence of its destructive character, we advise against the planting of young stock actually infested with these galls, which in reality are bacterial plant tumors.

From the date of organization, the central laboratory at Ottawa served as a bureau of information, inquiries reaching us regarding stock poisoning by plants, the control of weeds, of plant diseases, the indentification of native plants or requests for information on grasses and forage plants, etc., etc.

During the year 1912, the phase of the work dealing with fodder and forage plants, mainly confined to testing the comparative values of different varieties of plants such as clovers, alfalfa, grasses, etc., was transferred to a newly appointed officer placed in charge of a separate division, viz., that of Forage Plants, where this important work could receive undivided attention.

About this time, a peculiar disease developed in peach orchards in the Niagara fruit belt, and after several years' attempts to do justice to this problem at Ottawa—a region unsuitable for peach culture—it was realized that it was not sufficient to bring the orchards and their troubles, so to speak, into the laboratory, for it was principally the climatic factor which limited the success of such investigations at Ottawa, so it was decided that a branch laboratory should be established right in the fruit growing districts of Ontario, and, in 1912, the first plant pathological field laboratory opened its doors to the public at St. Catharines, Ont. This was found to be a most useful move. Fruit growers had expert advice right at hand. Our aims could be interpreted during personal contact; and the knowledge gained by us of the practices of fruit growing on a commercial scale, was as useful to us as it must have been to the growers to have special knowledge available to them. Thus was entered upon a policy of immediate application of scientific knowledge relative to the investigation and control of plant diseases to the practical problems confronting an important industry.

Co-operation with United States Investigators

During these years, repeated intercourse was held with the American authorities and experts on plant diseases. It is with considerable pleasure that we record here the many—and it is hoped mutual—advantages that were gained from this close co-operation. This spirit of co-operation is especially manifest in the mutual protection which it affords both countries through the identical aims set forth in the protective legislation affecting plant diseases. It is obvious that two countries so situated as are Canada and the United States of America have everything to gain from a close co-operation, from an exchange of experiences and from other mutual assistance, especially as concerning applied sciences and many instances could be referred to of the benefits resulting from such intercourse.

Another disease which had escaped attention on the Continent of America, namely, silver leaf disease, was first located, in company with Professor Smith of Truro Agricultural College, in the fall of 1911. Later investigations showed that this disease was widespread in Canada and was also present in the United States. In England, the disease is regarded as one of the serious obstacles in orchard culture, attacking, as it does in Canada, apple, pear, plum, peach, and a variety of other fruit crops. The disease was again studied here, and measures relative to its control have been suggested.

Probably the most important crop of Canada is the grain crop, with its large share of diseases. A careful study of the smut diseases affecting cultivated plants was made, and the results were issued in bulletin form. This bulletin, judging by the favourable criticism throughout Canada and elsewhere, has conveyed to the grain producers the information which they urgently required. By means of careful treatment of seed—an application of a method discovered many years ago—it is possible to eliminate almost entirely the great damage done by this disease.

From year to year the scope of the work along plant pathological lines increased. It became necessary not only to co-operate with the United States of America in reference to plant disease legislation, but to enter into a careful discussion of a policy of sound international legislation to which a country like Canada looked with considerable interest because of its dependence upon importations from abroad of nursery and other stock for propagation. An opportunity was afforded to present the views and requirements of Canada on the occasion of an International Phytopathological Conference held early in 1914 in Rome, and subsequently at a similar conference at Wageningen, Holland, in 1923, to which the Dominion Botanist was selected as Canadian delegate. The outbreak of the World War unfortunately postponed the going into effect of certain measures unanimously agreed upon at the first conference.

Inspection Service

In the year, 1912, the divisional chief discovered the presence of a potato disease resembling, somewhat, common scab, but which was recognized as a disease of European origin, viz., powdery scab. The discovery of this disease had a most curious effect, inasmuch as it resulted in an actual embargo being placed by the United States authorities upon importations of Canadian potatoes. However, the United States had produced that year the largest potato crop in its history, which fact in itself would have curtailed, if not inhibited, the Canadian export trade and the year after modifications of the regulations were secured after considerable negotiations, the outcome of which was the inauguration of an inspection and certification service of potatoes for export to the United States. The carrying out of this system of inspection fell within the scope of the Destructive Insect and Pest Act, and thousands of carloads of potatoes, certified to be reasonably free from powdery scab, once more passed the border. So far this solution proved satisfactory, inasmuch as it once more permitted the export trade of the Maritime Provinces, which were the most seriously affected by the embargo. From the plant pathological point of view, this solution was not satisfactory to Canada as a whole, since it resulted in the export of a superior grade of potatoes and the retention in Canada of diseased potatoes barred by the export regulations.

It was obvious, then, that there existed a very live problem, viz., the eradication of powdery scab, and this problem was at once attacked by a vigorous campaign of an educational character. Indeed, this occurrence was largely responsible for the establishment of two more field laboratories in 1915, one at Fredericton, N.B., the centre of the maritime export trade, and the other in Charlottetown, P.E.I., also deeply interested in the American markets. There were begun at once a series of co-operative experiments aiming at the control of this disease throughout Eastern Canada, the West being almost entirely free so far.

Success attended these efforts. In a few years' time, our experiments had to be discontinued for lack of infected tubers. Powdery scab is now only occasionally encountered. At present, the former free intercourse of trade in potatoes with the United States has been re-established, although a high tariff exerts its influence on the quantities exported.

We should not omit to chronicle here the remarkable development which resulted from the discovery of this disease, which gave rise to an endeavour towards production of potatoes free from diseases, or as free as possible, by the organization of a general potato inspection and certification service in which the Dominion authorities took the lead.

As a consequence of the close attention to potato production, there were recognized a number of constitutional diseases, principally "mosaic" and "leaf roll", which formerly had escaped notice. These diseases are not recognizable in the seed tuber, which appears quite healthy, yet, when tubers resulting from diseased hills are planted, there is manifest a reduction in yield of from thirty to forty per cent. It is doubtful whether the presence of these diseases would have been discovered at such an early date had it not been for the compulsory examination of potatoes for export to the United States, and the subsequent field work. Briefly, this inspection work consists of one or two examinations of the growing potatoes in the fields, the determination of the absence or presence of diseases, purity of variety and other more incidental, though useful, factors. This field crop inspection is followed by a tuber inspection of the harvest, in which is principally aimed at the elimination of disease visibly affecting the seed tuber, such as scab, black leg, wilt, etc.

This system of inspection has attracted considerable attention from producers as well as from provincial authorities. Gradually the system has been extended from province to province, aiming at uniform standards of quality throughout, and the results obtained would indicate that, even in competition with the United States, Canada has established her good name as a seed potato producing centre to which, sooner or later, our neighbours to the south will have to turn. At any rate, the object is to stimulate the production of seed potatoes free from disease and of high yield, with good prospects of Canada retaining the lead in this industry.

The inspection system has now extended from the east as far as, and including, Alberta. In British Columbia, the division carries on this work in close co-operation with the provincial government.

In 1923, 9,681 acres of potatoes were inspected, of which 7,099 acres produced seed of a very high quality.

The Grain Rust Problem

The year 1916 will long be remembered in the annals of Canadian agriculture owing to the occurrence of one of the most serious epidemics of rust of wheat. This rust—black stem rust—caused a loss of yield estimated at about $50,000,000 to $100,000,000. The seriousness of this loss was emphasized owing to war conditions when every ounce of food was needed.

While the division had endeavoured to issue from time to time information relative to the most reasonable methods for the reduction of losses from rust attacks, this epidemic was made the subject of a very exhaustive inquiry, the results of which were used to enphasize the necessity of co-operative research into the rust problem as affecting the Dominion of Canada. As a result there were equipped, in 1917, two new field laboratories, one at Brandon, Man., and one at Indian Head, Sask., and work along these important lines was begun.

It must be remembered that the grain rust problem has been approached from many aspects all over the world, the goal, i.e., freedom from rust of cultivated grain, or the discovery of one or more useful resistant varieties, or even a thorough knowledge of how to protect the grain crop from serious damage by rust, is a most tempting one, and a large number of investigators are spending their entire time on the solution of the problem—which is so truly one of the most important ones, not to the farmer alone but to humanity in general.

From time to time there have been brought to our attention so-called indisputable claims from persons who state they have succeeded in controlling rust by seed or soil treatment. Whenever their directions were tested no results whatsoever in support were found. The rust problem will have to be solved, if it can be solved at all, by painstaking, scientific research of as co-operative a character as possible. At the present time, this work is being carried on in co-operation with the Dominion Experimental Farms at Brandon, Morden, Indian Head, Rosthern, Scott and with the Universities of Saskatchewan and Alberta. The Manitoba Agricultural College, Winnipeg, especially brings much useful interest and assistance to bear. It is hoped that useful results may be obtained from the observation of the remarkable degree with which varieties of grain may be affected by rust. In durum wheats the rate of infection varies, according to the variety, from three to forty per cent; in common wheat, which includes our most important varieties such as Marquis, Red Fife, etc., susceptibility varies from thirty-two to sixty-five per cent; the emmers are uniformly resistant, showing infection of not more than one per cent, in tests made in common with the above. A selection made by Prof. W. P. Thompson of the Saskatchewan University, from the durum wheat Iumillo, remained altogether free from rust.

Subsequent to the establishment of the field laboratories, arrangements were made through the courtesy of Saskatchewan University, Saskatoon, and the Manitoba Agricultural College, Winnipeg, to establish two laboratories at those institutions in charge of Dominion officials, both of which devote their attention principally to cereal pathology.

It has been previously pointed out that the variation of the climatic and general physical conditions within the Dominion causes peculiarly local problems, inasmuch as these conditions favour certain branches or systems of horticulture or agriculture. For instance, the problems in the orchard regions of Eastern and Western Canada differ considerably. In the East, certain diseases are prominently interfering with the production of certain fruits, while these may not even exist in the West; this area has its own specific troubles. Among the principal diseases which cause concern to the fruit growers in the West is fire or pear blight, caused by bacterial organisms. This disease, no doubt, were it allowed to continue its ravages, would soon seriously interfere with production. Other problems of a local or regional character are also receiving close attention. Fruit growers in certain localities of British Columbia suffer severe annual losses from various causes, such as internal breakdown of apples, drougth spot, water core, etc. These troubles require very careful study, such as the determination of factors controlling picking maturity of fruits, a determination of the effect of leaching of soils due to irrigation, and similar physiological factors involved in the translocation of food materials from the leaves, before these are injured by frost. Advice in regard to these troubles was urgently needed, but owing to their obscure nature, a thorough inquiry had first to be conducted, and eventually, in 1921, there was established at Summerland, B.C., a further laboratory to supply the needs in this direction to the communities concerned.

In Nova Scotia, in connection with the Experimental Station at Kentville, a plant pathological centre has been authorized and will soon be in working order. One of the problems in Nova Scotia is apple scab, which seems to thrive under the existing conditions.

The Results and Value of the Work

In the preceding paragraphs, we have briefly dealt with the evolution, the general work and the organization of the division. The direct value of the work performed in the interests of agriculture in Canada is difficult to express in exact figures. Advising the general public along lines of plant disease prevention has shown the best results. Naturally, the first essential factor is the knowledge of those diseases and how to recognize them as early as possible; this permits of directions relative to control or prevention. For this purpose, the staff of the division are at all times eager to avail themselves of an opportunity to address meetings of interested people, to explain to them the importance of plant diseases generally and to discuss any specific or local problems. Numerous farmers' meetings are attended for this purpose, and farming centres or communities desiring at any time such assistance, especially during the winter months, will be gladly accommodated by the members o fthe staff all over the Dominion.

Yet, invariably, theoretical teaching cannot be so convincing as practical demonstration. It is of value to tell the general public that it is possible to prevent plant diseases; we have found it of far greater value to demonstrate disease control right among the farmers' own crops. Many are ready to reflect adversely upon any kind of work performed under government auspices, since, it is held, anybody can achieve such successes with the finances of the whole country behind them. This is just the very opinion which induced us to demonstrate the economic value of disease control, to show that at very little cost, with no more expensive apparatus than any individual farmer either already possesses or can easily afford to purchase, a disease may be controlled under his own conditions of farming. These demonstrations tell their story in a very tangible form. The experience with one farmer, rather sceptical towards prevention of late blight in potatoes by spraying, is one case in point. He grew forty acres of potatoes and never sprayed. Late blight, he claimed, did not do much harm. We offered to spray, as it should be done, one acre of his field and let the others go, if he himself did not care to spray. This he agreed to, providing labour and materials, of which a careful expense account was kept. At harvest time we secured, after paying all expenses, thirty-seven bushels more from the treated acre than the average yield from his thirty-nine acres not so treated. In some other similar cases, the increase secured by spraying was over sixty bushels per acre. The year after, he was the first applicant for spraying demonstrations, demanding that we should treat all his forty acres, which was not the object of the lesson. In this manner the use and value of potato spraying soon became more generally recognized, and a good many power spraying machines were sold in districts that had not heretofore known the value of spraying. In like manner, one might quote instances, in other directions, of stimulating community effort with far-reaching results.

The aims of the plant pathological work of the division, then, are, principally, the control of diseases causing financial losses. Far more money is so lost than is generally realized. Smut diseases of grain are annually responsible for losses amounting to millions of dollars. It is true that the majority of farmers now treat their grain with formalin or bluestone to prevent this smut, yet those who do not practice treatment, shoulder a loss. Potato blight, another destructive disease, causes the loss of more than ten million bushels of potatoes almost every year. At the cost of very few dollars per acre this might be saved. The list of diseases is headed by rust as a destructive agent in almost every country where grain is grown. In the latter instance it has not yet proved possible to prevent this enormous loss, but the researches of the Division have already found ways of lessening it.

Another phase of our work deals with the prevention of diseases reaching the Dominion of Canada from abroad by means of importation of commodities like potatoes, corn, nursery stock, etc. As has been referred to, early in 1909 there existed grave dangers through the importation of potato canker from Europe. Fungi introduced into new environments may do an immense amount of damage. During recent years some very hard lessons had to be learned as a result of such invasions. The chestnut bark disease suddenly appeared in the United States, for instance—no doubt imported from the Orient—and within a few years depleted that country's resources of chestnut trees almost entirely.

We are experiencing at present the results of an invasion of European white pine blister rust. This rust came from Europe apparently some twenty years ago. Whether our efforts in preventing the spreading of the disease into Canada's valuable white pine area will be successful, only time will tell. Indications in the United States would justify the viewing of the situation with considerable alarm; yet conditions under which this disease proved destructive there are not general in Canada.

The potato canker causes annually considerable losses in Europe; if it should ever become established in Canada, eventually the area now under potatoes might have to be doubled to yield anything like the harvest enjoyed at present.

The safest means to protect Canada from such insidious enemies is the prohibition of the importation of vegetation or vegetable matter from abroad, or at any rate to carry on a close inspection of all incoming vegetation, which in future is only to be admitted if accompanied by certificates issued by an authorized official of the exporting country, stating that the consignment concerned had been inspected before shipment and been found free from disease.

Eventually, it is hoped that international efforts will be made to unite in prohibiting altogether the export of any diseased matter from one country to another. As soon as such a measure comes into effect, the expense now incurred in inspecting imported material for diseases, which affords doubtful protection at the best, might be devoted with greater advantage towards disease control within our own borders. These are some of the aims of the division in its work under the Destructive Insect and Pest Act.

The main experimental work is done in the field laboratories, which uniformly have the advantage of being situated in important centres, and most of which have the further advantage of the use of land for such purposes.

The central office in Ottawa maintains a scientific staff of specialists, each in some particular phase of plant pathology, such as forest pathology, bacterial diseases of plants, and general mycology. The executive work has increased very largely as the outside work of the division grows. All expense accounts, purchases, supplies, and general office work, passes through this office from its field stations.

While encouraging spontaneous research by all its officers, this office is charged with the duty of supervision and co-ordination of efforts in order to use to the best advantage material and resources.

Visitors from at home and abroad are always welcome, and an opportunity to render professional services along the lines indicated is always appreciated. In further developing the work, and by reaching more members of the farming community of Canada, it is hoped the work of the division will serve to raise crop production, through elimination of plant diseases, to the highest level possible under up-to-date farming conditions.

ECONOMIC BOTANY.

The activities of this subdivision may be considered under the following heads: (1) Present Lines of Work; (II) Equipment; (III) Results of Climatic Tests; and (IV) Survey of Canadian Weeds.

Present Lines of Work

1. A considerable amount of time, particularly during the summer months, is devoted to correspondence of an advisory nature. This has to do with such subjects as the eradication of weeds, the culture and sale of medicinal plants, literature dealing with the wild plants of Canada, etc. In addition, articles for publication in the Press and in "Seasonable Hints" are prepared from time to time, dealing with some topic of interest to farmers. Various bulletins and circulars have been issued by this Division dealing with flax cultivation, medicinal plants, eradication of weeds, poisonous plants, wild rice and spraying weeds with chemicals.

2. Plants are received from all parts of Canada for identification, with requests for information as to whether they are noxious or poisonous weeds, or have medicinal value, or have any economic importance and whether certain wild fruits are edible or poisonous.

3. Each year an exchange list of seeds collected during the season and available to those who wish to experiment with them, is prepared. This list contains, on the average, about five hundred species, and is sent to all the leading botanical gardens in the United States, Brazil, Argentine Republic, Uruguay, South Africa, New South Wales, Java, Japan, Ceylon, and most of the countries of Europe. By means of this exchange system, we are able to procure in return, seeds of any species of plants that might be suitable for cultivation in the climates of Canada.

Equipment

To facilitate the identification of plants, many of which are received in a fragmentary condition, a herbarium of mounted specimens is of great service. Our collection is fairly extensive, numbering nearly six thousand specimens. In addition to the dried specimens there is a cabinet containing a large number of seeds of Canadian plants preserved in bottles.

Also attached to this division there is a botanical garden and arboretum, covering about sixty-five acres and containing about five thousand specimens of trees, shrubs and herbaceous plants, both Canadian and foreign. These are tested for their ability to stand the climate of Canada, and furnish a basis for the exchange list of seeds sent out annually. A special section has been set aside for a botanical garden containing only the wild plants of Canada grouped according to their proper families. Altogether one hundred and twenty plots have been laid out, and a beginning was made in planting these during 1921. In addition to these there is another set of one hundred plots devoted to experimental and climatic tests.

As an adjunct to the botanical garden there is a small greenhouse for experimental work and for growing plants in pots, which are set out, as soon as they are properly established, in the plots specially prepared for them.

Results of Climatic Tests

Flax.—The culture of flax for fibre purposes was undertaken by this division for several years before the establishment of the Economic Fibre Division. The year 1916 was the last devoted to experiments with this plant. Samples were submitted to the Ontario representative of the York Street Flax Spinning Company of Belfast, Ireland, who pronounced them to be the best flax he had yet seen in Canada.

Hemp.—This crop was grown both for seed and fibre during several seasons. The length and quality were both satisfactory, but some difficulty was experienced in the retting. A sample of the fibre was manufactured into twine by the Doon Twines Company of Ontario. In other plots the season proved to be sufficiently long to ripen the seeds satisfactorily.

Sunflowers.—A tall Russian variety has been grown for several years. Some of the plants attained a height of ten feet, and a considerable number of ripe seeds were obtained from each head. Care has, however, to be taken in drying the seeds quickly, as owing to the amount of moisture in the heads they are liable to become mouldy.

Soy Bean.—Four varieties of this plant were grown for several years and each year a good crop of seeds was obtained. The seeds of this species are claimed to be very nutritious, and the oil is used for soapmaking and other commercial purposes. Several samples were analyzed by the Dominion Chemist, who found the oil content to be slightly over twenty per cent.

Castor Oil Plant.—Several varieties of this plant obtained from the United States, Holland and Russia, ripened a considerable number of seeds each year for several years. The oil content of the whole seed was determined by the Dominion Chemist as ranging from thirty-nine to forty-seven per cent in the different varieties. The chief drawback to the culture of this plant lies in the fact that the seedpods when ripe burst successively and scatter the seeds around the parent plant. However, a large-seeded variety has been procured and grown satisfactorily for the last two years, in which the seedpods remain on the plant and do not open.

Mustard.—Several plots of both the yellow and black mustard seed were grown with satisfactory results. The black variety is, however, a difficult crop to harvest, as the seeds escape so readily from the pod. Samples of both varieties were submitted to one of the leading mustard manufacturers in Canada, who reported as follows: "The yellow mustard seed has a fairly good flavour, but not as good as the standard English, which we consider the best. The black mustard shows good volatile strength and good flavour, and, to our mind, equals the best that is grown."

Chicory.—A variety of this plant known as "Large Magdeburg" was tested and grew well, some of the fresh roots weighing as much as two pounds each. A sample was sent to the Dominion Chicory Company for examination, whose report reads as follows: "We received the samples of chicory root, and after examining and testing them thoroughly we find that they are excellent in every way."

Broom Corn.—Several varieties have been experimented with, but either they did not ripen seeds satisfactorily or the "brush" produced was too short for commercial purposes. One variety, however, was secured which has ripened seeds perfectly each year for the last three years. Seed was selected from this variety which gave a "brush" length of twenty-seven inches.

Other Plants.—Climatic tests have also been made on opium poppy, belladonna, peppermint, fenugreek, anise, dill and other medicinal plants, with satisfactory results in most cases.

Survey of Canadian Weeds

In the course of correspondence and travel in connection with our work, much information is obtained on the distribution and prevalence, as well as the spread, of weeds. We are trying to bring this information together in a form in which it will be readily available for reference; and at the same time, by questionnaire and other means, we are getting farmers and others to give their observations and experience in weed matters also. Some thousands of such reports on the weeds of localities all over Canada are now on file, and will soon indicate fairly reliably how far the commoner weeds have spread and under what conditions of soil, moisture, climate, and cropping or farm practice they are proving troublesome. We are thus enabled to make our advice to farmers more applicable to local conditions, and are also made aware of the points on which there is conflict of opinion due to imperfect knowledge of the facts, which we can then undertake to investigate further. The striking differences often existing in adjoining areas are well shown in the soil and moisture preferences of perennial sow thistle and Russian thistle, a locality badly infested with one having no serious trouble with the other.

In conclusion, and in order that some idea may be gathered of the present activity of the division in the realms of research, brief reference is here made to the number of projects under way in the lines of work detailed above:—

	No. of projects
(a) Forest Pathology	10
(b) Fruit Disease Investigations	40
(c) Grain Disease Investigations	40
(d) Vegetable Disease Investigations	70
(e) Miscellaneous Investigations	10
Total	170

THE DIVISION OF AGRICULTURAL BACTERIOLOGY

A. G. Lochhead, Ph.D., *Bacteriologist*

This division, representing the most recent specialization of the activities of the Experimental Farms Branch, was created in 1923 for the purpose of giving special attention to those matters in agricultural research which bear specially upon the science of bacteriology. In connection with every phase of agricultural practice, problems arise which have a direct relationship to the activities of micro-organisms, and so this division is endeavouring to assist the others in their investigational work by co-operating in their special problems of research which are essentially bacteriological in character.

Prominent among these are:—

Animal Husbandry: Pure milk production and maintenance, manufacture of dairy products, special phases of animal husbandry problems leading to studies of health of animals.

Horticulture, Field Husbandry, Cereal Husbandry, Forage Crops: General, soil fertility, action of fertilizers, legumes and soil inoculation, manufacture of silage, preservation of foods and food-stuffs, baking.

Apiculture: Diseases of bees.

Poultry Husbandry: Sanitation, health of poultry, incubation.

Fibre Production: Retting of textile fibres.

The above serve to illustrate some of the diverse problems of agriculture directly related to bacteriology and for the solution of which specialized bacteriological methods are necessary. With the establishment of this division it is hoped that, by providing means for attacking many such problems from a new angle, a useful complement to the co-operative work of the Chemical and Botanical Divisions will be supplied.

A beginning was made this year in equipping a bacteriological laboratory at the Central Farm which was ready for occupation in September, 1923. The laboratory staff consists at present of two, and the work done may be divided into two kinds—routine and extension, and research. The former consists in the examination of miscellaneous samples of water, milk and dairy products, food stuffs, etc., submitted for analysis, and (in future), in the preparation and distribution of nitro-cultures for legume inoculation.

With regard to the research work, investigations have already been commenced in co-operation with several of the other divisions. The chief experiments at present under way deal with pure milk production as regards sources of contamination, and with the retting of textile fibres. For the immediate future, a series of studies have been planned on milking machines, from the sanitary standpoint.

Now that a beginning has been made, it is expected that, as facilities improve and this Division establishes more numerous points of contact with the other divisions, increased assistance will be given, through laboratory and field investigations, in coping with some of the problems of practical agriculture which are pressing for solution.

Marquis Wheat—On left grown on fallowed land; on right is spring ploughed stubble. Illustration Stations. Pambrunm, Sask.

THE DIVISION OF ILLUSTRATION STATIONS

JOHN FIXTER, *Chief Supervisor*

For the past thirty-five years, the Dominion Experimental Farms Branch has been investigating problems relative to the soil, its cultivation and productivity, and making varietal tests of the different classes of cereals and forage crops, under a wide variety of soil and climatic conditions. During this time a great deal of information of practical value to the farmer has been gained relating to rotations, crops, cultural methods and the necessity of the timely performance of the various cultural operations. Having this information for dissemination, the necessity of having organized bodies of farmers to act as channels for the introduction of these new practices was realized. To accomplish this, the Division of Illustration Stations was established, to co-operate with the farmers in districts remote from the Experimental Farms, and to carry to them, in a practical, demonstrational form, the results of the experiments and researches as made available by the Experimental Farms themselves.

To demonstrate the usefulness of these practices, crops and rotations, Illustration Stations were established by the Experimental Farms Branch in the different provinces, starting first in Saskatchewan and Alberta in 1915. The value of this work was so strongly felt that the Division is now operating eight stations in Prince Edward Island, seven in Ontario, four in Manitoba, fifteen in Nova Scotia, sixteen in New Brunswick, thirty-five in Quebec, twenty-four in Saskatchewan, thirteen in Alberta, and fourteen in British Columbia, or, in all, 125 stations. In carrying out this work, the owner of a farm, when chosen, co-operates with the department, and, on a small rental basis, sets aside a certain area, varying from 10 acres to 50 acres, for demonstration purposes. In return, the farmer carries on such rotations, grows such crops, and performs such cultural practices as are deemed necessary by the department to stimulate greater and more economic production.

Rotations

Due to soil and climatic variations, of necessity the methods, crops and rotations demonstrated within the respective districts, correspondingly vary to meet the problems of those districts. In present-day agriculture, the lack of system and indifference relative to the work of producing crops are strikingly evident. Hence the first work undertaken on the establishment of an Illustration Station within a district is to divide the land selected into definite areas. In Quebec, New Brunswick and Nova Scotia, usually a four-year rotation is established as follows:—

FIRST YEAR. Hoed Crop—Land ploughed shallow as soon as hay is removed; cultivated; ploughed in the autumn. Manured.

SECOND YEAR. Grain—Seeded down 8 pounds red clover, 2 pounds alsike, 10 pounds timothy.

THIRD YEAR. Clover Hay—First cut clover hay. Second crop for red clover seed or clover hay.

FOURTH YEAR. Timothy hay or pasture.—To be prepared for hoed crop as soon as hay is taken off.

Careful accounts are kept of the hours work of performed on each crop; in this way its cost of production is ascertained. On the casual observer and on the farmers of the district, the first impression we wish to create is the importance of system and the necessity of keeping farm accounts.

Stimulation of Better Cultural Methods

The successful cropping of land is dependent upon favourable soil conditions. Plants, to grow, require ease of root extension, moisture, air and also that competitive plants be destroyed. The difference between satisfactory and unsatisfactory yields can often be traced to the quality and timely performance of these tillage operations. While quality of operation is essential, economy is also necessary. Thus the use of larger fields, more horses and wider machines is always encouraged on the Illustration Stations, as a means of obtaining efficiency and economic production.

To pulverize the soil completely and to bring about those conditions which are necessary for maximum production, the plough plays an all-important part. The value of the plough, and the time of year the land is ploughed, are not appreciated and, too often, crop failures may be traced directly to the careless and untimely performance of this operation. This season, on the Illustration Station at Bassin du Lievre, this fact was clearly demonstrated, a 3¼-acre, heavy clay field was taken, one-half was fall-ploughed the other was spring-ploughed. The portion that was fall-ploughed gave a yield of 30¼ bushels per acre, whereas the crop from the spring-ploughed land was practically a failure. Many such losses are suffered, particularly in dry seasons, due to delayed ploughing, to careless and inefficient rolling, harrowing, discing and cultivating. By using larger machines, and more horses, more work can be done in a given time; on the Illustration Stations we are demonstrating the necessity and practicability of this.

Stimulating Clover Seed Growing

Not until after the establishing of the Illustration Stations was red clover seed produced commercially in the province of Quebec. In New Brunswick, Nova Scotia, and in Prince Edward Island as well, good crops of red clover seed have been harvested from the second crop of clover, when the season is such that the clover gets an early start and the first crop can be cut by the last week in June. Otherwise, it is best to pasture up to the middle of June and to harvest seed from the first crop. In northern Ontario we find that best results are obtained when the first crop is harvested for seed. The system followed on the Illustration Stations in the western part of the province of Quebec, southern and eastern Ontario, is to cut the first crop early, not later than the last week in June, to be exact, when the secondary shoots start at the base of the plants. Care must be taken to cut high enough not to destroy these secondary shoots. Red clover seed has been successfully grown on the stations at Aubrey, Stanbridge East, St. Julie, St. Clet, Lachute, St. Casimir, Plessisville, Pierreville, Campbell's Bay, New Carlisle, and Woodstock. From these centres, clover seed growing on a commercial basis has extended into the surrounding districts.

In the district surrounding the Illustration Station at St. Clet, which was established in 1919, clover seed growing has been taken up quite extensively. A clover huller has been purchased by the operator of the Illustration Station, who grew five acres the first year, eleven acres the second year, and the third year threshed thirty acres. On the Illustration Station operated by Mr. Sam. Reddick, at Aubrey, clover seed has been successfully produced four years out of five since its establishment in 1916. In 1919, he harvested 2,700 pounds of red clover seed at a cost of six cents per pound netting him a clear profit of \$1,377. Up to the time the station was established he had never grown clover seed. The possibilities of this work extended into the surrounding district to such an extent that, in the same year, the secretary of the farmers' club reported that \$40,000 worth of seed was sold co-operatively through their association.

Tile Drainage

To reclaim to more profitable production those lands that are wet and cold and the heavy clays that are stubborn to till through lack of drainage, a special effort is being made to demonstrate the usefulness and possibilities of under-drainage, on certain Illustration Stations situated in such districts.

At Stanbridge East a four-year rotation on drained land is being operated alongside a four-year rotation on undrained land. Yields and costs are recorded on both rotations so as to determine and demonstrate the gains that are to be had from underdrainage and the returns that would accrue to others who might undertake similar work in the district.

Five years' average results taken from the Illustration Station show that the tile drained land has given an increased yield over the undrained land of $2\frac{1}{2}$ tons of ensilage corn per year, 9.3 bushels oats per year, 1,440 pounds clover hay per year, 900 pounds timothy hay.

These figures clearly show that in such districts tile drainage is profitable. The scarcity of labour and cost of transporting tile have seriously held up progress in this direction. Now that conditions and prices are again becoming normal, the installation of drainage systems will again be within the reach of the farmer.

Applying the Practice of After-Harvest Cultivation

The practice of after-harvest cultivation is being demonstrated on all the Illustrations Stations in Quebec, New Brunswick and Nova Scotia as a profitable means of preparing sod land for hoed crops, particularly when such land is to be seeded with grain, clover and timothy the following season. There are also many farmers who find it impossible to handle in hoed crop all the land they wish to seed down; for such also, after-harvest cultivation is a recommendable means of decomposing old sod, of destroying weeds and insects and pulverizing the soil in preparation for the seeding of grasses and clovers.

When preparing sod land for hoed crop, the system followed and found successful on the Illustration Stations is to plough shallow as soon as the hay is taken off, roll the land immediately after ploughing, so as to firm the soil and hasten decomposition of the sod, and disc and cultivate at regular intervals, frequently enough to keep down all green growth. Instead of ploughing stubble as soon as the crop is taken off, the practice of cultivating or discing thoroughly has been found satisfactory, provided the land is kept well cultivated throughout the autumn. Prior to freezing up, all land, whether it was disced or shallow ploughed, should again be fall ploughed, and to a depth of five or six inches or deeper, depending on the nature of the soil.

To cite the returns from one of the Illustration Stations, two four-acre fields were chosen, the first was ploughed shallow early in August, cultivated frequently during the autumn and ploughed late in the fall. The cultivated plot yielded 180 bushels of oats and the uncultivated plot yielded 120 bushels. The land on the cultivated plot was completely pulverized and was almost free from weeds. On a similar demonstration with mangels, the cultivated plot yielded $2\frac{1}{2}$ tons more than the uncultivated. This practice has gained considerable favour in the centres surrounding the Illustration Stations and, when passing through the district, one can readily see after-harvest cultivation being applied on other farms.

Introducing Mangels and Turnips

Old, worn-out meadows are too common a sight, the result of a one-crop system. Such a system is unsafe economically because it is too dependent upon crop and market conditions and does not maintain fertility. The fallacy of this system, of times, is not appreciated, with the result that in many sections of Quebec, New Brunswick, and Nova Scotia, productive lands are going back to cedars and balsams through lack of tillage. The reclamation of these lands to profitable production can best be accomplished by mixed farming practices, the use of hoed crops and early after-harvest cultivation. In many of these districts, the belief is held that root crops cannot be grown profitably under their conditions. Thus the work of the Illustration Station takes on two forms: first, the demonstrating of methods that will reduce hand labour, and second, the extension of the root growing areas. At a public meeting held in Portneuf county, prior to establishing the Illustration Station, the opinion voiced was that mangels, turnips and corn could not be grown in the vicinity of St. Casimir. The following year an Illustration Station was started there. Since that time quite satisfactory crops of each have been grown. Mangels have yielded $15\frac{2}{3}$ tons per acre, turnips $16\frac{1}{3}$ tons, and ensilage corn 12 tons per acre, on an average for the three years. These yields would have been higher had it not been for the dry season of 1921. With the idea of introducing and improving the cultural practices relative to these three crops, the growing of one, or all of them, is being demonstrated on all the Illustration Stations in Quebec, New Brunswick, and Nova Scotia. In Nova Scotia, on Cape Breton Island, an Illustration Station was established at Big Baddeck on a seventy-year-old sod. After giving a crop of grain and practising harvest cultivation, Mr. Kiley, the operator, produced a twenty-five ton crop of turnips. The cases cited represent thousands of acres of similar lands. It is along these lines that the Division of Illustration Stations is trying to demonstrate successful methods of solving this worn-out land problem.

Introducing New Varieties and Sale of Seed

The results of experiments clearly show that many districts are not growing the varieties of wheat, oats, barley, forage crops, etc., that are best suited to their soil and climatic conditions. A great deal of valuable information has been gathered on the different Experimental Farms, not only in the testing of old varieties but also in the establishing of new. Those found most suitable, both old and new are sent out from the Experimental Farms to the Illustration Stations located in the different provinces. In this way, the Illustration Station serves as a seed centre from which surrounding farmers may buy seed at a moderate price and supply themselves with the varieties best suited to their locality. A number of the operators are now growing registered seed and disposing of it through the Canadian Seed Growers' Association to outlying districts.

The uniformity and suitability of these varieties have attracted considerable attention, and because of their productivity, are replacing the old varieties grown around these centres. The operators of the Illustration Stations in both the East and the West are finding ready sale for this seed, individual local sales ranging from 50 to 700 bushels having been made. Walter Tait, operator of the Illustration Station at Meota, Saskatchewan, writes:—

"I will be able to sell all the grass seed I have for sale as there are a lot of people asking for it. I cannot supply the demand for Marquis."

The quality of the seed is further emphasized by the fact that the only two operators, Mr. Walter Tait, Meota, Sask., and Mr. Hugh Hill, Lloydminster, Sask., who exhibited seed at the Chicago International Exhibition in 1921 ranked with those winning honors. In exhibits of farm produce, Mr. Traversy, Pierreville, Que., won four firsts and three seconds. These are only a few of the many operators who annually win honours in their local seed and crop competitions.

Introducing Indian Corn and Sunflowers

The value of Indian corn, as a succulent food for live stock has long been appreciated in the old established dairy sections of the east. While many others realize its value many, likewise, hold the view that it is not a suitable crop for their district because of soil and climatic conditions. By selecting suitable varieties, experiments show that corn and sunflowers may be much more widely grown in eastern Quebec, New Brunswick, Nova Scotia and Prince Edward Island than is the case at the present time. This fact has been demonstrated at the Illustration Stations in the Metapedia valley. At New Carlisle, New Richmond and as far east as Prince Edward Island, 14 tons 1,040 pounds of ensilage corn per acre have been grown. After demonstrating the possibilities of corn growing in Levis county, Mr. Cantin, operator of the Illustration Station at St. Jean Chrysostome, built the first silo in the municipality. There are, nevertheless, certain districts, such as the Lake St. John and Northern Quebec, where corn does not prove fully adaptable. Here sunflowers for ensilage now give great promise. Thus in the illustration work with these two crops in the eastern provinces, an attempt is made to determine how successfully each can be grown in a district, and in places where corn cannot be so grown for ensilage purposes, to encourage the growing of sunflowers by demonstrating on the Illustration Stations the most successful manner of handling the crop.

In the western provinces, work with sunflowers started in 1916. They were first grown on a small scale to determine the growth they would make and what state of maturity they would reach in different localities. In 1917, corn was introduced into the rotation with the view of lessening the amount of land under summer-fallow. A two-year rotation was started, alternating wheat and corn in comparison with a two-year rotation of summer-fallow and wheat. In 1919, the corn field was divided, planting corn on one half, and sunflowers on the other, thus comparing the two crops in a two-year rotation with wheat, against wheat and summer fallow. This demonstration has aroused considerable interest, but the comparisons have not extended over a sufficient period to permit of reliable deductions as to the value of an inter-tilled crop as a substitute for summer fallow. However, both corn and sunflowers are now being grown on a much larger scale for ensilage purposes, on fields of from ten to twenty acres.

During the summer of 1921, eleven Illustration Station operators in Alberta and Saskatchewan excavated trench silos and two others put up crib silos. A field of corn and sunflowers and a silo is now the aim of many farmers who formerly had little faith in these crops in their districts.

Demonstrating the Method of Construction and Use of the Trench Silo

As the growing of corn and sunflowers gains in popularity, a corresponding interest is taken in silos and their construction. Finding that the trench silo was proving satisfactory, an effort was made during the summer of 1922 to encourage as many as possible of the Illustration Station operators in Alberta and Saskatchewan to excavate silos of this type. When locating the site for the trench, it was planned to have it convenient to the buildings, on high ground, protected from the prevailing winds if possible. The size of the trench varied with the number of cattle to be fed, and on the amount of feed available for silage purposes. The height and width should be fairly constant; those on the Illustration Stations varied from seven to eight feet in depth and from ten to fourteen feet in width. The length may vary to meet individual requirements. When excavating the trenches at the stations, the work was done with the plough and scraper. It took, on an average, three days for two men and two horses to do the excavating. By fastening a chain from the scraper to the double-tree it was possible to work close to the side, thus making a good square edge, with little hand work. It is very important to have the side perpendicular so as to allow the ensilage to settle properly. The cost of the horse and manual labour for the opening up of eleven trenches, with the dimensions as above, ranged from $26 to $32 each.

The silage came out of these trenches in excellent condition, the stock relished it, thrived on it and there was a comparatively small percentage of spoiled material. Thus our experience has proven that the trench silo is a cheap and efficient method of storing corn and sunflowers for the winter feeding of live stock in Alberta and Saskatchewan. From the satisfactory results demonstrated on these eleven Illustration Stations many adjoining farmers have excavated silos for their own use.

Growing Certified Seed Potatoes

While there are many factors which influence the yield of a crop, in potato growing the use of certified, or disease-free, seed has been striking in this respect. Mosaic, black leg, leaf roll and blight are the four potato diseases mainly responsible for this loss of yield. On the Illustration Stations in New Brunswick, Nova Scotia, and Prince Edward Island, valuable information has been gained as to the merit of this class of seed potatoes. Acre plots of certified seed and also of ordinary home-grown seed were planted on each Station in these provinces, with the object of,—

(1) Demonstrating the yielding ability of certified seed as compared with the general run of home-grown seed.
(2) Having a supply of this disease-free seed available in these districts for distribution to adjoining farmers for seed purposes.
(3) Growing certified seed on a large scale for shipment to other countries.

In field appearance, the contrast has been very marked, so much so, that at some of the stations where certified seed was grown adjoining the general crop, passersby have noticed the decidedly more vigorous appearance of these and have stopped and enquired as to the difference in treatment. The only difference was that the vigorous rows were produced from certified seed. Not only did the crop from certified seed excel in field appearance but outyielded the ordinary home-grown seed by an average of 62 bushels per acre.

Live Stock and Poultry

Though the Illustration Stations are directed mainly along lines leading to the more economic production of crops, it is fully realized that crop and stock improvement must go hand in hand. To stimulate a keener interest in the grading-up of the dairy herd, milk scales and daily record sheets are supplied to such operators of Illustration Stations as can be induced to take up this work. The record sheets are sent in each month, so that we can note from year to year the improvement that has been made. All possible assistance is rendered in the obtaining of pure-bred herd sires. When possible, we try to have a number of farmers in close proximity to the Illustration Station purchase these herd sires co-operatively. In this way the benefits are far-reaching.

A flock of well-kept poultry is a profitable adjunct to any farm. They utilize a great deal of farm waste and at the same time the farm provides them that free range so essential for the development of a strong constitution. Couple with this strength of constitution, egg laying ability on the part of the fowls, and judicious housing and feeding on the part of the operator, and profits are assured.

In order to stimulate greater interest in the farm flock, the Division of Illustration Stations is trying to accomplish this by introducing bred-to-lay strains of poultry on each of the Illustration Stations, and in this way make the flock more profitable.

Summer-Fallow Treatment for the Prairie Provinces

It has been apparent, for many years that the system of growing grain exclusively is not one that will do permanently. In order to bring to light certain drawbacks connected with this one crop system, the Division of Illustration Stations has established comparative demonstrations in twenty-four districts of Alberta and Saskatchewan. On the Illustration Station in each of these districts, wheat was grown continuously on the same plot for four years, alongside a two-year rotation of wheat and summer-fallow and a three-year rotation of wheat, wheat, summer-fallow. The average yield for the four years from the twenty-four stations was, in the case of wheat continuously 10½ bushels per acre, wheat and summer-fallow 20½ bushels per acre. The field on which wheat was continuously grown steadily became weedy, the water-holding capacity of the soil was reduced, and, in some cases, soil drifting occurred. For this reason the growing of wheat continuously has been abandoned and the value of a summer-fallow has been realized.

The system followed in handling the summer-fallow on the Illustration Stations is: Land that contains weeds or creeping-rooted grasses, is shallow ploughed in the fall. If the land is clean and free from these, it is cultivated or double-disced lightly as soon as the crop is taken off and again in the early spring. This mulches the soil, allows the moisture to penetrate it more readily, checks evaporation, encourages the weed seeds to germinate readily; the ploughing and subsequent tillage keep these under control. The best results are obtained by early ploughing of the summer-fallow, as soon as it can be done after seeding. Harrow the fallow immediately after ploughing or, preferably, at the same time. The disc harrow has not been found a satisfactory implement to work down a summer-fallow as it pulverizes the soil too much, causing it to drift when dry or puddle after heavy rains.

Variations in soils and climatic conditions are such that no hard-and-fast rule can be followed in handling a summer-fallow in semi-arid sections. A well ploughed, properly tilled summer-fallow is the farmer's greatest protection against weeds and crop failure.

The Profitable Recurrence of Summer-Fallow in the Rotation

Because of the wide variation in soil and climatic conditions, within short distances, the Division of Illustration Stations has established a number of rotations, of different duration, on each of the Illustration Stations in Alberta and Saskatchewan, to demonstrate the profitable recurrence of a summer fallow-in the rotation. The value of the summer-fallow is being tested by the use of rotations of different duration, one in which fallow is used every second, third and fourth year. The first rotation is fallow and wheat alternately; the second is fallow, wheat, wheat; the third is fallow, wheat seeded to western rye grass or brome grass, and two years' hay. Similar rotations are also followed with oats. In the case of the short rotations, wheat and oats are not included in the same rotation; where this has been done it has been found that there has been considerable volunteer grain produced, sufficient to render the crop unsuitable for seed and also to lower its grade commercially.

In the northern portions of these provinces, longer rotations are followed, namely, a five-year rotation of fallow, wheat, oats seeded to Western rye or brome grass, and two years' hay.

Yields so far go to prove that the longer rotations, containing some fibre forming crop, are to be preferred, for while, in the short rotations, the moisture supply is more abundant for the succeeding crop, the soil is steadily depleted in fibre or humus forming constituents, the loss of which in many cases is directly responsible for soil drifting.

Growing Alfalfa

Perhaps no other crop requires such a variety of different treatments as alfalfa, depending upon the locality in which it is grown. Many succeed in its production only after sowing it for several years in succession. The readiness with which it renews its growth after each cutting, as well as its value as a feed, makes it an ideal soil crop. The roots add nitrogen directly to the soil and are efficient by reason of their deep feeding habit, bringing up other mineral constituents from the lower layers of the soil and thus rendering them accessible to the shallow-feeding crops.

Field demonstrations in the growing of alfalfa have been carried on, along with the regular rotations, on the Illustration Stations in Alberta and Saskatchewan. In the districts where these are operating, so far alfalfa growing has only been a partial success. Seeding in drills and broadcast has shown that the drill seeding, followed by frequent cultivation, has given the best returns. Yields of two tons of hay per acre and 128 pounds of seed have been procured. Five years' results on twenty-one Illustration Stations in Alberta and Saskatchewan tend to show that moisture is quite a determining factor in successful alfalfa growing in these sections. The future of this crop for these districts, if it is to become a staple one, depends on the tenacity and skill of its introducers and natural acclimatization.

Encouraging the Production of Fall Rye

Fall rye has many attributes which render it a suitable crop for many sections of the west, especially southern Alberta and Saskatchewan. In sections where soil drifting occurs, it is found that summer-fallow sown to rye in August is less subject to soil drifting than when sown to spring wheat; the fall growth gathers the snow and in this way renders more moisture available, and because of its early growth it is of particular value for combatting weeds. In this connection, it has been found that a summer-fallow and two crops of fall rye in succession, followed by another fallow, will practically eradicate wild oats.

On the establishment of the Illustration Stations in Alberta and Saskatchewan in 1915, encouragement in the production of fall rye was rendered through field demonstration, carried on in co-operation with Illustration Station operators in these districts. These demonstrations have opened up new districts to the culture of fall rye and returned to production many acres of soil drifting land.

Introduction of Western Rye Grass

The introduction of Western rye grass into the rotations on the Illustration Stations in Alberta and Saskatchewan serves a twofold purpose. Now that the prairie is being rapidly broken, and more live stock is being pastured, farmers are finding it more difficult to secure sufficient prairie hay to carry them through the winter. For such, Western rye has been found very suitable, as yields ranging from 1 to 3½ tons per acre have been harvested, depending on the season. Its value is not limited to a hay crop since also, because of its fibrous root system, it adds humus to the soil. Due to continuous cropping, the soils in many sections have become so depleted in humus that they have lost their binding power to the extent that, in many districts, soil drifting occurs.

To succeed in the growing of Western rye, a well prepared seed bed is essential. In dry soils, 10 pounds of seed is advisable, per acre. Under arid climatic conditions, lighter seeding will give better results. It may be seeded either with or without a nurse crop. In the drier sections it has been found, on the Illustration Stations, that better results are obtained by seeding without a nurse crop on a well prepared summer-fallow. The seed is very light and should be mixed with twice its quantity of broken wheat—using the grain drill preferably. It is advisable to sow shallow but deep enough to get the seed into the moist soil. During the first season it is best to cut all growth up to about August, leaving it all on the ground to form a mulch.

The second season the crop may be cut for fodder, for which purpose it should be cut just when it begins to bloom.

Demonstration work with this crop, on the Illustration Stations, also includes the production of Western rye grass seed. Care has to be taken neither to cut on the green side, nor to allow it to get over ripe. The ordinary binder is used to cut rye grass for seed and threshing is done with the regular grain thresher. On two Illustration Stations 850 pounds per acre and 900 pounds per acre, respectively, of choice seed was harvested. The value of this crop is being appreciated and it is being increasingly grown. The operators state that they have more enquiries for seed than they can possibly supply.

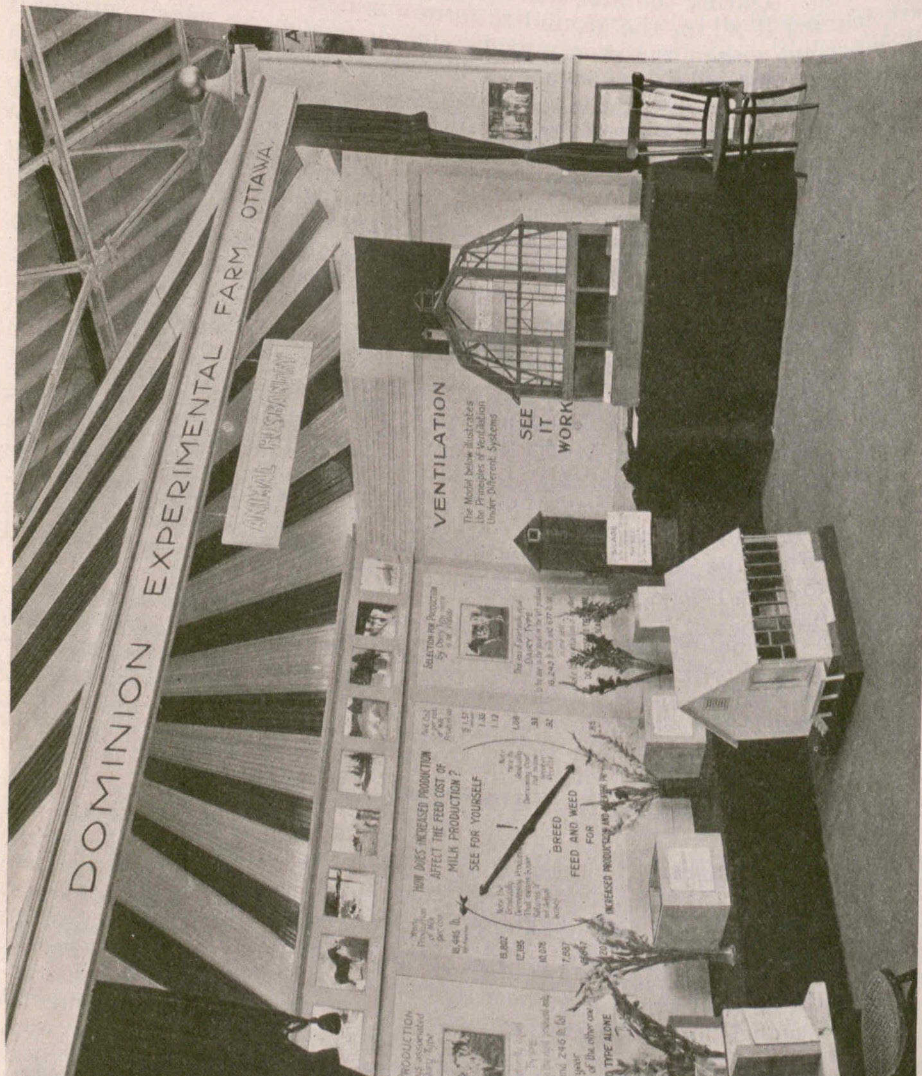
Introducing Sweet Clover

Once considered a weed, sweet clover is rapidly gaining in favour as a crop for building up soils low in fertility and organic matter. It contains natural characteristics which render it highly adaptable as a green manure crop for nitrate production. Its deep-rooting habit enables it to assist in rendering impervious soils more porous and to feed at great depths. Because of its resistance to drouth and cold, sweet clover is adapted to a wide variation of soil and climatic conditions, provided the soil is not sour, and the seed has been scarified and inoculated.

For the humus-depleted, drifting soils of the West, sweet clover gives promise of being a useful plant because of these characteristics. For this reason, demonstration fields of sweet clover have been established on the western Illustration Stations, to determine to what extent sweet clover can solve this drifting soil condition.

Encouraging the Growing of a Farm Garden

The labour necessary to make a garden is too frequently overestimated and the value of a garden underestimated. When vegetables are used fresh from the garden they are more appetizing. Greater use can be made of them and, as a result they will be more appreciated. To stimulate a keener interest in the farm garden and home beautifying, collections of flowers and garden seeds the suitability of which have been determined by the Experimental Farms, are supplied each Illustration Station operator. Accompanying these, instructions and record sheets are sent out, that notes may be kept on the different vegetables, to be returned to the office at the end of the season. In this way, new and tested varieties of garden and flower seeds are introduced into these different centres for benefit of the surrounding district. Flowers are a source of interest and beauty. Their presence in the city is evident; their necessity in the country is apparent for the establishment of homelike homes.



Animal Husbandry Booth Experimental Farms Exhibit—Canadian National Exhibition, 1923.

THE DIVISION OF EXTENSION AND PUBLICITY

F. C. Nunnick, B.S.A., *Chief.*

The Division of Extension and Publicity is among those more recently formed at the Central Experimental Farm, having been established in the spring of 1915, after certain preliminary organization work had been conducted during the previous year. As the valuable results of the experimental work being carried on by the investigational and research divisions were rapidly increasing, it became more and more evident that some definite connecting link between the Experinemtal Farms and the farmers was needed, and that a systematic effort to disseminate this knowledge should be organized. It was in consequence of this need that the division was formed, and included among the chief features of the work with which this divison is charged are the following:—

(1) Supervision of the securing and distribution of press articles which are sent out regularly to the newspapers of Canada.

(2) Supervision of the securing of material for "Seasonable Hints."

(3) The issuing of exhibition circulars, and assistance in the preparation of reports and bulletins for publication.

(4) The preparation and staging of Experimental Farms' exhibits.

(5) The enlarging of the mailing list.

(6) Management of a central bureau of lantern slides for the Dominion Experimental Farms System, and the preparation of charts for use by the officers of the Central Farm and the superintendents of the branch Farms.

(7) The supervision of the preparation of sets of lantern slides with explanatory manuscript, which are lent to agricultural and horticultural organizations and other societies and clubs throughout Canada, for educational purposes, and attending to the applications for and the routing and sending out of these slides.

(8) Attention to applications for circulars, pamphlets, bulletins and other literature.

(9) And many other avenues of extension and publicity work as they present themselves.

Press Articles

During 1916 and 1917, press articles were sent out to all of the newspapers in the districts for which these special articles were prepared. In 1918 all of the newspapers of Canada were asked if they wished to continue to receive for publication the articles sent out by this division. Over 600 of the papers replied in the affirmative and have since been receiving these regularly. In 1923, the mailing list was again revised and over 800 newspapers in Canada are now receiving these articles. Twelve articles were sent out in 1916, 82 in 1917, 139 in 1918, 150 in 1919, 166 in 1920, 159 in 1921, 160 in 1922, and 231 during the first ten months of 1923, making a total of 1,099 sent out to date. Each article is sent out under the heading of "Experimental Farms Note" and usually appears as such, though occasionally the articles are used by the papers and no credit given. These articles are short and an endeavour is made to have them written in a crisp, snappy and readable style, and in language easily understood by the practical farmer. Many hundreds of papers use these articles freely each month and in this way much timely information, and the results of many of the experiments being conducted, are being constantly placed before the reading public of the rural districts of Canada.

It can be readily seen how, through this press service, the farmers of Canada are quickly reached, and how exceedingly valuable this is in the event of sudden outbreaks of animal and plant diseases or the appearance of new noxious weeds, as it is possible to place in the hands of the farmers, with very little delay, the means of identification and information regarding methods of control. Three articles of this nature were sent out to Canadian newspapers and thus to the farmers of the Dominion during the first two months of 1922.

Articles with a general application are sent to the papers in all the provinces of Canada, but where the matter treated refers to conditions in one province or in a part of a province, the article is sent only to the newspapers in the districts where the information is applicable.

"Seasonable Hints"

"Seasonable Hints" is a pamphlet of sixteen pages, issued three times during the year, in March, July and November. There are two editions, namely, the "Prairie" edition, which contains articles especially prepared for agricultural conditions in the Prairie Provinces, and the "Eastern and B.C." edition, containing articles applicable to conditions found in British Columbia and the eastern provinces.

This publication has proved to be very popular. Its articles, as indicated by the title, deal briefly, and in a practical manner, with features of farm work demanding attention at the time each issue reaches the farmer's hands. It has done much to arouse interest in the work of the Experimental Farms. Much of the correspondence received from farmers all over Canada asking for information, may be attributed to the receiving of "Seasonable Hints."

Upwards of 300,000 copies per issue are sent out from the Publications Branch to a regular list of farmers throughout Canada, while 63,000 copies per issue are sent out to banks in the rural parts of Canada which co-operate in distributing them to the farmers of their districts. The following banks are cordially co-operating in this work:—

The Bank of Nova Scotia
The Canadian Bank of Commerce
The Bank of Montreal
The Bank of Toronto
The Sterling Bank of Canada
The Molsons Bank
The Imperial Bank of Canada
The Standard Bank of Canada
The Royal Bank of Canada
Weyburn Security Bank
Union Bank of Canada
Dominion Bank of Canada
La Banque Provinciale
La Banque D'Hochelaga

The following quotation is from a letter recently received from the manager of a branch of the Banque Provinciale du Canada, in Quebec:—

> "I may say that these 'Seasonable Hints' are much liked by our farmers. Very often they call at the bank and enquire if we have received them, even before they are printed."

Besides those being sent out to farmers on the regular mailing list and those distributed by the banks, copies of this publication are sent to many Dominion and Provincial Government officials and other agricultural workers, who distribute the pamphlet to the members of the various organizations with which they are connected, while a number of copies are sent to various elevator companies and machinery agents for distribution among farmers. The total number of copies printed of the last issue was 413,500. This includes the English and French of both the "Prairie" and "Eastern and B.C." editions.

Exhibition Circulars

These have been especially prepared for distribution at the fairs where Dominion Experimental Farms exhibits are staged. They are brief and to the point, written in a popular manner, and give in a concise form valuable information on many agricultural matters. In fact, the collection deals with most of the problems with which the Canadian farmer has to contend. While these circulars are primarily intended for distribution at fairs, they have been found to be exceedingly useful in answering correspondents making inquiries on various agricultural subjects, and large numbers also have been sent by mail to applicants.

Following is a list of the exhibition circulars which have been issued:—

1. Natural Incubation.
2. Artificial Incubation.
3. Varieties of grain recommended by the Dominion Cerealist for Manitoba and Saskatchewan.
4. Varieties of grain recommended by the Dominion Cerealist for Alberta.
5. Distribution and Sale of Seed Grain.
6. The Farmers' Poultry House.
7. Profitable Field Root Varieties for Ontario and adjacent parts of Quebec.
8. Profitable Field Root Varieties for the Maritime Provinces and Eastern Quebec.
9. Crop Rotations for Central and Fastern Canada.
10. Awnless Brome Grass vs. Western Rye Grass.
11. Growing Grapes for Home Use.
12. The Farm Flock.
13. Brooding and Rearing of Young Chicks.
14. Sweet Clover—The Truth.
15. Top Grafting
16. Hot Bed and Cold Frames.
17. Protection of Fruit Trees from Mice and Rabbits and Care of Injured Trees.
18. Bee-keeping in Canada.
19. Tobacco Culture in Canada.
20. Clean Milk.
21. Profit from Dairy Cows.
22. Coulommier Cheese.
23. Cream Cheese and Butter.
24. Seed Treatment for Grain Smut.
25. Catalogue of Publications.
26. The Farmer as a Manufacturer. Part I.
27. The Farmer as a Manufacturer. Part II.
28. The Farmer as a Manufacturer. Part III.
29. Duck Raising.
30. The Management of Turkeys.
31. The Management of Geese.
32. Nature's Bank.
33. The Feeding of Live Stock.
34. The Farm Well.
35. Crop Rotations for Dry Farming Districts of Canada.
36. Varieties of Grain Recommended by the Dominion Cerealist for British Columbia.
37. Varieties of Grain Recommended by the Dominion Cerealist for Quebec and Ontario.
38. Varieties of Grain Recommended by the Dominion Cerealist for the Maritime Provinces.
39. Planning the Home Lot.
40. Beautiful Homes and How the Farmer May Make Them.
41. Tile Drainage on the Farm.
42. Lime Water for the Preservation of Eggs.
43. Trap Nests.
44. Potato Scab.
45. Do you know your weeds?

46. Apple Scab.
47. Seed Oats.
48. Forage Crops and Pasture Grasses.
49. How the Ripening of Grain Crops may be Hastened.
50. Potato Growing in the Maritime Provinces.
51. Facts about Honey.
52. Care of Farm Machinery.
53. Varieties of Grain recommended by the Dominion Cerealist.
54. The Utility Poultry House.
55. The Stockman's Duty to Conserve Manures.
56. Alfalfa Growing in Eastern Canada.
57. Pitting Roots.
58. Mangel Seed Growing.
59. Winter Steer-Feeding.
60. The Feeding of Swine.
61. The Feeding of Sheep.
62. Cream Cheese.
63. The Feeding of Beef Cattle.
64. Crop Production.
66. Feed Racks and Troughs for Sheep.
67. Soiling Crops for Dairy Farming in the Eastern Provinces and B.C.
68. The Feeding of Dairy Cattle.
69. Buttermaking.
70. Crate Feeding.
71. Plan of Root Cellar for Western Canada.
72. Labour Saving Devices on the Irrigated Farm.
73. Hardy Bush Fruits for the Western Farmstead.
76. Horticulture in Saskatchewan.
77. The Cultivation of Flax for Fibre.
78. Varieties of Wheat, Oats and Barley.
79. Planning the Western Farmstead.
80. Alfalfa Growing in Manitoba.
81. Potato Spraying for Late Blight and Rot.
82. Black Leg Disease of Potatoes.
83. Factors Influencing the Profitable Production of potatoes.
84. The Cultivation of Small Fruits.
85. How to Rid a Henhouse of Mites.
86. Lime in Agriculture.
87. The Feeding of Horses.
88. On Purchasing Feeding Stuffs.
90. Sheep Dipping.
91. Club-Root of Turnips and Allied Plants.
92. Framing the Barn Truss.
93. Self-Feeder for Hogs.
94. Corn for Ensilage.
95. The Sheep Barn.
96. The Farmer's Piggery.
97. A Cheap, Portable Hog Cabin.
98. Increasing Production but reducing cost of Dairy Products by using Silage made from Peas and Oats, or oats alone.
99. Mushroom Culture.
100. Potato Growing in the Maritime Provinces.
101. All-Year Hog Cabin.
102. Silo Construction.
103. Labour Saving Devices on the Irrigated Farm.
104. Fertilizers for Flowering Plants, Vegetables, Small Fruits and Lawns.
105. Bee Diseases.
106. Feeds for Wintering and Winter Fattening of Beef Cattle in Eastern Canada.
107. Growing Feeds for the Winter Feeding of Beef Cattle in Northwestern Saskatchewan.

Educational Exhibits

The preparation and staging of educational exhibits at agricultural fairs in Canada has been, and still is, one of the main features of the work conducted by the Division of Extension and Publicity. By means of these, many of the valuable results obtained through the experimental work of the Farms have been placed before hundreds of thousands of Canadian farmers. During the years 1915 to 1922 inclusive, exhibits, varying in size, were staged at over 875 agricultural fairs in Canada. The largest number of fairs visited in any one year was 146 in 1917 and the smallest number of fairs visited was 72 in 1919. When it is taken into consideration that exhibits have been placed each year at most of the larger fairs and many of the smaller ones, it will be seen that vast numbers of people each year have had opportunity to derive benefit from this phase of the extension work.

Previous to 1922, the most complete and comprehensive exhibit staged each year was that put on at the Central Canada Exhibition, Ottawa. It had been possible to arrange a larger display here than elsewhere on account of the absence of railway charges, and close proximity to the headquarters of this division. Early in 1922, satisfactory arrangements were made for the securing of suitable space in which to place an exhibit at the Canadian National Exhibition at Toronto, and in 1922 and 1923 a comprehensive exhibit from the Dominion Experimental Farms Branch has occupied the west wing of the Horticultural building. These exhibits are quite similar to those staged at Ottawa. A number of special exhibits, varying in size, have been sent out each year from the Central Farm to many of the larger fairs. The branch Farms have also been used as centres from which portable exhibits have been sent to many of the fairs in their districts.

The complete exhibits staged at Ottawa from year to year, and more recently at Toronto, have included something from each division at the Central Farm. A brief description of this display which is, in a large degree, applicable to the divisions featured in other exhibits shown throughout the Dominion, may be of interest. In the space allotted to the Animal Husbandry Division, models of sanitary barns, stables, hog cabins, feed racks, dipping tanks, etc., have been shown. A special exhibit on the subject of "Clean Milk" was the chief feature in 1921. Samples of butter, cream cheese, Meilleur and Coulommier cheese, with the necessary equipment for their manufacture, together with the equipment necessary for testing milk have also been shown.

The exhibit from the Poultry Division has been composed of models of portable colony houses, farmer's poultry houses, feed and grit hoppers and trap-nests. Electric incubators and hovers have been demonstrated. Killing and plucking demonstrations have also been held in connection with the exhibit of this division. A water pool containing domestic and wild water fowl has, upon several occasions, added to its attractiveness.

The Field Husbandry Division has shown the benefits of under-drainage, suitable seeding mixtures for hay crops, results of tests *re* corn and sunflower crops for silage, etc.

In the Tobacco Division, specimens of tobacco leaf for various purposes have been attractively shown and the various stages of maturity at which the crop should be harvested have been demonstrated.

The Botanical Division exhibits staged have shown the effects of various plant diseases. Explanations have been given as to how they may be identified, and methods of control have also been clearly explained. Educational displays of edible and poisonous mushrooms have also been made.

The Cereal Division exhibit has consisted of displays of various varieties of grain recommended by the Dominion Cerealist for the different districts throughout Canada. These varieties have been displayed as grain in glass receptacles and also in the sheaf, which gave the farmer an opportunity to study the appearance of the grain and the length of the straw. The varieties originated on the Dominion Experimental Farms have been given much prominence through these exhibits.

The space allotted to the Flax Division has been filled with a display of specimens of flax in the various stages of the process of manufacture and samples of table linen, rugs, twine, etc., made in Canada from Canadian flax.

The exhibit from the Division of Forage Plants has consisted of specimens of various varieties of roots, corn, grass and clover seeds especially recommended for the district in which the exhibit was being displayed.

The Horticultural Division has shown varieties of fruits recommended for the Ottawa Valley, seedling apples originated on the Central Farm and cross-bred apples of good quality. The work in plant breeding has also been shown. The desirability of giving intelligent care and attention to the farm home surroundings has also been emphasized.

With the Bee Division, an observation hive has been an interesting feature of the exhibit. Models of good hives, honey extractors and other equipment for the bee-keeper have also been displayed.

In the Division of Chemistry samples of various kinds of feeds were shown with legends explaining their values based on analysis. Samples of various kinds of commercial fertilizers have also been exhibited and valuable information regarding their use has been placed before the public.

Suitable explanatory legends have always formed a part of each one of the divisional displays. Transparencies illustrating important methods and features of the work of each division have also been used with excellent effect. A complete change in the structure of these exhibits has been made each year and new legends used. Different features or phases of the work of the various divisions have thus been presented, and the methods of presentation varied sufficiently to sustain the interest of the public.

In preparing exhibits for fairs in different parts of Canada, special attention has been given to the requirements of the districts in which the exhibits were to be shown. The varieties of grains, grasses, fruits, vegetables, etc., recommended in each exhibit have been those which have been found to give best results in the districts in which the exhibit was being placed.

Enlarging the Mailing List

Special cards are used for this purpose, on which is printed the following:—

DOMINION DEPARTMENT OF AGRICULTURE, OTTAWA

The Department issues every four months to all whose names are on the mailing list an Experimental Farm periodical known as SEASONABLE HINTS, which contains useful facts for farmers and is sent free. Along with it the Department sends out a list of new publications, any of which may be had on request.

If you are not receiving this publication and wish to do so, fill in and return this card.

Publications are in English and in French. Write an "F" here............if you desire the French edition.

Name..

Postal Address..

Rural route number

or street and number..

County..

....*Province*..

These cards are placed in conspicuous positions wherever a Dominion Experimental Farm exhibit is staged. Anyone who desires to receive publications of the Dominion Department of Agriculture simply fills one of these cards which is sent to the Publications Branch, where it is given prompt attention. Many thousands of farmers have, in this way, been brought into close touch with the work of the "Farms" and are now availing themselves of their services.

Central Bureau of Lantern Slides

In this division is kept a bureau of lantern slides pertaining to the work of the various divisions of the Farms system. There are hundreds of these slides named, numbered and card indexed. These are for the use of the officers of the various divisions and the branch Farm superintendents, who may need them from time to time, in connection with lecture work. This has been found to be a great convenience, particularly to the branch Farm superintendents who desire to give illustrated lectures on the results of experimental work conducted on the Central and branch Farms. Collections of these slides are sent to the Superintendents in each province from British Columbia to Prince Edward Island.

This division also prepares charts which are found very useful in connection with lectures on crop rotations, breeding experiments, cereal work, etc.

Lantern Slides for Lending

During the latter part of 1921, arrangements were completed for the preparation of two sets of lantern slides especially designed for lending to agricultural and horticultural organizations and other societies and clubs interested in the subjects treated. The two sets which have already been prepared are on the following subjects:—

"The Planting and Care of the Farm Home Grounds."

"Profitable Poultry Keeping."

There are between fifty and sixty slides in each set. An explanatory manuscript or lecture, of about twenty-five type-written pages, accompanies each set of slides, which may be read as the slides are projected on the screen. Six duplicate sets of slides have been prepared in connection with each subject and while only a limited announcement has been made regarding these slides, a very great number of requests for their use have been received. No rental charge is made and the only cost to the users is the express charge one way, as this division pays the return charges.

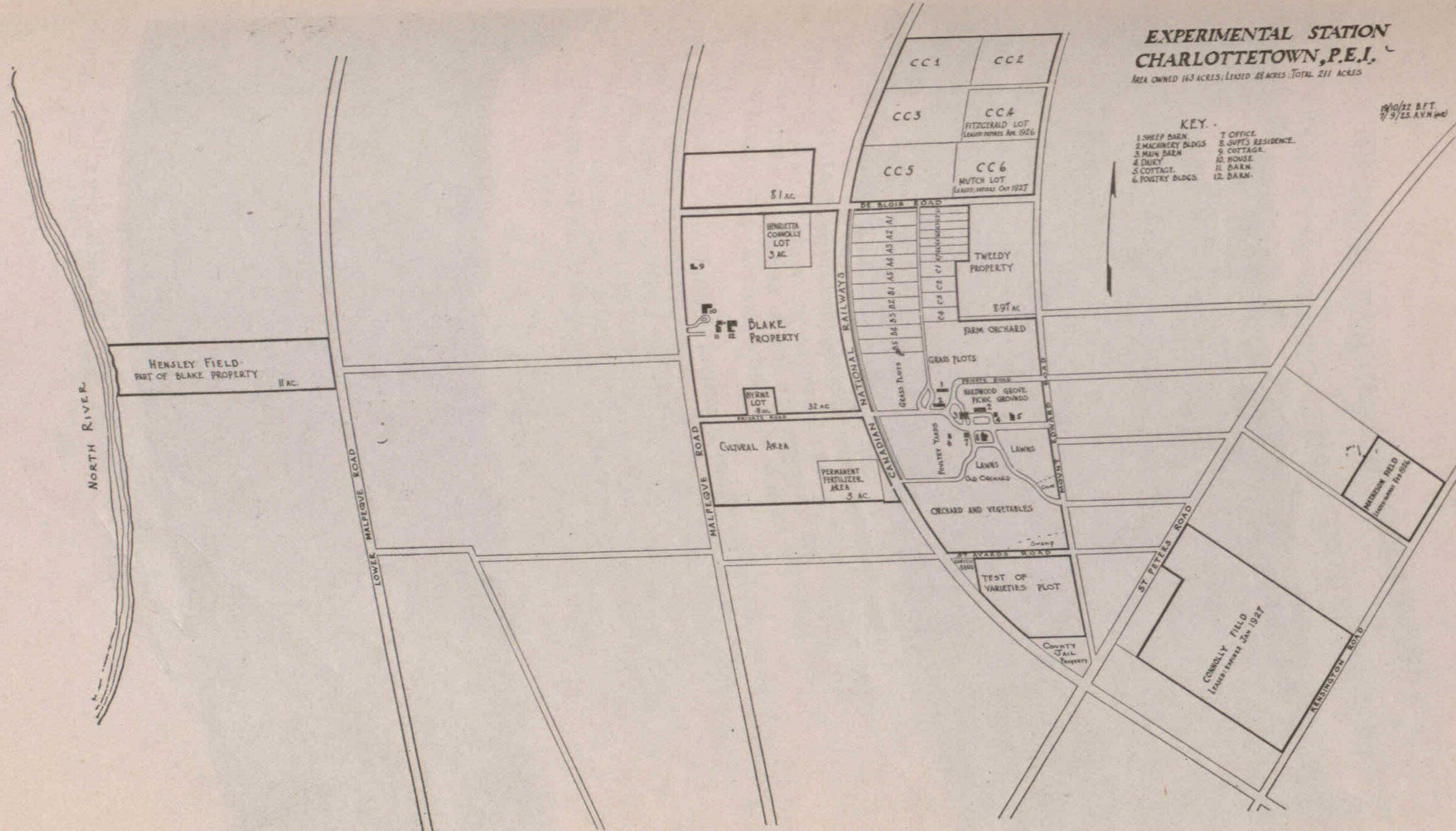
The making of the slides and the preparation of the lectures required considerable time and, as a result, the slides were not ready for sending out until about the second week of February, 1922. During the first six weeks after the first announcement that these slides were available, sets were sent out and used at over forty meetings in Canada. The indications are that this feature of our extension work will prove exceedingly popular. Many letters have been received from those who have used the slides, reporting attendances of over 300 at their meetings with some running over 400. The average attendance so far at these meetings has been 148. On account of the great demand for slides illustrating the beautification of urban home grounds, a set on this subject was assembled during the latter part of 1923 and duplicates made. These have met with great favour and have been lent to many towns and cities during the last year.

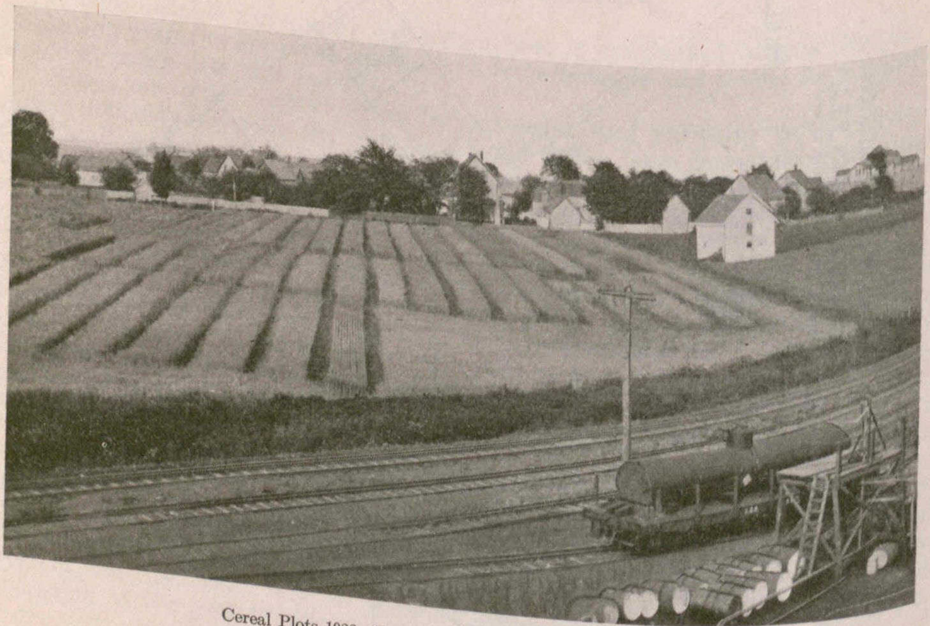
It is the intention to prepare sets of slides illustrating subjects in connection with the work of other divisions of the system.

Distribution of Literature

A considerable volume of correspondence is conducted in this division in connection with the applications received from farmers and others for exhibition circulars, pamphlets and bulletins.

Numerous other opportunities for extension and publicity work have presented themselves during the past nine years which have been taken advantage of. Small collections of models of various kinds of farm buildings have been sent out for demonstration purposes at agricultural short courses in various parts of the country. Collections of seeds have been put up in bottles and properly labelled which have been used in connection with short courses, and at meetings held where the subject under discussion pertained to seed selection and seed improvement. Collections of flax, grains and forage plants have been placed in attractive cases and set up in various college museums in different parts of Canada. A particularly comprehensive and attractive exhibit was placed in the Commercial and Industrial Museum of Montreal in 1918. A number of poultry house models were prepared and sent to Alberta for use in connection with a number of meetings being held there during the winter of 1921-22, etc. Requests for assistance of this kind are being constantly received and this division is endeavouring to serve farmers and all others in Canada by disseminating a knowledge of the results of the investigational work conducted by the research divisions of the Experimental Farms system, in as wide and comprehensive a manner as possible. Plans whereby the future work of this division may be made still more valuable and efficient are being given consideration at the present time.


EXPERIMENTAL STATION
CHARLOTTETOWN, P.E.I.
AREA OWNED 163 ACRES; LEASED 48 ACRES; TOTAL 211 ACRES
KEY.
1. SHEEP BARN.
2. MACHINERY BLDGS
3. MAIN BARN
4. DAIRY
5. COTTAGE.
6. POULTRY BLDGS.
7. OFFICE.
8. SUPT'S RESIDENCE.
9. COTTAGE.
10. HOUSE.
11. BARN.
12. BARN.
CC1
CC2
CC3
CC4
FITZGERALD LOT
CC5
CC6
MUTCH LOT
81 AC.
DE BLOIS ROAD
HENRIETTA CONNOLLY LOT 3 AC.
TWEEDY PROPERTY
BLAKE PROPERTY
FARM ORCHARD
GRASS PLOTS
NATIONAL RAILWAYS
CANADIAN
HENSLEY FIELD
PART OF BLAKE PROPERTY
11 AC.
NORTH RIVER
LOWER MALPEQUE ROAD
MALPEQUE ROAD
BYRNE LOT
PRIVATE ROAD
32 AC
CULTURAL AREA
PERMANENT FERTILIZER AREA 3 AC.
POULTRY YARDS
LAWNS
OLD ORCHARD
ORCHARD AND VEGETABLES
MOUNT EDWARD ROAD
ST AVARDS ROAD
TEST OF VARIETIES PLOT
COUNTY JAIL PROPERTY
ST PETERS ROAD
CONNOLLY FIELD
KENSINGTON ROAD
MATHESON FIELD



Cereal Plots 1922—Experimental Station, Charlottetown, P.E.I.

Cows in Pasture, 1922—Experimental Station, Charlottetown, P.E.I.

BRANCH FARMS AND STATIONS

THE EXPERIMENTAL STATION FOR PRINCE EDWARD ISLAND

J. A. CLARK, B.S.A., *Superintendent.*

The Experimental Station for the "Garden of the Gulf", as established at Charlottetown, P.E.I., in August, 1909, had an area of 29 acres. This original area, "Ravenwood", was purchased by the Prince Edward Island Government and leased to the Federal Government on a long-term lease for experimental purposes. This has been added to by purchase and lease, so that 204½ acres are now available. The Station is situated about one mile northeast of the business section of the city of Charlottetown, and along either side of the Prince Edward Island railway. This location adds much to its usefulness. The land on the east of the track has a general slope to the west, enabling travellers to see most of the farm crops throughout the season. From the Station buildings the land slopes away on all sides except on the north. Towards the railway on the west the hill is quite steep.

The soil is a dull red colour, formed from the red sandstone (Triassic) that underlies the province. In general it is a sandy loam underlaid with a hardpan of brick clay. The subsoil over a large area of the Farm is so impervious to water that it was necessary to underdrain both the low areas and several sections of the higher land to fit them for experimental work requiring uniform soil conditions. Many different types of soil are represented. These range from almost pure sand to heavy clay, with swamp areas of pure peat that have been reclaimed by drainage.

The Station is the Island farmer's headquarters for investigational and research work with pests, fertilizers, soils, crops, stock, and for information concerning the many hundred subdivisions into which the problems connected with these divide themselves.

The work may be divided roughly into research and experiment, demonstration of methods, and assistance and actual instruction throughout the province as opportunity offers.

Cereals

Perhaps the most important investigational work was that which resulted in the origination of Charlottetown No. 80 barley. The first work with this grain was done in 1912, and it was registered under the C.S.G.A. No. E-8596, in April, 1916. This barley has averged about eight bushels more per acre than the average of the eight next best sorts tried at this Station for the last nine years. It has practically replaced other varities in the province. It drops most of its awns in the field and is spoken of locally as a "Farmer's Barley". A conservative estimate would be that this superior sort has added 25,000 bushels more barley to the yearly output of grain on the farms of the province. At \$1.50 per bushel, this would be \$37,000 per annum. Wherever this barley has been tested in other provinces, it has already demonstrated its superiority over most others, and its general use would probably add many million bushels to the barley crop of Canada.

Two series of experimental investigations have been conducted, in cooperation with a number of farmers in different districts of the province, to determine the variety of oats best suited to Prince Edward Island conditions.

The first test covered a period of five years, 1912-16, and the average returns from over one hundred and fifty plots demonstrated that Banner oats was the leading variety. During the five seasons it produced 6 bushels and 2 pounds more grain than Old Island Black, and seven bushels more grain per acre than Ligowo.

The second series of co-operative tests was with twelve farmers, for one year, with Banner and Victory oats. The Banner oats again led in yield, and were much superior in colour and appearance to the Victory.

All promising new varieties of cereals originated through plant breeding at the Central Farm are tested out at the Charlottetown Farm. In addition to this, the best commercial sorts are all improved under the C.S.G.A., regulations by careful hand-selection. Each year, the superior plants from each sort are propagated, multiplied, registered and sold as foundation stock to applicants, the quantity distributed being governed by the amount of land available on the Station for seed production.

Forage Plants

In the work with forage crops, co-operative experiments have been carried out with farmers throughout the province, with alfalfa. Inoculated soil has been sent out whenever requested, and while alfalfa is not believed to be as satisfactory a forage crop on Prince Edward Island as is red clover, yet the farmers have received this information and have been saved the loss of having their fields bare. Many strains of alfalfa and other clovers have been tested over a period of years, and the hardiest recommended. Among the grasses, timothy stands in first place for hay, Red top, orchard grass and meadow fescue have shown that they are promising grasses for pasture.

The records show that Indian corn cannot be counted on for a full crop every year, and the farmers are advised to sow oats, peas and vetches to replace corn in the off years. In good corn years, the oats, peas and vetches may be allowed to ripen, and will produce a heavy crop of grain. Work at this Station is only just begun with sunflowers as a forage crop. In 1921, the Mammoth Russian produced 14 tons 1,000 pounds per acre of green forage. This was fed to steers as a soiling crop. They ate the heads, leaves and stalks clean. This method of feeding was recommended to a dairy farmer who had quite an area of sunflower and no silo. He reported that his cows ate the sunflowers greedily and made good gains in their milk flow. Selected seed of the Mammoth Russian gave a good return of ripe seed.

In 1922, a larger area of sunflowers was sown; a silo was built and the sunflowers put in the silo under the corn. The steers ate it well, but the dairy cattle preferred the corn ensilage. In 1922, the sunflowers averaged a yield of 19 tons, 1272 pounds, and the corn averaged 16 tons, 438 pounds, per acre, of green forage.

The work with roots has secured a turnip resistant to club root; over 250 pounds of this seed were produced in 1921. This has since been distributed among the Experimental and Illustration Stations of the Maritime Provinces and has proved to be more resistant than any other strain yet tried.

A series of six farm rotations was laid out in 1912, under a plan suited for demonstration. Accurate records have been kept, and the results from these different systems can be secured, not only through reports, bulletins and press articles, but every summer they are before the eye of every farmer who passes on the train, or calls to spend a few hours at "The Farm". These have demonstrated methods of eradicating noxious weeds and of steadily increasing the fertility of the land by applying manure at the rate of five tons per acre per year.

Cultural Methods

Perhaps the most interesting work, to the farmers, of all that has been undertaken by the Experimental Station is that connected with the cultivation of the soil by different methods. Over three hundred plots are used in this investigational work. Several years were spent in draining and in getting the land as uniform as possible. The records now date back to 1916, and quite a number of press articles have been sent out based on these experiments. A few of the results obtained are:

When seeding with a drill, rolling just before seeding gave better results than rolling after seeding or when the grain was up. Fairly deep ploughing of sod (5 inches) gave better yields than shallow ploughing, and early autumn ploughing of sod gave much better crops than spring ploughing. Sod ploughed in August and top-worked in autumn gave 13 bushels and 5 pounds more oats per acre than sod ploughed the following spring. Even the poorest method of autumn ploughing gave 6 bushels per acre more oats than any spring ploughing. Land that has produced a hoed crop, such as potatoes or roots, usually produces a better crop if the seed bed is formed for the following grain crop without using the plough.

It is rather surprising to find that oats made one of the best nurse crops for seeding out land when sown at the rate of 2½ bushels per acre. Barley sown at the rate of 1½ bushels per acre gave 3 bushels and 12 pounds less grain than when sown more thickly but the area produced 600 pounds more clover the following year, and 1,200 pounds more timothy the second year than did the plots sown at the rate of 2½ bushels of barley per acre.

Horticulture

The farmers, and more particularly the farmers' wives, who visit the Station every summer, take a very great interest in the gardens, orchards and small fruit plantations. In these, careful investigations have been carried on for many years to determine the best varieties of the different sorts of vegetables, fruits and flowers.

Experiments and demonstrations conducted in cultural methods, with all of the important vegetables and fruits, have enabled the Experimental Farm greatly to assist, in assuring the success of a very large number of farm home gardens. In fact, ripe tomatoes, which were a rare luxury in the Province only a few years ago, are now common vegetables to be found selling at moderate prices, throughout the country.

Many of the better sorts of vegetables and flowers have been propagated for seed or tubers and sold or distributed to the schools, women's institutes and the farmers of the province.

Live Stock

The Experimental Farm at Charlottetown was not planned originally for live stock work; only enough stock was to be kept to operate the farm and to use up the roughages and other surplus products from the investigational work with cereal, forage and garden crops. However, investigations in feeding lambs and steers have been carried on since the Farm was started, and valuable information on methods of feeding and housing has been published from time to time. An annual auction sale of stock always brings a large number of interested persons to the Farm. These are furnished with a detailed statement at the time of the sale, of the feeds, methods of feeding, and weights and gains of the animals auctioned.

Additions to the original Station area from time to time have permitted the taking up of wider work in animal husbandry and the following classes and breeds of pure-bred stock are now represented at the Farm: Clydesdale horses, Ayrshire cattle and Yorkshire pigs. Many of these have been shown at the leading fairs and exhibitions, and a goodly number of the best prize ribbons now hang in the superintendent's office.

The dairy cows are all entered in Record of Performance. They have qualified in the past with good records. "Buttercup of Glenholm," No. 56491, in 1921 broke the four-year-old Ayrshire record of Canada, giving 16,444 pounds of milk and 662 pounds of butter fat, with a test of 4·02 per cent. In 1922, three cows qualified in R.O.P. with records of over 14,000 lbs. milk. In 1923 "Daisy of Sunny Slope," No. 72581, in the 2-year-old class is finishing with over 12,000 lbs. of milk.

Poultry

This Station led the way in a most marked advance in the poultry industry. The first Federal Egg Laying Contest was started at Charlottetown in the autumn of 1918, and based on the success of this, eleven others have since been started at other Experimental Farms. These contests are now recognized as a most vital force in the present very rapid development of the poultry industry. From these contests have grown the Record of Performance and the Registration of Poultry, in which Canada has led all other countries.

The average profit over cost of feed on all the hens in the five Prince Edward Island contests was $1.30 per hen. Estimating that the average hen in Canada earns a net profit of $1 per annum, which is more than she really does, and assuming that as a result of the contests now being carried on, the profits were increased to the average of the Prince Edward Island Egg Laying Contests, then the 31,324,498 fowls in Canada would earn a net profit of 30c. each more than at present, or, in round numbers, they would produce $9,400,000 to the greater financial advantage of the Dominion.

Drainage of Agricultural Land

When the Experimental Station was established in 1909, at Charlottetown, modern tile drains had not been laid, so far as we know, for agricultural purposes, in the province. The drainage of a large area of unprofitable land at the Station produced remarkable results. This land, which did not produce enough barley to re-seed the land in 1910, has since produced over 50 bushels of barley, 35 bushels of wheat and 80 bushels of oats respectively, per acre.

Experiments were conducted with subterranean outlets, and it has been demonstrated that a four-inch hole, drilled almost anywhere in the Province to the level of the general water table, will carry off the water from a "pot-hole" or other swamp area not exceeding one acre in extent. One such outlet was observed to carry off the surface water at the rate of 20,000 gallons per day. At present the Blake property, recently added to the Experimental Station, is being drained.

Bee Investigations

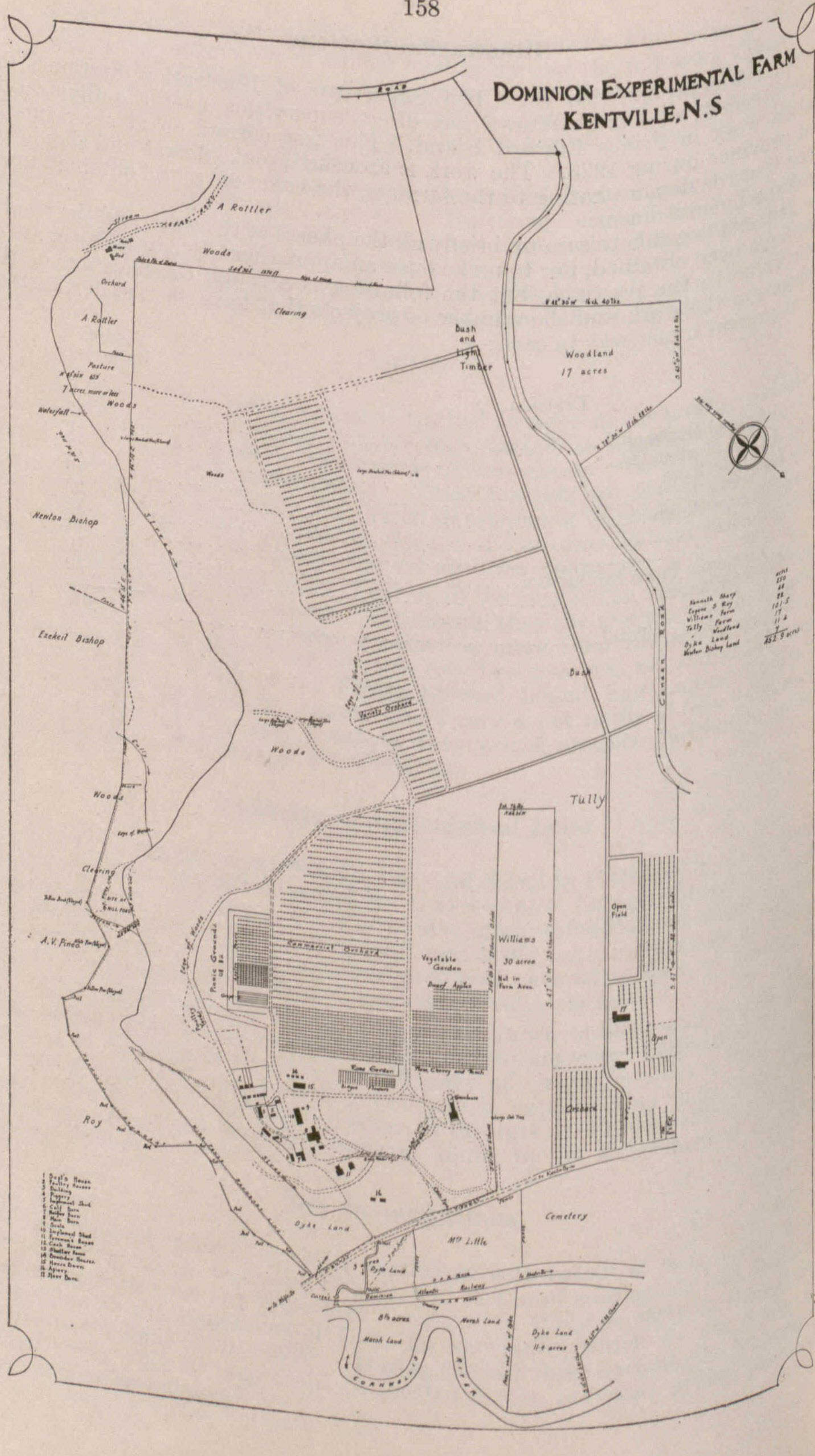
Many investigations have been carried on with breeds of bees, methods of preventing swarming, wintering of bees, and means of eradicating bee diseases. Beekeepers who have any difficulties are asked to apply as early in the season as possible to the Experimental Farm for assistance, which we are ready to furnish to the limit of our ability. During the last three seasons, the beekeeper visited every apriary that could be located in the province, giving personal assistance or instruction.

Illustration Stations

In co-operation with the Chief Supervisor of Illustration Stations, the superintendent at Charlottetown has direct supervision over the Illustration Station work in Prince Edward Island. This was carried on at six farms in that province during 1923. The work is arousing great interest and should do much towards demonstrating to the farmers, the value of results obtained upon the Experimental Farms.

It is not possible to sum up briefly all the phases of the work and the results that have been obtained, nor to make even an approximately correct estimate of their value to the province, but the following is a rough classification of the divisions of the work and the number of projects that have been undertaken or are at present under way in each:—

Division	No. of Projects
Animal Husbandry	18
Field Husbandry	18
Horticulture	71
Cereals	10
Forage Plants	28
Poultry	22
Bee	14
Economic Fibre Production	10
Miscellaneous	10
Total	201


DOMINION EXPERIMENTAL FARM
KENTVILLE, N.S
Road
A Rottler
Stream
Woods
Orchard
A Rottler
Clearing
Pasture
7 acres more or less
Woods
Waterfall
Bush and Light Timber
Woodland
17 acres
Newton Bishop
Ezekeil Bishop
Variety Orchard
Woods
Woods
Bush
Canaan Road
Tully
Clearing
A. V. Pineo
Picnic Grounds
Commercial Orchard
Vegetable Garden
Dwarf Apples
Williams
30 acres
Open Field
Rose Garden
Orchard
Roy
Dyke Land
Cemetery
Dyke Land
Marsh Land
Marsh Land
Dyke Land
11.4 acres
Cornwallis River

Apple Orchard planted in 1912—Experimental Station Kentville, N S.

THE EXPERIMENTAL STATION FOR THE ANNAPOLIS AND CORNWALLIS VALLEY

W. S. Blair, *Superintendent*

Location and History

The locating of an Experimental Station at Kentville, Kings county, Nova Scotia, was the result of an agitation on the part of the Nova Scotia Fruit Growers' Association. The large fruit interests centred in the counties of Kings, Annapolis and Hants demanded that assistance be given for the purpose of carrying on experimental work to aid them in their fruit-growing undertakings. The early educational efforts of the above Association centred around the establishment of a Horticultural School at Wolfville, N.S., and when this was made a part of the Provincial College of Agriculture, Truro, N.S., an understanding was arrived at with the Provincial Department of Agriculture for the establishment of a Fruit Station in its place. This agreement was carried out, and a part of the present Kentville Station property consisting of 250 acres, known as the K. Sharpe property, was purchased in 1910 by the Provincial Department of Agriculture through a committee of the Fruit Growers' Association, of which R. S. Eaton, Esq., was chairman, and the most active in furthering its purchase. This property was taken over by the Dominion Department of Agriculture in 1911 and made a unit in the Experimental Farms system. This farm was, for the most part, uncleared. Operations were started during 1911 under the direction of Mr. J. R. Starr, and sufficient land cleared to allow of the planting of 12 acres of orchard in the spring of 1912. W. Saxby Blair, who held the position of Professor of Horticulture at Macdonald College, Que., was engaged as superintendent, and assumed duties in that capacity early in July, 1912.

As already stated, the original purchase was 250 acres. In the fall of 1912, 44 acres, consisting largely of a broken, wooded area, was acquired from Eugene S. Roy, and in 1913, 7 acres of similar land was purchased from Newton Bishop. In 1919, the original John Tully property, consisting of 130 acres was purchased, and, in 1923, an area of 22 acres was purchased from Edward Williams, making a total area of 453 acres in the present Station property. This area, for the most part, is situated within the boundary of the town of Kentville, with the entrance to the farm one mile from the Kentville railway station.

Description of Station

The front area of the property is more or less hilly and broken, and along the eastern boundary a ravine, with abrupt banks, extends the whole length of the farm, included in which is 100 acres of wooded land not suitable for agricultural purposes but forming a natural wooded park. The central and western upper section, all of which is arable, is fairly level. The surface soil of the farm for the most part is a sandy loam, and has a subsoil ranging from sandy to clay loam, more or less gravelly. Where the clay subsoil predominates, underdrains are necessary for satisfactory experimental work. Some 20 acres of land have so far been underdrained. Of the areas purchased, only approximately 100 acres was cleared land. Since the establishment of the Station 150 acres have been cleared and broken, mostly from green forest, which rendered the task difficult and expensive.

Horticulture

Sixty-five acres are devoted to orchard trees, included in which are 2,700 apple, 230 pear, 370 plum, 150 cherries, 100 peach, and a few apricot and quince trees. With those growing on the more or less broken front area, the total is approximately 4,000 trees. There are 240 varieties of apples, 55 of pears, 92 of plums, 54 of cherries, 47 of peaches and 12 of apricots and quince under test, a total of 500 varieties of orchard fruits. Included in the collection of apples are the leading English varieties, all of which do exceptionally well at this Station but none of which has particular merit above the old, established English varieties now quite extensively grown in this fruit section. In addition to the testing of new varieties, cultural tests are being carried on with standard varieties. Certain areas are devoted to fertilizer trials, and spraying tests have been conducted on quite an extensive scale. The information obtained is proving of great aid to fruit growers in handling their orchards in the most profitable way.

Three acres are set aside for variety and cultural tests with small fruits and vegetables, results from which work are of great assistance to those engaged in this line of farming. Potatoes have received considerable attention and an effort has been made to encourage the use of seed stock free from disease. The work so far has demonstrated the importance of care in this particular, and the demand is steadily increasing for certified seed. The difficulty is to keep the stock free from mosaic, and it would seem desirable that still greater effort be put forward in this important work in order that a supply of disease-free stock may be readily obtainable.

Ornamental plantings have received considerable thought in the development work of this Station and the leading varieties of ornamental trees, shrubs and flowers have been planted, so that information is now available as to the kinds likely to be most suitable for home decoration.

Bees

The management of bees is receiving special attention and an apiary of seventy colonies and two out apiaries of eight colonies each are included in the equipment. It is generally considered that bees can be managed with profit in orcharding, and that orcharding is more profitable because of having bees to distribute the pollen and aid in the set of fruit. However, poison dust is being extensively used by orchardists for the control of insect pests and diseases of fruit trees, and through the gathering of pollen from plants under dusted trees and the feeding of this pollen, which is mixed with poison, to the young bees, considerable loss results. Experimental work to determine whether this can be prevented is being carried on.

Poultry

Poultry raising is developing into a profitable business and the quality of the stock is being gradually improved. On the Station, much attention is being given to the selection of stock by means of trapnesting to obtain the production of individuals, with the consequent elimination of the low producing birds and the using of only the best producers for breeders. The work along this line has been continued for several years, and strains of good producers have been obtained from which surplus cockerels are available for sale. The demand for cockerels from such birds is increasing rapidly, and wherever such are used, there is a marked improvement in the egg production. Feeding trials are also carried on and fairly definite information as to methods of management likely to give most economical returns is available.

Live Stock

In swine rearing, the Yorkshire breed is used, with the aim of assisting in the production of a good class of bacon hog. Feeding trials with young pigs for bacon purposes are being made, to determine the feeds one may grow or use to make most profitable gains.

The herd of Shorthorn cattle kept at this Station has been managed as a dairy herd. The original cows, although of Scotch foundation breeding, along beef lines, were fair milk producers, and it is hoped that, by using sires from productive dairy lines, a dual-purpose strain of merit may be obtained. The work along this line is at best tedious, requiring many years in order to fix characters and obtain a fair proportion of really good milkers in the progeny and still retain the beef qualities that are desirable. All cows are carried in the Record of Performance test, and those not qualifying are discarded as breeders. The bull calves are disposed of for breeders or turned into steers for baby beef. The herd now numbers about sixty head. Information as to the quantity of feed required to develop thrifty growth in young stock is available from the records of feeding tests made. Steers for winter feeding are purchased in the fall and fitted for market, thus securing information as to the profit of such livestock work, and the management likely to prove the most profitable. One shipment of such stock has recently been made to Great Britain.

Fertilizer Experiments

In the orcharding work, large quantities of fertilizers are used to keep up the fertility of the orchards. The majority of orchardists do not depend upon the live stock kept to supply their requirements of fertilizer, and as a result extensive tests are being made with commercial fertilizers, in varying amounts, to determine the rates that may be used for the greatest economic gain. It has been found that, on new lands, the soil of which is usually acid, an application of limestone is very beneficial, resulting in almost double the crop yields over areas not so limed but otherwise fertilized in the same way. This increase is due largely to the fact that a good stand of clover on new lands is rarely possible unless the land is treated with lime, and that no crop so benefits the soil as red clover, due largely to its power of taking in, by means of the nitrogen-fixing bacteria on the roots, large amounts of nitrogen, which, when the strong growth of roots later decays, is given up to the crops that follow. The physical properties of the soil are also greatly improved by the root development of this crop.

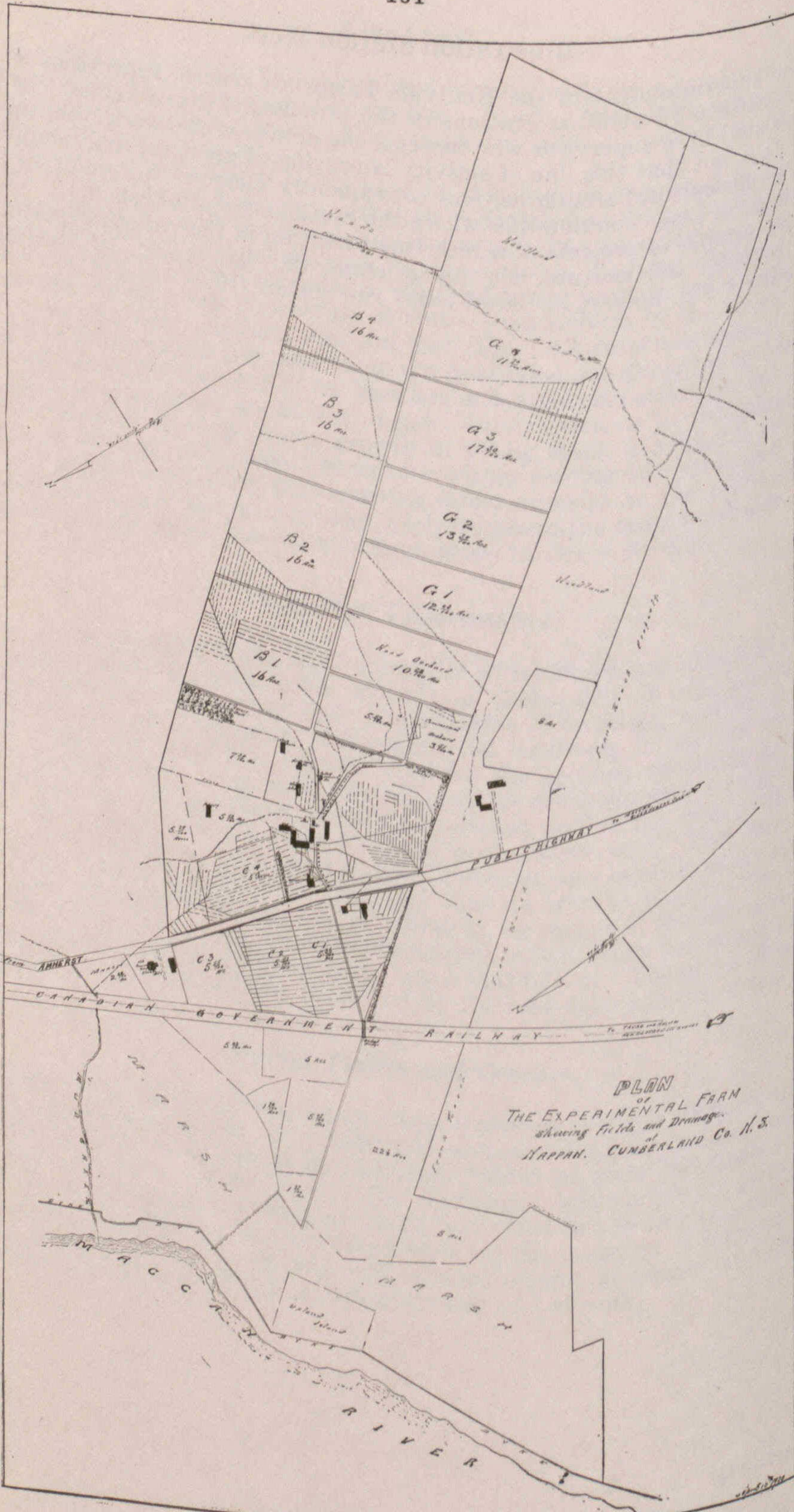
Forage Plants and Cereals

Tests are being made with forage crops, including mangels, turnips, carrots, and the silage crops, Indian corn, sunflowers, and the oats, peas, vetches mixture, to determine the most profitable succulent fodder to grow for stock feeding purposes. Cereal crops also receive due attention. Fibre crops are grown and information thus made available for those interested in this line of work. For the purpose of gathering further information on the question of increased hay yields, trials are being conducted with selected strains of grasses and clovers, and different mixtures of the principal grasses and clovers.

Illustration Station Work

The superintendent of the Kentville Farm has general supervision of the work on fifteen Illustration Stations in the province of Nova Scotia. In this, he is assisted by a supervisor who inspects the details of the work from time to time. It is felt that this line of activity is proving of great value in tending to raise the agricultural standards, and consequently increase the profits of farm operations, in those communities where the Stations are established.

The number of projects now receiving attention in the various departments are as follows: horticulture, 65; forage crops, 26; live stock, 12; fertilizers, 18; poultry, 17; apiary, 21; field crops and cereals, 10.


PLAN
of
THE EXPERIMENTAL FARM
showing Fields and Drainage
at
NAPPAN. CUMBERLAND Co. N.S.
B 4
16 Acs
B 3
16 Acs
B 2
B 1
G 3
G 2
G 1
PUBLIC HIGHWAY
From AMHERST
CANADIAN GOVERNMENT RAILWAY
M A R S H
MACCAN RIVER

THE EXPERIMENTAL FARM FOR NOVA SCOTIA

W. W. Baird, B.S.A., *Superintendent.*

Establishment and Location.—The Experimental Farm for Nova Scotia is located at Nappan, in the county of Cumberland, about eight miles from the border line of New Brunswick. It was established in 1888, being one of the original farms authorized under the Act passed by the Dominion Parliament in 1886. It was first known as the Experimental Farm for the Maritime Provinces, the activities of the Farm at that time being designed to meet the needs of the three provinces. Later, Stations were established at Charlottetown, P.E.I., Kentville, N.S., and Fredericton, N.B., and this Farm has since been called the Experimental Farm for Nova Scotia.

Area. The original Farm contained, in all, about three hundred acres, some forty-five of which were dyke land or marsh land, and one hundred and twenty acres of upland were under cultivation. The remainder was in rough, unbroken land and woods. From 1915 to 1918, ninety-two acres of the original wooded area were cleared and brought under the plough, thus increasing the original upland under cultivation some 76·7 per cent. In 1919, the adjoining farm to the south, including one hundred and twenty-five acres of marsh land was purchased. These much-needed additions have permitted enlarging the scope of the Experimental work both with field crops and live stock. There are now two hundred and seventy-five acres of cultivated upland, about eighty acres of marsh-land and one hundred and nine acres in rough pasture and woodland, making a total area of approximately four hundred and sixty-five acres.

Soil

The soil of this Farm is chiefly clay loam, with some parts gravelly, and with a sub-soil varying from a heavy clay pan to gravelly clay, with a limited area running from a sandy to a gravelly character. Some seventy or eighty acres of the heaviest clay have been under-drained with most beneficial results. A marked improvement has been noted in the texture of the soil on the under-drained areas. It can be worked from two to three weeks earlier in the spring, which, in Eastern Canada, where the growing season is so short, is a valuable asset. The under-draining has made the heavier clay soils much easier to work, reducing the labour of preparing a seed bed for grain. This is most in evidence in a wet season for, if the heavy clay is not well dried out and is worked when damp, it will bake very hard and a poor seed bed results.

Live Stock

Live stock feeding and breeding is one of the main activities of this Farm, the surrounding country favouring the development of dairying and beef raising to a much greater degree than other branches of agriculture.

Beef Cattle (Shorthorns). The breeding herd maintained at this Farm is of the beef type, with a fair percentage of milking blood obtained from the dam's side. The majority of these cows were selected from the dual-purpose herd kept at the Kentville Experimental Station and only those showing beef tendency were chosen. The herd to-day consists of eight mature cows, one two-year old heifer, four yearling heifers, one yearling bull, one heifer and one bull under one year of age, one aged bull and three yearling steers All calves are allowed to suckle their dams. Individual records are kept of feed consumed and, in this way, the actual cost of maintaining the herd is obtained, also the cost of rearing Shorthorn calves to one year and from one year to two years of age. These records also show the profit that may be realized from a beef herd under present-day conditions. Good bulls are offered to breeders wishing to purchase Shorthorns for the improvement of their stock.

Projects.

The following are the projects that have been conducted at this Farm with beef cattle: (1) Feeding tests of different grades of beef steers; (2) Medium vs. heavy feeding; (3) Effect of dehorning; (4) Light vs. heavy steers; (5) Feeding tied vs. loose in box stalls; (6) Influence of age on feeding steers; (7) Costs of finishing good beef steers; (8) Feeding good butchers versus good stockers; (9) To determine the value of molasses in the ration for finishing beef steers; (10) Roots vs. ensilage in the feeding of beef steers; (11) Finishing beef steers in open sheds vs. in barn; (12) To study the problems related to the successful breeding of beef cattle and the application of such principles of breeding as are already established. To improve the beef cattle of the district by demonstration in feeding and development and by the sale of good bulls to farmers in the district; (13) To determine the relative value of ground screenings vs. crushed oats vs. corn; (14) To show the difference in feeding and finishing dairy type of steers vs. beef type; (15) To determine the cost of rearing beef claves; (16) To determine the cost of maintaining beef herd.

Guernseys.

The breeding herd of Guernseys at this Farm consists of six mature cows, three two-year-olds in milk, two two-year olds not in milk, one yearling, two females under one year, one yearling bull, three bull calves and two mature bulls. Individual records are kept of production and feed consumed. From these records the feed cost of milk production is obtained, the cost of rearing dairy calves from birth to one year of age and from one year to the date of dropping first calf; also the possible profit realized from a Guernsey herd over feed cost. Each year a number of good bulls are offered to breeders for the improvement of their stock.

The five mature cows in this herd have given an average butter fat test of 5.67 per cent with an average of 502.14 pounds fat, with an average feed cost for 100 pounds of milk of $2.09, or a profit over feed cost of $108.31 per cow. All cows are entered in the Record of Performance.

Grade Herd.

During the past eight years, the improvement of the common dairy cow by the use of a pure-bred sire has received a great deal of attention. In 1910, twelve heifers, born in 1909, were purchased for the experiment, the object being to collect data on the cash value of the pure-bred dairy sire on a herd of common or mixed breeding in the increased production of the progeny as well as their proportionately greater market value. The grade foundation heifers were first bred to an Ayrshire bull. From this Ayshire cross (1A) breeding was carried along as for pure-breds, breeding the Ayrshire crosses always to a pure-bred Ayrshire bull. The next year, the foundation herd was bred to a Holstein bull, yielding the first cross Holsteins (1H). All progeny was bred to a bull of like breeding. All heifers were bred to freshen as near two years of age as possible and for fall calving. Each foundation heifer will, in her heifers, originate a family hence her number has been incorporated into the number of all her progeny.

Accurate data have been collected on (*a*) Cost of rearing to first calving; (*b*) Cost of feeding for each lactation period; (*c*) Character and quantity of feeds for each lactation period; (*d*) Milk, fat and butter produced in each lactation period; (*e*) Profit produced in each lactation period; (*f*) Photographic records of each of the progeny of each foundation heifer which show the influence of heredity as to quality, size and type. While the experiment has not been completed yet, the data so far give some very interesting and valuable information. The first outstanding feature is the marked influence of a pure-bred sire on the average grade herd in transmitting to the progeny the breed characteristics, such as colour, size and conformity to type. These have been most marked in both Holsteins and Ayrshires. In Holsteins, colour marking has been as high as 98 per cent, in Ayrshire 95 per cent. In breed type, Holsteins have scored 90 per cent and Ayrshires 85 per cent. In size, Holsteins have shown 96 per cent and Ayrshires 90 per cent.

Space will not permit of a detailed analysis of the results obtained from the production of the progeny compared with that of their dams, but a summary will give this in a general way. The only fair basis of comparison is that of butter fat. The data so far show that, in the case of first-cross Ayrshires, 29·5 per cent are superior to their dams, covering a period of five years' production. In the case of second-cross Ayrshires, over a period of five years 56 per cent were superior to their dams. In the case of third-cross Ayrshires, over a period of three years 66·6 per cent were superior to their dams. It will be noted that a gradual increase has been obtained in each succeeding cross. In the case of first-cross Holsteins, covering a period of five years 33·2 per cent were superior to dams in butter fat production. In the case of second-cross Holsteins, covering a period of three years 90 per cent showed superiority to their dams.

One of the most important phases of this work is the result obtained by using a pure-bred sire of the right breed type, having official qualifications for production in his ancestry, vs. using a pure-bred sire of the right breed type but not sufficiently qualified by official production in his ancestry.

The foregoing results are worthy of note from the standpoint of the breeder who is selecting his herd sire, whether he be for a grade herd or a pure bred herd. The principle is the same and one may expect similar results to follow its application.

The cost of milk production was computed over a period of nine years from the grade herd mentioned above, where no selection of females was made because all were retained for experimental purposes. This would tend to increase the cost of production, as the poorer females would lower the average production. Nevertheless, it is felt that these figures from a grade herd may be of interest and value to the breeder and feeder. The nine-year average was as follows:—Amount of different feeds required to produce 100 pounds milk was 37 pounds meal, 113 pounds roots, 80 pounds hay and 35 pounds green feed at an average cost of $1.77 per hundredweight, roots being valued at $3 per ton, hay at $13 per ton, green feed at $3 per ton and pasture at $2 per month.

SHEEP—*Pure-bred Flock.* The breeding flock of Shropshires kept at this Farm consists of fifteen mature ewes, nine two-shear, ten yearlings, four pure-bred rams (three shearlings and one two-shear). Data are being collected on the cost of maintaining a pure-bred flock, cost of rearing lambs and supplying breeding stock to the breeders. During the season of 1922, the thirty-one ewes bred, dropped and raised forty-two lambs, or 135·5 per cent.

Grade Flock. In 1917, a bunch of average grade ewes was purchased and bred to a good ram, possessing not only good breed type but an excellent fleece. Other rams used on the progeny were equally as good with the following results:— The grade ewes gave a wool clip that averaged six and one-quarter pounds per fleece. Their progeny yielded a wool clip that averaged eight and nine-twentieths pounds per fleece which graded 85·6 per cent medium combing, 11·6 per cent low medium and 2·8 per cent low combing. Their progeny, in turn, gave an average wool clip of eight and five-sevenths pounds per fleece, grading 85·5 per cent medium combing, 11·7 per cent low medium and 3·4 per cent low combing, showing an increase in three years of nearly two and five-eighths pounds per fleece. To the breeder having a flock of 100 ewes, this would mean an increase in production of 262·5 pounds wool, which, figured at 30 cents per pound, would realize a net increase profit from the flock of $78.75. The foregoing results are indicative of the fact that cheap sires are dear sires at any price and that good sires with official qualifications in ancestry are cheap sires at any reasonable figure.

SWINE. Swine breeding has also received much attention at this Farm, two herds being maintained, namely Yorkshires and Berkshires. The object in maintaining these herds is three-fold: first, to collect data on cost of production under present-day conditions; second, to determine the relative value of different feeds in economical production and, third, to supply good breeding stock.

HORSES. Eighteen horses are kept at this Farm, the heavy horses being used for general farm work while the lighter horses do the express work and necessary driving. Some attention is being given to the breeding of Clydesdales and data are being collected on the cost of rearing colts until four years of age, and also on the cost of maintaining work horses.

Field Husbandry

Three rotations are being demonstrated on acre plots. These rotations may be modified to suit the needs of the individual farmer.

Three-year rotation "D."—First year, roots or corn; second year, grain; third year, clover hay.

Four-year rotation "C."—First year, roots or corn; second year, grain; third year, clover hay; fourth year, timothy hay or pasture.

Five-year rotation "B."—First year, roots or corn; second year, grain; third year, clover hay; fourth year, grain; fifth year, clover hay.

Data are being compiled each year on the cost of producing wheat, oats, barley, mixed grain, corn ensilage, sunflower ensilage, o.p.v. ensilage and hay. These figures, covering a period of five to ten years, will be of value to the farmer in determining the cost of production of the various farm crops.

Cultural Methods. Two hundred and thirty plots of one-fortieth of an acre each were laid off for this work and the following tests are being conducted on clay loam, fairly uniform throughout: (1) The best method of preparing sod land for grain; (2) The best method of cultivating sunflower ground for grain, after harvest; (3) The best depth of ploughing sod for grain; (4) The best method of preparing sod for roots; (5) Rates of seeding nurse crop of oats; (6) The best method of preparing sod land for sunflowers; (7) Experiments with barnyard manure; (8) Fertilizer experiments with hay; (9) Best method of preparing seed bed for grain; (10) Experiments to show the value, or *vice versa*, of green manure versus no green manure.

A test to determine the value of barn-yard manure as a top-dressing is being conducted on a five-acre plot, one-half receiving a top dressing every four years at the rate of twenty tons per acre while the balance is left undressed. A test was started in 1921 to determine the value of an application of barnyard manure and commercial fertilizer to natural, rough pasture. An experiment is being conducted with run-out marsh land and data on cost of renewing are being compiled, as there are thousands of acres of such land in this district that are gradually becoming less productive due to lack of drainage and ploughing. Tests are being conducted to determine the value of using commercial fertilizers on run-out marsh lands.

Forage Crops

Variety tests of turnips, mangels, sugar beets and carrots are being conducted in triplicate plots of 1-100 of an acre; data are being collected on purity and trueness of type, and the growing of club-root-resistant swede turnips has been receiving attention for the past three years with marked success.

Cereals

The work in this division comprises variety tests with wheat, oats, barley and buckwheat and the development of good elite stock for seed purposes.

Fertilizer Tests

These are being conducted to determine the benefits that may be derived from applications of complete fertilizers to the hoed crop, as well as their effect upon the subsequent crop, of a three-year rotation. Thirty plots in duplicate, together with ten check plots, have been laid off, fertilized and planted to potatoes in 1923.

An experiment to determine the relative value of the different brands of basic slag is being conducted, the test being carried on with oats followed by clover hay. Sixty-six one-fortieth acre plots were started during 1923 for this work.

Poultry

The Barred Plymouth Rock is the breed kept at this Farm. Similar work to that with live stock is being carried on with poultry; figures are being collected to show the value of using cockerels selected from high producing dams. Special pedigree breeding work is also receiving careful attention and marked progress is being made. In three years one family has been established with the following records: 308, 272, 273, and 224 eggs, in 365 days. Data are also being collected on cost of production of eggs and chicks; value of commercial vs. home feed mixtures; milk vs. beef scrap in the feeding ration.

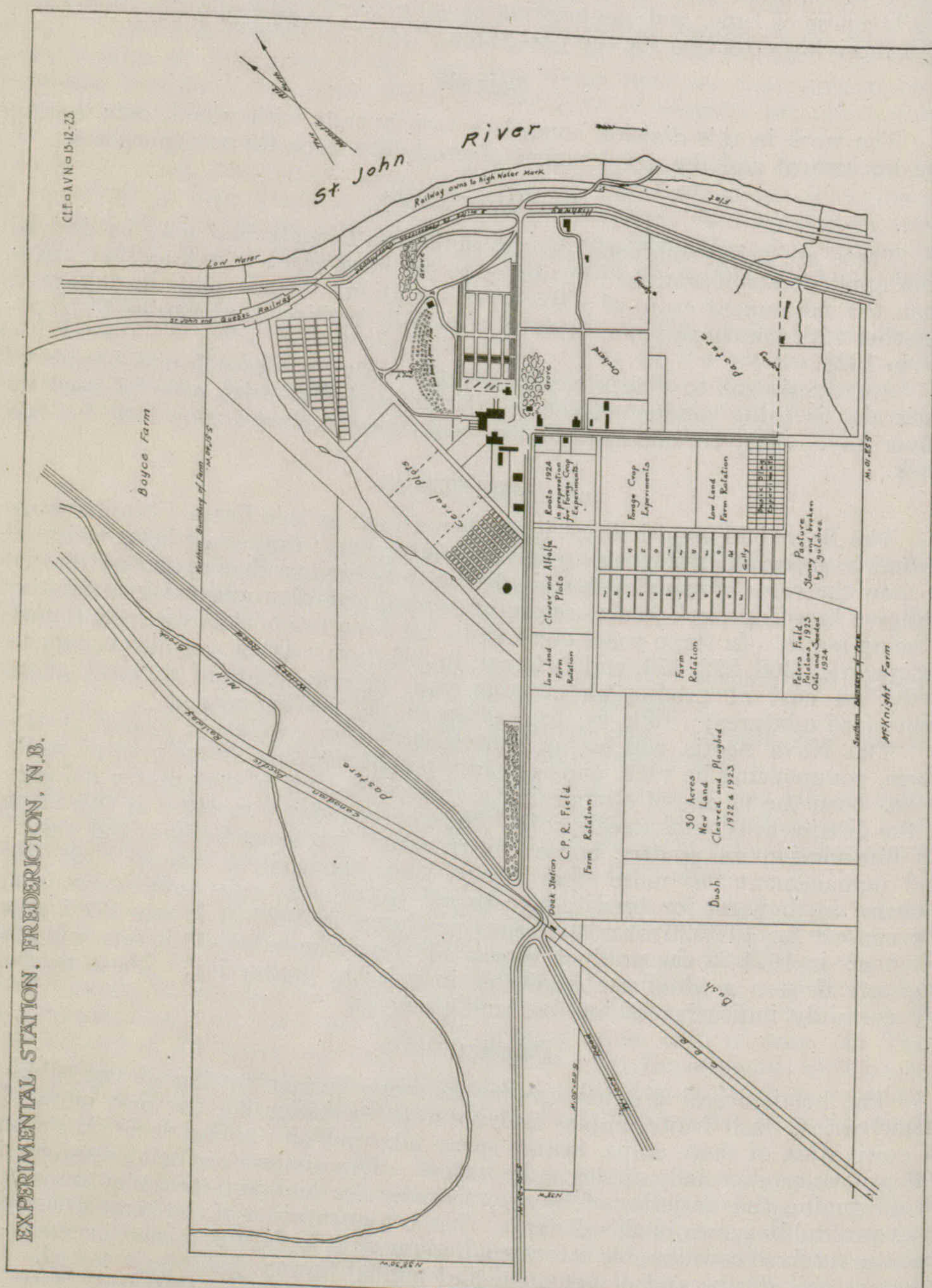
The Nova Scotia egg laying contest has been conducted yearly at this Farm, commencing in 1919, and is a very popular feature of the poultry work. It has been the means of stimulating a greater interest in the poultry industry in the district as is evidenced by: (1) The correspondence received at this Farm for information on poultry house construction, breeding, feeding and care and management has more than tripled since the contest started. (2) The increase in demand for bred-to-lay stock. (3) The average production from the contest for 1919-20 was 121.1 eggs per hen; in 1920-21 it was 127.7 eggs per hen; in 1921-22 the production was 138.3 eggs and 1922-23 it was was 143 eggs per hen—a gradual yet creditable increase in production. These results are certainly indicative of interest and progress.

Horticulture

The horticultural division has for its work variety testing of vegetables, strawberries, bush fruits, apples and potatoes, investigating the best methods of cultivation of these crops, testing spray mixtures and noting their effects on different crops especially apples and potatoes. Experiments are being conducted to determine the varieties of apples, strawberries and potatoes that may be most profitably grown in this district. The ornamentation of the home grounds has also received considerable attention, and many different varieties of ornamental trees and shrubs and of perennial and annual flowers have been tested.

Bees

Twenty colonies are maintained at this Farm. Data are being collected on the best methods of wintering and feeding of bees and on the profits of bee-keeping. The average production for the season of 1922 was 121 pounds per colony.



EXPERIMENTAL STATION, FREDERICTON, N.B.

THE EXPERIMENTAL STATION FOR NEW BRUNSWICK

C. F. Bailey, B.S.A., *Superintendent.*

The Experimental Station for New Brunswick is beautifully situated on the St. John river, three and a half miles from the centre of the city of Fredericton but within the city limits. It was established in October, 1912, and comprises 525 acres, of which 300 acres are under cultivation. One hundred and fifty acres of this have been cleared and broken since the Station was established.

The soil, in general, is a clay loam with hard clay sub-soil. A few small areas are of a loamy nature and underlaid by strata of sand.

The development of the work, except for a brief period during the war, has been rapid. A number of comprehensive experiments are now under way in the different divisions, and while it is too soon as yet to draw conclusions, definite results may be expected in the near future.

Buildings.

Buildings.—The buildings include five houses, one horse barn, one main cattle barn, one dairy barn attached to main barn, two silos, dairy, bull barn, one isolation barn, one sheep shed, potato house and cellar, two implement sheds, eighteen poultry houses, poultry administration building and pump and power house. These are all new buildings with the exception of three houses and two barns which have been remodelled. The main cattle barn is 50 by 100 feet, with twenty-one cattle stalls, six large box-stalls and seven smaller stalls for calves. The dairy barn has accommodation for forty-eight milch cows.

Organization.—The work of the farm falls under the following divisions:—

Animal Husbandry; Field Husbandry; Cereal Husbandry; Horticulture; Forage Crops; Poultry; Chemistry; Apiculture.

Animal Husbandry

Cattle.—The stock on November 24, 1923, totalled sixty-two head, and included fifty-six pure bred cattle and six grades. Two of the grades are beef steers and four are work oxen. The following table shows the number of cattle of each breed:—

Ayrshires	9 milch cows,	12 heifers,	2 bulls.	
Holsteins	8 " "	4 "	1 bull.	
Shorthorns	6 " "	11 "	1 "	2 steers.
Grade Stock—				
Ayrshire	1 steer.			
Shorthorn	1 steer.			
Working cattle	4 oxen.			

The work with cattle includes keeping records of milk production, cost of milk production, cost of producing baby beef and cost of rearing young stock. Numerous feeding experiments have also been carried on. An experiment to determine the relative value of turnips, sunflowers and corn ensilage for milk production was begun last year.

The herd at the present time is smaller than usual. This is due to several causes. In 1914, a grading-up experiment was begun. Twenty-six cows of, mixed breeding and typical of the cows on the average New Brunswick farm were secured as foundation cows. These were bred to pure-bred Holstein, Dual-purpose Shorthorn and Ayrshire bulls. The object of the experiment was to compare the female progeny of these cows with their dams, for milk production, cost of milk production and improvement in type. The female progeny were to be kept for three generations for the purpose of comparison with the foundation cows, but losses from tuberculosis made this impossible. The experiment has therefore been discontinued and the remaining grade stock disposed of. During the past year the herds were severely culled. All the Shorthorns, Ayrshires and Holsteins which failed to qualify in the R.O.P., or were off type, were disposed of. The remaining individuals in these two herds are now very creditable. One of the Holsteins, Helen Clover Ormsby 67693, produced 18,318 pounds of milk testing 3.5 per cent fat, a total of 676 pounds of fat, in 365 days in her first lactation period. The herds were fully accredited in February, 1922.

Horses.—The horses at date of writing number seventeen, consisting of one aged stallion, three mature mares, one 2-year-old mare, one 2-year-old gelding, one yearling mare and one horse foal—all pure-bred Clydesdales; also one grade Clydesdale mare, two grade Clydesdale geldings, one grade Clydesdale mare, one Percheron mare, one grade Percheron gelding and two general purpose mares sired by standard-breds.

Accurate records are kept of the feed consumed, blacksmithing, cost of upkeep and number of hours work performed by each mature horse. From these records the cost of horse labour per hour is compiled. Records are also kept of the feed consumed by each horse raised at the Station and data are gathered of the cost of raising horses to six months, one year, two years and three years of age. The mature horses are worked all winter and therefore no experimental work on maintenance rations is carried on at present.

Sheep.—The Shropshire breed of sheep is kept at this Station. The flock on November 24, 1923, consisted of 18 breeding ewes, 10 spring lambs and 1 ram.

The Shropshire flock is an exceptionally creditable one. The stock ram, Buttar 329 (imp. -38071-) was imported from Scotland in April, 1923, and is a splendid individual.

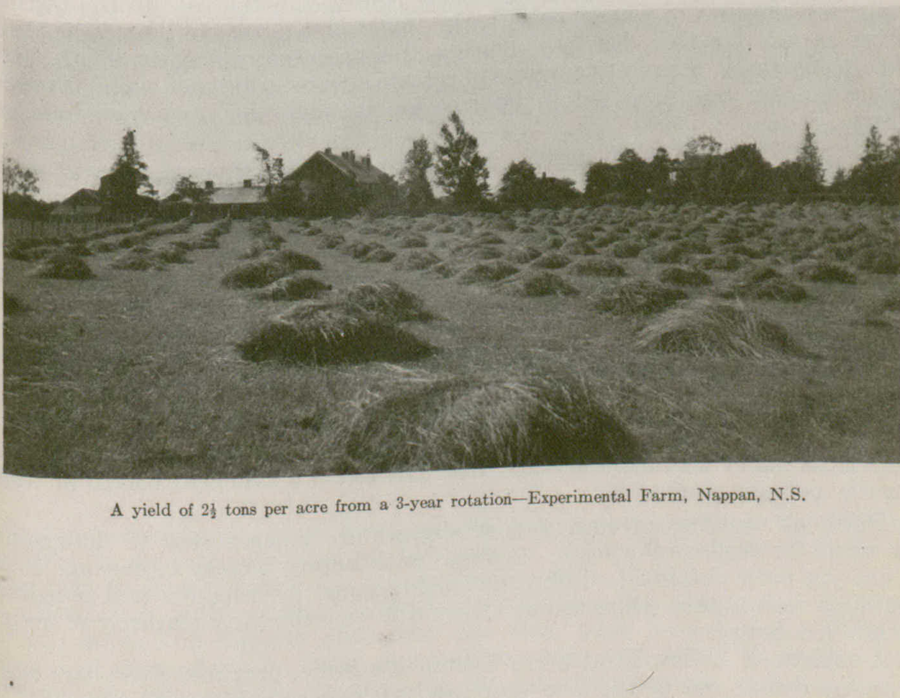
The work with sheep includes lamb feeding experiments, early weaning experiments and experiments on the value of rape for ewes, market lambs and early weaned lambs.

Swine.—The hogs at the Station on November 24, 1923, totalled eleven. They included one boar, two aged sows, five young sows and three barrows, all pure-bred Yorkshires. The herd, though small, is of excellent quality. The herd sire, Rogerfield Wonder (imp–88844–) was imported from Scotland in April, 1923. He is of especially fine bacon type.

The work with hogs includes keeping careful records of cost of raising litters, rearing young sows, maintenance of brood sow, maintenance of boar, cost of producing bacon, and experimental work with different rations for producing high-class bacon. In this work, buckwheat and barley, which are home-grown grains, are compared with corn, an imported grain, both as to economy of production and quality of product. Experiments are also being carried on to ascertain the value of tankage and mineral matter for hogs.

Goats.—A flock of Angora goats was maintained at this Station from 1918 to March, 1923. They were purchased in order to obtain data on the feasibility of using goats for clearing New Brunswick bush land. It was found that they would eat only certain kinds of bushes, and the mohair from goats raised in New Brunswick was practically worthless. Goat flesh for meat could not be sold at a profit and for these reasons it was found impractical to keep goats for the purpose of clearing land. They were accordingly disposed of.

Pasture Scene showing Princess of Northland, 108371, in the foreground—Experimental Station, Fredericton, N.B.



A yield of 2½ tons per acre from a 3-year rotation—Experimental Farm, Nappan, N.S.

Field Husbandry

The major part of the cultivated land is devoted to field husbandry. A four-year rotation is followed on all this land with the exception of 12 acres, which was laid off this year (1923), for rotation experiments. The four-year rotation consists of: first year, hoed crops; second year, grain; third year, clover hay; and fourth year, mixed hay. Barnyard manure, supplemented with commercial fertilizer, is applied for the hoed crops in the rotation. The hoed crops grown include corn for ensilage, sunflowers, turnips, potatoes and mangels. Oats, with smaller areas of barley, wheat and mixed grains, comprise the grain crop. The hay crop consists of red clover, alsike clover and timothy.

Careful records are being kept of the yields and costs of producing the above crops. Corn, though it frequently makes very little ear development, has been successfully grown for ensilage purposes since the Station was established. The yield ranges from 10 to 15 tons per acre, at a cost of from $3.40 to $5.25 per ton. Sunflowers have been successfully grown for ensilage purposes for three years. The yield has averaged 13 tons per acre, at an average cost of about $4 per ton.

Oats, peas and vetches have been grown for ensilage purposes with varying results. The yield has ranged from slightly over three tons to nine and three-quarter tons per acre, at a cost of from $5 to $10 per ton. Wheat, oats and barley are successfully and economically grown as grain crops.

Hay yields range from $1\frac{3}{4}$ tons to $2\frac{1}{4}$ tons per acre.

In 1913, an experiment was begun to test the value of different materials for underdrains. Stone, pole and brush and concrete and clay tile were used. All are working well except the concrete tile which have broken down badly.

Cereal Husbandry

The work with cereals has been largely confined in the past to the testing of different varieties of wheat, oats, barley, peas and beans, to determine their relative merits for this district. During the past season, experiments were begun to determine the relative merits of certain strains of Banner oats. Experiments were also begun to obtain information on different rates and dates of seeding

The results so far indicate the superiority of Victory and Banner oats. Among the different varieties of wheat tested, the Huron, White Russian and Early Russian varieties have proved best adapted to this section. The two varieties of barley which are most promising are Charlottetown No. 80 and O.A.C. 21. Winter wheat has been tried but owing to the danger of its being winter-killed, it is not a reliable crop.

Forage Crops

Extensive forage crop investigations were begun soon after the establishment of the farm. During the war these were quite largely discontinued, and the experiments under way have not yet been carried on a sufficient length of time to justify definite conclusions.

Different varieties of corn and sunflowers are being tested to determine their value for ensilage purposes. A really satisfactory variety of ensilage corn has not yet been obtained. Efforts are being made by selection and breeding to obtain a variety that will combine high yields with the early maturity so desirable for this district.

A variety of Yellow Flint corn, Twitchell's Pride, procured five years ago, has matured four out of the five years and yielded a satisfactory crop.

Variety tests are also being carried on with swedes, mangels, sugar beets and carrots. Mangels and sugar beets are not reliable crops here. Swedes grow well, and several varieties show promise. One of the outstanding features of our variety test of swedes in 1922 was the marked resistance of a strain of Bangholm to club root.

During the war, extensive experiments were made in turnip seed production. When carried on in a commercial way, the project was not very successful on account of the loss of roots in storage. At the present time, only sufficient seed is being grown annually to supply our farm needs, and when grown in this small way the result is practical and applicable to the individual farmer.

Grasses, clover and alfalfa, alone and in various combinations, are being experimented with for hay crops. Mixtures of alsike and red clover with timothy have given the best yields to date.

Experiments are also being carried on with grass mixtures when seeded with nurse crops as well as without nurse crops.

The following experiments are being carried on with alfalfa: (1) Broadcast vs. rows; (2) Inoculated vs. uninoculated; (3) Limed vs. unlimed. The crop has not been found to be satisfactory on account of killing out during the second winter.

Poultry

The development of the poultry work at this Station has been rapid during the past five years. During the first years the Station was established, several breeds of hens were kept, and, with the accommodation available, it was difficult to make much progress with any of them. At the present time only one breed, viz., Barred Plymouth Rocks, is kept. Every effort is being made, by careful breeding, to raise the egg standard. An average production for the year of 246·3 eggs from one of our pens of this breed in the 1922-23 New Brunswick Egg Laying Contest, and individual hen records of 306 and 291 eggs speak well for the success of the efforts in this direction.

Records are being kept of the cost of egg production, hatching results, cost of rearing chicks and growing them to marketable age. Different types of houses, incubators and brooders are being tried, and experiments are being carried on to compare beefscrap with skim-milk, water with milk, commercial with home mixed feeds, and different grain feeds, for laying hens. Chick feeding and caponizing experiments are also being carried on. These trials have been conducted two seasons and conclusive results will soon be available.

Egg laying contests have been carried on at this Station for the past three years. Registration has been available for hens laying over 200 eggs during either of the past two contests. Twenty-five hens qualified in 1922, and forty-six in 1923. The records have been especially creditable. In 1921, the New Brunswick egg laying contest had the second highest average production of any Canadian contest. In the 1923 contest, a pen of Barred Rocks belonging to this Station had the highest pen production for any contest pen in Canada. One hen in this pen, Fredericton Eighteen, laid 306 eggs. This records equals the highest individual record in any Contest.

Fertilizer Experiments

Commercial fertilizers are largely used by the potato growers in the province. In order to meet the demand for information, extensive fertilizer experiments have been carried on since the establishment of the Station.

Fertilizers with varying percentages of nitrogen, phosphoric acid and potash, applied in various quantities per acre, have been tested. Different carriers of these elements have also been experimented with. Because of the difference in soils and the variation in the price of potatoes, it has not been possible to announce any best fertilizer. The superiority of a complete fertilizer had been established as well as the economy of home-mixed fertilizers. Six per cent potash has also been found to give as good results as ten per cent, in most cases.

Extensive experiments have been carried on to determine the value of commercial fertilizer for garden crops. The results show that one-half the manure generally used for these crops can be replaced with commercial fertilizer with increased profits.

During the past season, extensive experiments were begun to determine the value of different grades of basic slag and also to determine the value of basic slag for renovating old pastures. A young orchard was also set out to permit of study of orchard fertilization.

Apiculture

There are forty colonies of bees in the apiary at the present time. These have been built up from eight old colonies and by the purchase of package bees, since the spring of 1922.

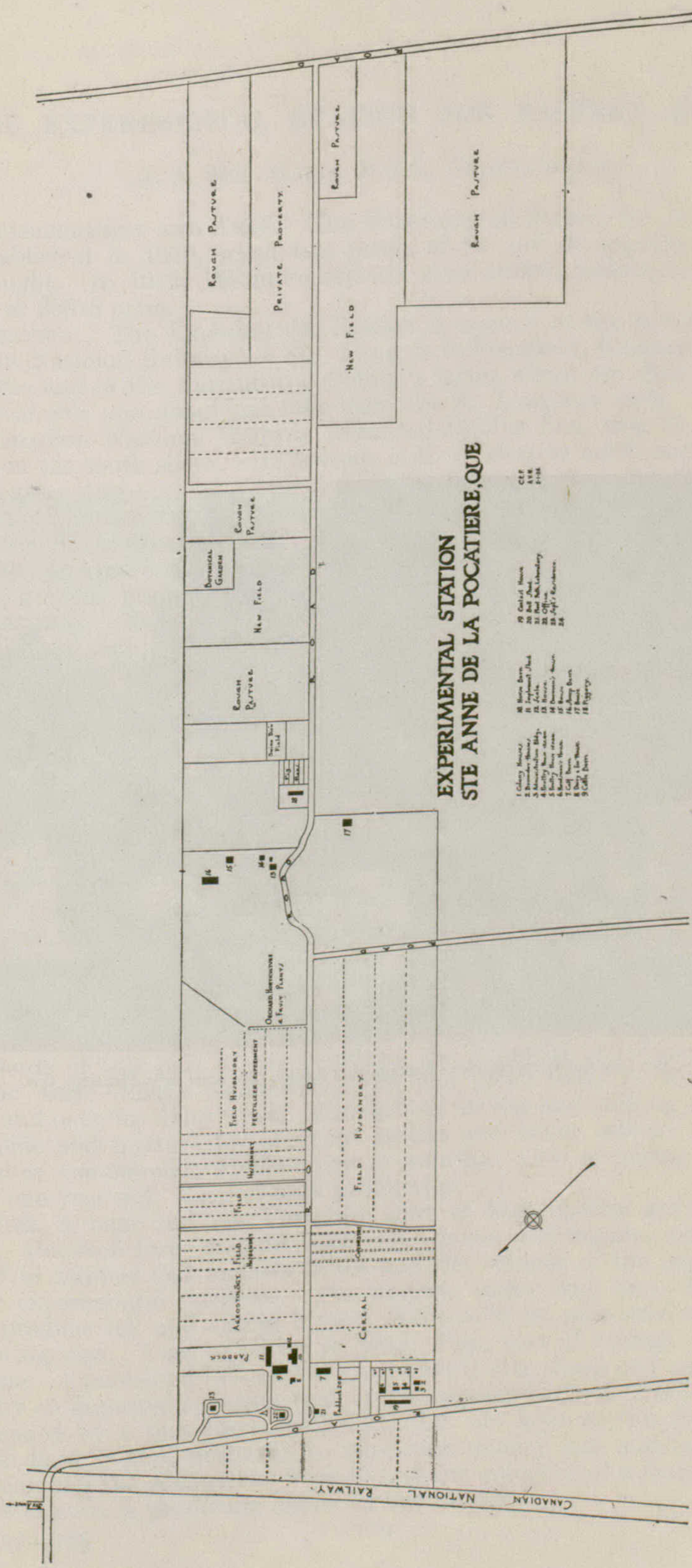
Records are being kept of honey production and experiments are being conducted on swarm control, swarm detection, methods of making increase, wintering, and methods of strengthening weak colonies in the spring.

Illustration Stations

There are now, in the province of New Brunswick, seventeen Illustration Stations. These vary in size from eight to twenty-four acres. They are situated one in each county. Practical demonstrations are carried on at the Illustration Stations, including the rotation of crops, the use of good seed, proper tillage, seed treatment, spraying, etc. Considerable attention is also paid to the live stock and poultry owned by the farmers operating these Stations. Summer meetings are held at the Stations, and the methods pursued are thoroughly explained to the farmers of the surrounding districts. The farm practice carried on at the Illustration Stations is patterned after that carried on at the Fredericton Experimental Station and thus the results of practical experiments there are brought home to the farmers of the province.

Agricultural School

A very pleasing feature of the work at the Fredericton Station is the close co-operation and good-will which exist between the New Brunswick Department of Agriculture and the Experimental Station. During the summer of 1923, the Provincial Department of Agriculture erected a school of agriculture at the Experimental Station. In this school they are conducting classes in agriculture, and propose, during 1924, to conduct classes in domestic science as well. The live stock at the Experimental Station are available for classes in judging, etc. This co-operation enables the New Brunswick Department of Agriculture to run the school at a minimum cost, and at the same time to bring the work of the Experimental Station before the youths of the province. The building in which these classes are conducted is a handsome two-story one, 86 by 52 feet, built of concrete blocks with a structural steel frame. In the lower story there is an excellent live stock judging pavilion, 66 by 48 feet. The upper story is divided into class rooms. The building formerly used by the Experimental Station as a community hall has been converted into a dormitory for the students. This school supplies a long felt need in the province.


EXPERIMENTAL STATION
STE ANNE DE LA POCATIERE, QUE
ROUGH PASTURE
PRIVATE PROPERTY
NEW FIELD
BOTANICAL GARDEN
ORCHARD HORTICULTURE & FRUIT PLANTS
FIELD HUSBANDRY
FERTILIZER EXPERIMENT
AGROSTOLOGY
CEREAL
PADDOCK
ROAD
CANADIAN NATIONAL RAILWAY

'A Bee Day and Demonstration—Experimental Station, Ste Anne de la Pocatière, Que.

THE EXPERIMENTAL STATION FOR EASTERN QUEBEC

J. A. Ste. Marie, B.S.A., *Superintendent*

Establishment and Area. The Experimental Station for eastern Quebec was established in 1910, when two farms of 84 and 60 arpents respectively were bought. In 1913, 125 more arpents were added, making a total of 269 arpents or 200·8 acres.

Location. The Experimental Station is located at the south side of the Canadian National Railway at Ste. Anne de la Pocatiere, Kamouraska county, and at the end of the Agricultural College's farms which are close to the town on its west side and about one mile from the St. Lawrence river. It is on the main Canadian National Railway Montreal-Halifax line, and 73 miles below Quebec on the south shore. Its latitude is 47·22 degrees north and is longitude 70·22 degrees west.

Soil. The lower part of the farm, which has an altitude of 47 feet above that of the St. Lawrence river, is of a very heavy blue clay and level. The soil of the upper part, which rises to an altitude of 334 feet, is very stoney and of a coarse, gravelly nature and quite uneven.

Buildings. The Station has now a fairly good set of buildings, including housing accommodation, horse barn, cattle barns, sheep barn, piggery and poultry houses.

Live Stock

Horses. The stud is now composed of sixteen pure-bred Percherons and three grades. In 1917, two pure-bred mares were imported and four more were added in 1918 and 1919. It is hoped that a few good individuals will soon be available for sale as breeders every year. Besides supplying horse-power for the farm work, the following experimental projects are carried with horses:—Cost of maintenance; Joint Ill control(potassium iodide *vs.* bone meal); Work *vs.* no work for pregnant mares; Spring vs fall foals; Cost of raising colts from birth to one year old; Cost of rearing colts from one year to two years of age; Cost of horse-power.

Cattle. Pure-bred Ayrshires are kept at this Station and the herd is now composed of the following: 1 senior sire, 1 junior sire, 24 cows, 11 heifers, 12 calves. Besides raising outstanding males and females for the improvement of the herds of this part of the province, the following experimental projects are under way:—Silage (sunflowers, corn and green feed) *vs.* roots (turnips) *vs.* peas and oats, for dairy cows; Mineral feed for dry and milking cows; Potassium iodide and mixture for pregnant heifers and heifer calves; Home-made calf meal *vs.* commercial; Heifers, cost of growing; Cost of raising heifers from birth to one year old; Cost of milk production.

Swine. A boar and ten Yorkshire sows of high quality are kept at this Station. Between forty and fifty pure-bred males and females are distributed annually to farmers and farmers' clubs and the balance of the hogs raised are kept for experimental purposes. The projects under way are:—Housing and cost to produce fall and spring litters; Skim-milk *vs.* powdered skim-milk to feed growing pigs. Corn *vs* barley *vs.* oats; Pigs, cost of raising.

Sheep. A pure-bred Leicester flock of twenty-five sheep and ten ewe lambs, headed by an imported Leicester ram, and a commercial flock of fifteen Leicester sheep headed by a pure-bred Shropshire ram, are kept at this Station. The pure-bred flock is kept primarily to raise high quality ram and ewe lambs for distribution and the commercial flock to test the influence of a Down breed ram on Leicester ewes in producing lambs for the market.

There is, in this part of the province, a very large area of rough and poor land where sheep could be kept to advantage. To throw more light upon this, and induce farmers to keep more sheep, the following experimental projects are now being carried on:—Comparison of cross breed lambs; Early *vs.* late lambing for eastern range conditions; Breeding ewe lambs *vs.* year old sheep; Breeding sheep to lamb in March *vs.* April; Breeding Leicester ewes to a Shropshire ram to raise lambs for market.

Field Husbandry

The work in Field Husbandry is quite extensive and is arranged in four divisions: To determine the most advantageous cultural methods, the best crops to grow in this part of the province, the value of chemical fertilizers on a field scale and the effect of drainage on heavy clay soil. The following work is carried:—A. Three-year rotations (two sets of fields). B. Four-year rotation (four sets of fields). C. Five-year rotations (two sets of fields).

The projects carried in the above fields, follow: Roots *vs.* corn; Corn *vs.* sunflowers; Mangels *vs.* swedes; Wheat following corn and sunflowers *vs.* following roots; Clover growing following corn, sunflowers and roots; Roots, corn and sunflowers on drained *vs.* undrained land; Cost of wheat production on drained *vs.* undrained land; Cost of clover hay production following corn, sunflowers and roots on drained *vs* undrained land; Sod land *vs.* oats and peas stubble for the growing of roots; Corn *vs.* sunflowers *vs.* sunflowers and corn for silage; Peas, oats and vetches *vs.* clover for hay; Oats *vs.* barley; Fertilizers experiment.

Horticulture

The work under this head was started in 1913 and comprises the testing of varieties of apple, plum, cherry and pear trees and of small bush fruits, including red, white and black currants, gooseberries, and raspberries and of strawberries.

The tree fruit orchard now contains 1,100 trees, including practically all the standard varieties grown in Canada and a great many crosses and new varieties originated at the Central Experimental Farm, Ottawa and elsewhere. The trees have withstood the winters and have done remarkably well since the orchard was started. Of the 261 apple crosses and seedlings under observation, those which have now come to bearing and are so far worthy of note are: Melba, Pedro, Lobo, Rupert, Thurso, Kildare, Brock, Herald, Brisco, Kelso.

Of the plum varieties under observation, those generally found in this part of the province are proving more adapted to our climatic conditions. The varieties doing best in order of merit are: Damas Blue, Reine Claude de Montmorency, Lombard, Hudson River, Saunders, Kerry, Greengage.

The same may be said of the cherry trees and the best adapted and most persistent bearers are: Cerise de France, Early Richmond, Cerise d'Ostheim.

A certain acreage of land is also devoted to vegetable gardening and to the testing of a great number of varieties of flowers and shrubs to beautify the grounds.

There are, in all, sixty experimental projects in horticulture now under way at the Station.

Cereals

In this part of the province of Quebec, where the farms are small, it is imperative to sow the very best varieties known, to bring forth the highest possible returns. To assist in solving some of these problems, the following list of experimental projects are being carried on: Variety test of wheat; Variety test of oats; Variety test of barley; Variety test of peas; Variety test of beans; Variety test of flax for seed; Variety test of rye.

Forage Crops

Twelve acres of the Station are devoted to the testing of varieties of grasses, clovers, roots, corn and sunflowers, to determine the highest yielding and best adapted varieties for this part of the province. The work is divided into thirteen main experimental projects.

Fertilizer Experiments

The question of maintaining and increasing the fertility of the land has always been one of much concern and a section of the Station has been set aside for experimental work in this connection. The object of this work is to ascertain the relative effects on crop yields of applications of the following: —burnt lime; ground limestone (with and without manure), basic slag; superhosphate; a complete fertilizer mixture, (with and without manure) and to determine if possible, which element of plant food is most essential crop production.

Botany

A plant pathological laboratory was built at this Station in 1923 and a special officer is in charge to carry on research and experimental work on diseases affecting the various farm and garden crops in the province. It is also the headquarters for the officers inspecting fields for certified potato seed production, an increasingly important industry in this province.

Poultry

The Barred Plymouth Rock and Rhode Island Red breeds are kept. These two breeds are practically the only ones kept in this part of the province. Pegigree breeding was started two years ago with the object of selecting and multiplying record-producing strains, to permit of the distribution of hatching eggs, day old chicks and male and female birds of high quality to the farmers.

Five main experimental projects are being carried to determine the best methods to follow in poultry husbandry.

Poultry Contest. With the advance in poultry breeding throughout Canada, the desirability of obtaining officially recognized, selected families of birds of high quality became obvious. This official recognition, the poultry contest will supply. The contest birds laying 200 eggs and over during the year, are eligible for registration in the C.N.P.R.A.* Although the contest at this Station is of a recent origin, it is already awakening very much interest and will prove of great benefit to the poultry keeper.

Bees

This section of the province has for a long time past been noted for the high quality of honey produced, due to the natural flora prevailing. It is planned to have at this Station, an apiary of one hundred hives with which to carry on experimental projects, such as: Hive, divisible brooding frames; Bees, swarm control; Bees, queen rearing; Hive, Jumbo *vs.* 10-frame *vs.* 12-frame; Wintering bees in silos, east *vs.* west opening; Wintering bees. Silos *vs.* cellar.

Flax

This crop was quite extensively grown a few years ago in this part of the province, but, owing to the influx of imported goods, it has had a temporary set back which would soon be overcome with the coming of a small flax mill. Flax of a quality second to none can be grown here and in this connection a few experimental projects are carried, such as variety tests for fibre production.

---

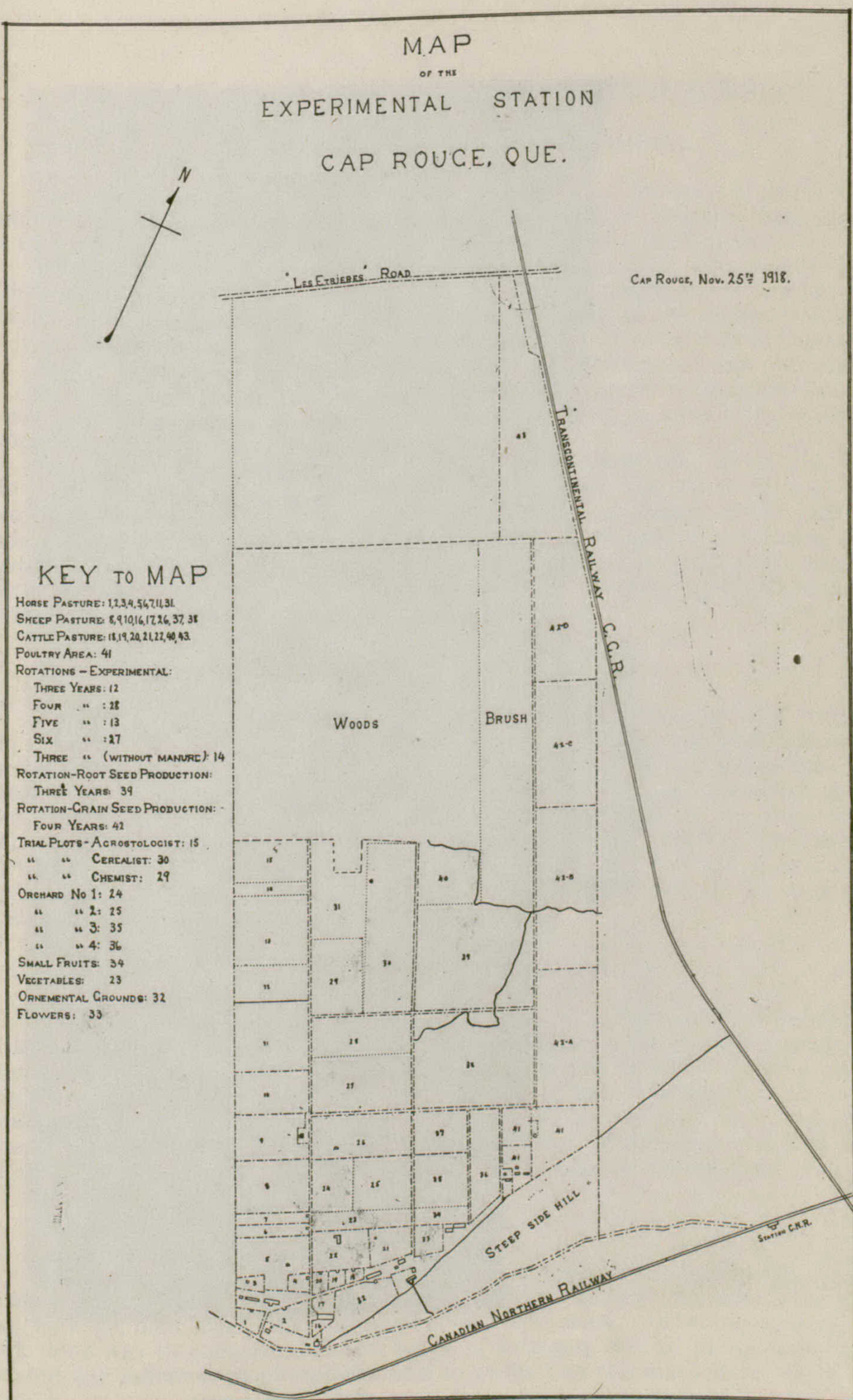
*Canadian National Poultry Registration Assn.

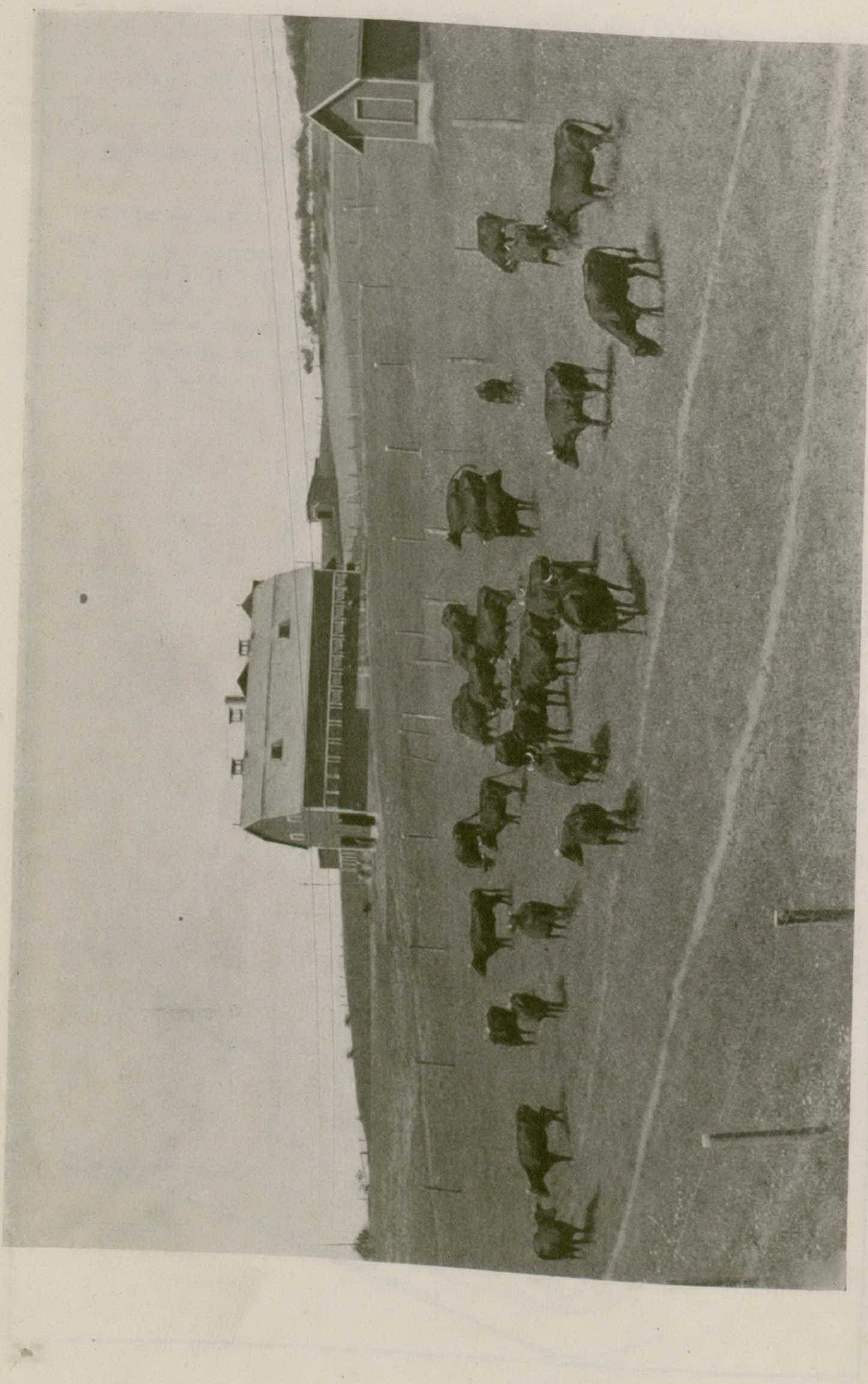
Illustration Stations

Once an experimental project has reached a final and favourable conclusion, the next move is to have it applied on as many farms, and as soon, as possible. With this in view, the Illustration Stations were established and twenty are now, in co-operation with the chief supervisor, directed from this Station. This system connects directly the Experimental Station with the farming public and a few years of work have already demonstrated its direct value in fostering a more progressive agriculture, wherever an Illustration Station is established.

Extension and Publicity

This work is carried on (1) through the medium of small and large fairs where live stock and illustrative exhibits are shown for the benefit of visitors, (2) the distribution of much literature and verbal information; (3) the preparation of reports experimental farm notes and press articles, farmers' days at the Station, judging seed and live stock at fairs, short courses, and live stock and agricultural lectures in different parts of the province.


MAP
OF THE
EXPERIMENTAL STATION
CAP ROUGE, QUE.
N
"LES ETRIERES" ROAD
CAP ROUGE, NOV. 25TH 1918.
TRANSCONTINENTAL RAILWAY C.G.R.
WOODS
BRUSH
STEEP SIDE HILL
CANADIAN NORTHERN RAILWAY
STATION C.N.R.
KEY TO MAP
HORSE PASTURE: 1,2,3,4,5,6,7,11,31.
SHEEP PASTURE: 8,9,10,16,17,26,37,38
CATTLE PASTURE: 18,19,20,21,22,40,43.
POULTRY AREA: 41
ROTATIONS – EXPERIMENTAL:
THREE YEARS: 12
FOUR " : 28
FIVE " : 13
SIX " : 27
THREE " (WITHOUT MANURE): 14
ROTATION-ROOT SEED PRODUCTION:
THREE YEARS: 39
ROTATION-GRAIN SEED PRODUCTION:
FOUR YEARS: 42
TRIAL PLOTS - AGROSTOLOGIST: 15
" " CEREALIST: 30
" " CHEMIST: 29
ORCHARD No 1: 24
" " 2: 25
" " 3: 35
" " 4: 36
SMALL FRUITS: 34
VEGETABLES: 23
ORNEMENTAL GROUNDS: 32
FLOWERS: 33



French -Canadian Cattle—Experimental Station Cap Rouge, Que.

THE EXPERIMENTAL STATION FOR CENTRAL QUEBEC

G. A. Langelier, D. Sc. A., *Superintendent*

Establishment.—The Station was established on January 1, 1911. It comprises lots 23, 26, 27, 30, 31 of the first concession of Demaure Seigniory, in the parish of Cap Rouge, county of Quebec, and is in a solid block.

Area.—The property comprises 425 arpents or about 350 acres, about two thirds of which are in cultivation. The soil varies from a light sandy to a heavy clayey loam and represents all classes which are found in the district; some of it is suitable for every plant, bush, or tree which will thrive in central Quebec.

Arrangement.—The farm has been divided in such a manner that practically each field may be used in the most advantageous way for experimental purposes. Sometimes special rotations have to be taken up so as to bring certain crops around at short intervals.

Location.—The farm is in Cap Rouge village, about nine miles west of the old, historic City of Quebec and is connected with the latter by a good macadamized road. The nearest railway station is Cap Rouge, about half a mile distant, on the Quebec and Montreal north shore line of the Canadian National Railways. The Grand Trunk Pacific touches the northeast corner of the property while the Canadian Pacific station at Lorette is about five miles away. The name of the post office is Cap Rouge.

LINES OF WORK

Everything done at Cap Rouge converges towards experimental work. For instance, clearing, draining, fencing are preparatory to getting land in shape for this, while building or remodeling barns and stables may become necessary because the studs, herds and flocks require larger numbers of animals or else special facilities for feeding individually. The main divisions of the work are soil and crop management, fertilization, forage crops, cereals, live stock, poultry, horticulture. In 1923, there were 163 different projects, as follows; 5 for field husbandry, 4 for chemistry, 23 for forage crops, 20 for cereals, 11 for animal husbandry, 10 for poultry, and 90 for horticulture.

Soil and Crop Management

The main projects which come under this head are a comparison of autumn with spring ploughing for silage corn, the determination of the average yield per acre and the cost per ton of digestible nutrients in the principal crops of the district, the comparison of different rotations, also of corn, sunflowers, peas and oats for silage, of corn for silage planted in drills and in hills, of rates of seeding oats, of rates of seeding timothy, red clover and alsike, of the yield of hay after different kinds of nurse crops, also after different rates of sowing oats.

Fertilization

At one time, there were sixty-seven plots, on sixty of which different combinations of farm manure, nitrate of soda, dried blood, acid phosphate, basic slag, tankage, bone meal, and muriate of potash were tried. Other experimental work done was to compare different forms of nitrogen, also of phosphorus, to find out the influence of phosphoric acid in promoting the maturity of Indian corn, and to get at the value of ground seaweed as a fertilizer. The two main projects at the present time are the effect of basic slage on the composition of herbage on meadows and pastures, and the comparative value of burnt lime with ground limestone. The part played by tilth, also by organisms, will, with time, receive attention, besides farm manures, green manures, amendments such as lime, and chemical fertilizers.

Forage Crops

One of the important parts of the work is the testing of varieties and strains best adapted to Central Quebec. In 1923, there were 440 plots for this purpose, on which were grown timothy, alfalfa, alsike, red, and sweet clover, corn for silage and for grain, sunflowers, carrots, mangels, fall and swede turnips and sugar beets. The number of plants growing are counted in all plots so as to correct as far as possible, the yield of those on which the stand is light, composite samples are taken, accurately weighed, air dried and sent to the Dominion Chemist for analysis, to get at the yield of dry matter per acre. Some breeding work has been done with alfalfa for hardiness, with corn for early maturity, and with swede turnips for dry matter content. The other projects consist of a comparison of different mixtures of grasses and clovers for hay and pasture, of certain varieties of oats for hay, of rates and methods of sowing red clover for seed production, of home grown with commercial root seed, of trueness to type of roots grown from seed bought from the leading seedsmen, of methods of helping the germination of mangel seed, of the profit derived from hay or from seed production with red clover, and of the adaptability to the conditions of the district of clover grown from seed procured in different parts of Europe and of Canada.

Cereals

A time will probably come when suitable varieties and strains will be found not only for every district, but for each kind of soil of every district. This is why the testing of varieties and strains of barley, field beans, field peas, flax, oats and spring wheat is receiving such careful attention. The new, or much advertised, sorts are given a preliminary trial in the nursery where they are carefully compared with the ones recommended for Central Quebec. Those that are subject to disease, are late, poor yielders, weak in the straw, or practically the same as the standard varieties, are left aside after the first year; the ones which show some merit are grown in the nursery the second year, and the few which promise to be valuable are sent to the trial plots where they must be grown during at least five years before they are either finally rejected or recommended. Variety and strain testing is found so important that there is a special project to find methods of obtaining more accurate data; in this experiment it is intended to compare plots of different sizes and shapes, to study the effect of replication, of borders, of cultivating alleys between plots, etc. After a variety has shown itself to be well suited to the conditions of the district, typical heads are selected from it, the progeny of each head is grown separately and the one which gives the best results is multiplied and afterwards sent to the trial plots for five years to compare it with the mother variety. Three strains have thus been obtained, Manchurian barley, Cap Rouge 14; Banner oats Cap Rouge 31; and Huron wheat, Cap Rouge 7; which have outyielded the parent varieties and will be offered as registered seed from the autumn of 1924. Other projects which receive attention are mixtures for grain production; oats and barley, oats and peas, oats, barley and wheat, percentage of hulls in different varieties, comparison of so-called pure varieties with commercial grain for seed purposes, and a study of what influences the cooking qualities of field peas, whether it is the variety, the soil, or the preceding crop.

Live Stock

Work with live stock is now confined to horses and dairy cattle, and experiments are conducted, or have been conducted, in breeding, feeding, housing, and management of each class of the above-named.

The superintendent of the Cap Rouge Station is also superintendent of the horse farm at St. Joachim, which is on a trolley line, 25 miles east of Quebec city. French-Canadian horses are used for experiments having the main object of improving this excellent general purpose breed. Some ninety head are kept at present and over thirty mares, all registered, are due to foal in 1924. Different methods of breeding, close, in line, or outcrossing, are now the main project, but other ones include the feed requirements of young horses until of working age, feed requirements of working horses, wintering idle horses at low cost, work vs. no work for brood mares, and the raising of autumn colts. All these horses, including weanlings, with the exception of the few mares kept for work, are wintered in open front, single-boarded sheds and there are no sounder hardier stock to be seen anywhere.

A cup and diplomas have been awarded the Cap Rouge Station for best stallion, best mare and best lot of French Canadian horses.

The herd of French-Canadian cattle at Cap Rouge, numbering over eighty head, is unexcelled from the point of view of production, and the herd is fully accredited, that is, is free of tuberculosis. The two-year, three-year, and four-year-old champions in Record of Performance are all in the same stable and it is the exception, rather than the rule, for a heifer not to qualify for Record of Performance with her first calf. In breeding up this herd, the main lessons learned were that it is useless to attempt anything if the stock is not kept perfectly healthy, also that the use of bulls out of heavy producers is absolutely necessary to increase the average milk yield of a herd. Amongst the important projects are the improvement of a dairy herd by the use of sires of known productive ancestry, a comparison of close breeding, line breeding and outcrossing, also of whole milk with skim milk and substitutes for raising calves, the food requirements to rear heifers until of milking age, heavy vs. light grain feeding for winter production, wintering stock in single-boarded, open-front sheds, and extra good vs. poor rearing of heifers as influencing type and production of the mature cow.

First prizes have been awarded the Station for old herd, young herd and get of sire.

Poultry

A flock of about 500 Barred Rocks is kept during winter and some 1,250 chicks are hatched annually. As it has been proven by a careful experiment of five years' duration that early pullets are the most economical winter layers, only 150 hens are kept over while 350 pullets are added each year. With the aid of trap nests, wire covered trays in the incubators and sealed wing bands, pedigree breeding is conducted so that any bird's ancestry can be traced at any time. When starting this work five years ago, no male bird was used if not out of a dam with a yearly production of more than 150 eggs, but the minimum requirement is now over 200 eggs. This pedigree work is not only interesting from the point of view of trying to breed up the Cap Rouge flock of Barred Rocks but also from the general point of view of genetics. Amongst the other projects are hatchability of eggs and viability of chicks from pullets and from hens, also from good and from poor layers, comparison of fluctuations of temperature in houses of different widths, of methods of preserving eggs, of time of year when cockerels, also breeding hens, should be sold, of commercial grain vs. screenings, of water vs. snow, of roots, sprouted oats, clover, Epsom salts, of beef scrap, skim milk, powdered skim milk, green bones and raw meat.

Horticulture

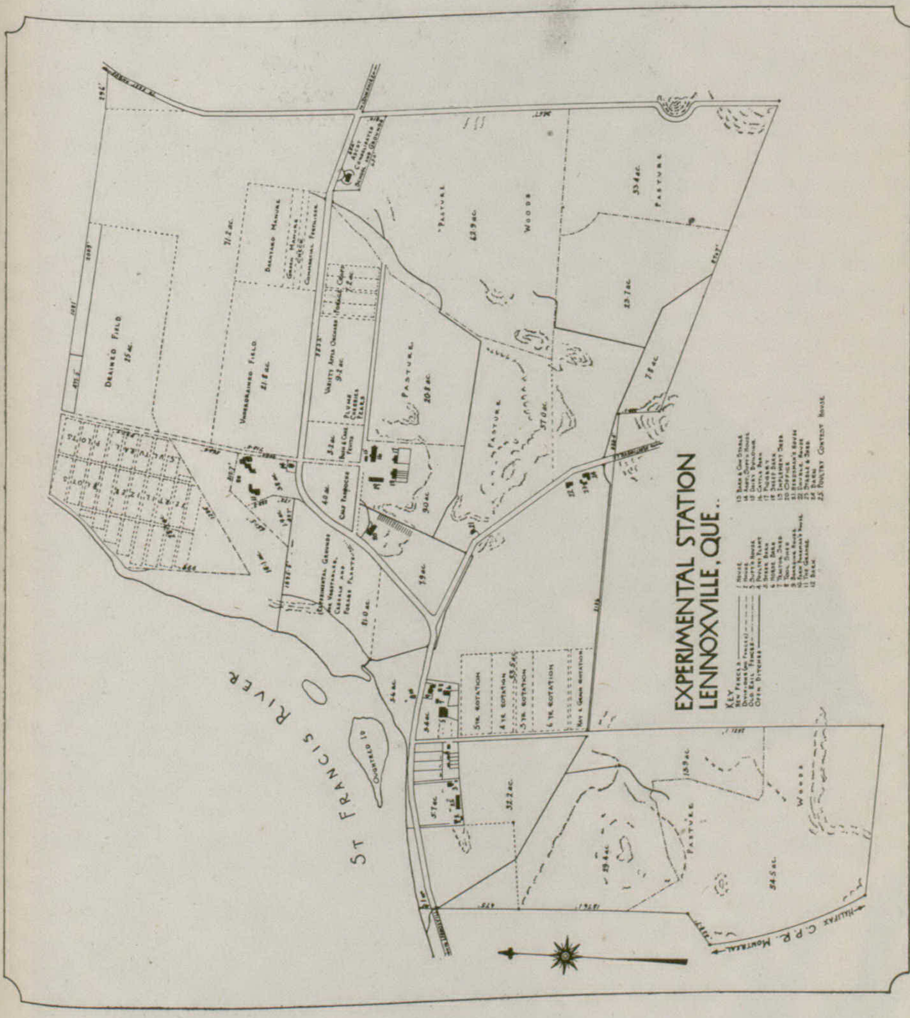
A great deal has been done at the Cap Rouge Station with fruits, vegetables, and flowers, as there are a very large number of people interested in these in a district with two fair-sized cities and a lot of live, small, industrial centres. The main phases of the work have been testing and breeding varieties and strains, and cultural experiments. Several selections have been made which have so far proved superior to all others tried with them.

In fruits, attention is given chiefly to apples, plums, strawberries, raspberries, currants and gooseberries, but there are also projects relating to cherries, pears, and grapes. In 1923, 230 varieties and strains of fruits comprising 6,706 trees, bushes, vines, canes and plants were tested very carefully, with the result that the following may be recommended for the district: apples, Yellow Transparent, Duchess, Wealthy, from summer to mid-winter; black currants, Climax; gooseberries, Silvia; strawberries, early, Excelsior, mid-season, Dunlap; raspberries, early, King, mid-season, Herbert. A few selections and seedlings, especially of black currants and strawberries, are very promising. Amongst the important projects with fruits may be mentioned a comparison of different cover crops for an apple orchard, also of the hill and matted row systems for strawberries, and the cost of establishing an orchard of McIntoshes with Wealthys as fillers.

A number of special prizes have been awarded at the provincial exhibition for displays of fruits from this Station.

Practically every vegetable of any importance in the district has received attention, such as asparagus, beans, beets, cabbage, carrots, cauliflower, celery, corn, cucumbers, muskmelons, onions, parsnips, peas, potatoes, pumpkins, rhubarb, squash, tomatoes, turnips, watermelons. An idea may be had of the scale on which variety testing has been conducted when it is known that for one kind of vegetable only, the tomato, seventy-six strains or varieties were tried. Plant breeding has been very successful indeed, especially with asparagus, beans, beets, cabbage, corn, parsnips, peas, and tomatoes. Cultural experiments have been made with thirteen of the above-named vegetables.

In ornamental plants, over 600 varieties and strains of trees, shrubs, perennials, annuals, and bulbs have been tested. A number have been discarded because they were not hardy enough or not as pretty as others of the same size and season.


EXPERIMENTAL STATION
LENNOXVILLE, QUE.
ST FRANCIS RIVER

Imported Shire Stallion "Snelston Topper" —38528— Experimental Station, Lennoxville, Que.

THE EXPERIMENTAL STATION FOR THE EASTERN TOWNSHIPS

J. A. McClary, *Superintendent*

This Experimental Station for the Eastern Townships and southern Quebec was established at Lennoxville on April 1, 1914. It is located partly in the town of Lennoxville and partly in township of Ascot. It is bounded on the north by the St. Francis river and the Cookshire road, on the east by divisional lines, on the south by the Canadian Pacific railway and divisional lines and on the west by the Bishop's College property. It is one mile from the town of Lennoxville, four miles from the city of Sherbrooke, which has a population of 25,000 and is the metropolis of the Eastern Townships, one hundred miles east of Montreal and thirty miles from the American boundary. Lennoxville is reached by the Canadian Pacific, Canadian National, Quebec Central, and Boston and Maine railways, as well as connected with the city of Sherbrooke by electric railway.

The area of the Station is 600 acres, 120 acres being in the town of Lennoxville and 480 acres in the township of Ascot. Four hundred and forty acres of this area were purchased in the winter of 1914, consisting of three farms and two small holdings. One hundred and sixty acres were acquired from the Soldier Settlement Board in the spring of 1920, this having been previously used as a training centre for returned men. Three hundred acres of this area consists of arable land, 200 acres being already underdrained, 40 acres occupied by buildings, ornamental grounds, vegetable garden and poultry, 200 acres in permanent pasture and 50 acres in wood-lot.

The soil in the lower parts near the river consists of a heavy loam with clay subsoil; the higher elevations are light loam with gravel subsoil in some places.

As soon as the Station was acquired, all boundaries were re-established, on which permanent fences were erected, as well as along roadsides and other divisional lines.

In the general work of this Station, besides the carrying on of experiments with cereals, roots, corn, grasses, clovers, vegetables and fruits, etc., the one object, above all others, has been to increase the fertility of the soil. To this end, much attention has been paid to the keeping of live stock, and to a short rotation of crops in which clover has played an important part.

The buildings on the Station at present consist of eight dwelling-houses which are occupied by the superintendent, staff and employees; seven of these are the original houses on the property when purchased. One of the original houses is occupied as an office and horticultural building. Three of the barns, on the property when purchased, are used for live stock. In two of these, stockers are wintered for spring market, and one is used for young breeding stock. There was built, in 1915, a dairy barn 37 by 96 feet, accommodating fifty head, a dairy building 22 x 42½ feet, piggery 24 by 60 feet, a sheep barn 30 by 75 feet, and an implement shed 30 by 100 feet.

Live Stock

The Eastern Townships is considered one of the districts best adapted for live stock raising in the province of Quebec on account of its climate, soil, pure spring water and hilly, rolling pastures which supply sweet, nutritious grass for summer feed. In December, 1916, the first purchase was made of a herd of twenty-three registered Ayrshires. This herd at present numbers thirty-four, and is headed by the herd sire, Ottawa Masterpiece —77928—. Six registered

Shorthorns were purchased in January, 1919, and at present there are seventeen head. This herd is headed by the noted dual-purpose Shorthorn bull, "Weldwood Lassie's Lad," —135100—. In March, 1922, there was purchased a small nucleus of a Jersey herd which at present comprises eight head.

For the purpose of consuming the large amount of hay and silage produced, and at the same time, of conducting experiments in beef feeding, ninety head of stockers are purchased every autumn and are usually disposed of about the first of May.

Six Yorkshire sows and a stock boar are kept, and from these sows two litters are raised annually. A certain number of these young pigs are sold for breeding purposes at the age of six weeks, the balance are used as experimental feeders with different grain rations, and self-feeders, in order to have data on the most satisfactory rations and method of feeding for the most economical bacon production.

Twenty registered Oxford Down ewes and forty-five high grade Oxford Down ewes are kept for breeding purposes. The work with sheep is conducted much along the same lines as with swine.

Fifteen horses are kept for farm work; very little breeding work has yet been done. The noted imported Shire stallion, "Snelston Topper" 38528 four years of age, weighing 2,250 pounds, which was presented by Mrs. Stanton of Snelston Hall, Ashbourne, England, to the Dominion Government for the purpose of improving the draft horses of Canada, was sent to this Station last May, where he has stood for service since.

There are twenty projects in live stock work underway at this Station.

Horticulture

The work in horticulture at this Station occupies approximately twenty-one acres and comprises sixty-three projects. These include experiments and breeding work with fruits, vegetables, flowers, ornamental shrubs and trees.

Fruits.—Strawberries, raspberries, currants and gooseberries are well suited to the district and variety tests with these fruits have been conducted each year since the Station was established.

Grapes and blackberries have not proved dependable, as only the earliest varieties of the former will ripen and the commercial varieties of the latter winter-kill badly. A project with the object of developing a hardy strain of blackberry is at present under way.

Owing to the extremely low temperatures frequently experienced during the winter months, the immediate district in which the Station is situated is not suitable for the commercial production of tree fruits, as most of the standard varieties of apples, plums and pears will winter-kill three seasons out of five. However, as a testing ground for hardiness, the situation is ideal and in this capacity the Station is in a position to render valuable service to the Experimental Farm system and to the country as a whole. Varieties of tree fruits that survive the Lennoxville winters will, in all probability, prove hardy for districts situated much farther north.

About eleven acres have been planted with fruit trees composed largely of breeding stock, and varieties originated at the Central Experimental Farm, Ottawa. A large number of these have proved hardy and several of the best of the new varieties, such as the Melba and the Pedro apple, and the Kahinta plum, may be safely recommended for the district.

A nursery composed of the best of the hardy varieties that are not obtainable commercially, has been started and it is intended to distribute such trees as may be produced, chiefly to those living in districts where standard commercial varieties are not likely to succeed.

Vegetables.—Practically all kinds of the common garden vegetables do well at Lennoxville and the district is quite suitable for vegetable gardening Forty-seven projects are being conducted with vegetables at the Station. These include variety tests and cultural experiments with the various species, and breeding for increased production with several of the principal varieties.

Ornamental Gardening.—Perennial and annual flowers are almost always successful in the district, and a continuous display of bloom is easily maintained from early spring until late fall. Perennial phlox is particularly successful and a large collection of the best varieties is established throughout the perennial border. Several excellent seedling varieties of this species have been developed at the Station.

Although a number of the best ornamental trees and shrubs have not proved hardy, it has been found that a great many desirable kinds are quite suitable and may be safely recommended for the district.

Cereals

Previous to 1922, little or no experimental work with cereals was conducted at the Station. In that year a few of the popular varieties of oats, barley and spring wheat were tested and, in 1923, these experiments were enlarged and extended to include systematic variety tests with the aforementioned cereals and also with field peas, beans, fall rye and winter wheat. All varieties are tested in duplicate in fiftieth-acre plots, separated by four-foot paths and the ranges indicated by fourteen-foot roadways. In order to determine soil variation and thereby permit of more accurate comparisons, the various experiments are checked by several replications of a standard variety, spaced at regular intervals throughout the ranges. It is hoped that this method will be productive of fairly reliable results.

Poultry

During the early spring of 1919, about three acres of land, just within the limits of the town of Lennoxville, were permanently fenced for poultry work. The soil is of a very sandy nature and very well adapted for the purpose. An administration building was put up, with cement basement used for incubation and egg packing rooms, the ground floor being used for the office for all record work and the upstairs as a feed and storage room. Two laying houses, each 16 by 36 feet, of the straw loft type, were built to house the 200 pullets which are put in each fall for cost experiment work. Six colony houses, 10 by 12 feet, are used with brooder stoves for brooding the chicks each spring, for housing the growing stock while on range during the summer, and as special pens for breeding stock during the winter and early spring. A 2,440-egg incubator was installed and coal-burning brooder stoves are used. Barred Plymouth Rocks were chosen as a very suitable breed for the cold climate of the Townships, being a good winter layer when bred for production and, at the same time, a good bird for table purposes. Eggs for hatching were bought in April and early May of 1919, and from the chicks hatched, a start was made to build up a good bred-to-lay strain of winter layers. All females are trapnested and only those individuals making a good showing are used as breeding stock.

A decided improvement in the average production each year has been recorded; a number of individuals have made records of over 250 eggs, including two hens which made, in 1921, the records of 301 and 290 eggs respectively.

About 2,000 chicks are hatched annually, 1,000 being sold as day-old chicks in small lots to farmers wishing to secure a start in a better strain of producers, the other 1,000 being grown on the Station to replace the birds in the laying houses and to supply breeding cockerels for sale to farmers to improve their flocks, while a certain number are used for experimental work in crate feeding. The projects under way are as follows: Cost of feeding chicks; Cost of feeding hens of various ages; Cost of winter eggs; Difference of ability to produce eggs; Crate feeding; Early vs. late hatched pullets for winter eggs; Eggs required to pay feed for four winter months; Eggs required to pay feed for twelve months.

During the summer of 1922, a building was erected just west of the poultry plant to house the birds entered in the first Quebec Western Egg Laying Contest. This building is 16 by 136 feet, with a feed room in the centre, and ten pens, 6 by 16 feet each, to each annex to the house, each pen being equipped with trapnests, hoppers, etc., for the accommodation of ten birds. Every pen was filled on October 30, 1922. Some very valuable data were secured on production and costs of different breeds, and an extraordinary amount of public interest was aroused in the community. The second contest commenced on November 1, 1923, with every pen filled again.

The greater interest being taken in poultry work in general, the more sanitary way in which poultry buildings are kept, and the greater numbers of new-laid eggs for sale during the winter months are indications of encouragement for the work being carried on by the Experimental Station.

Bees

Since 1918, a few colonies of bees have been kept at this Station, largely for demonstration purposes. As the district is suitable, and bees are kept by many, it was decided in the fall of 1922 to build up an apiary with which to conduct experiments. Beginning with three colonies in the spring of 1923, the apiary was increased by division to twelve colonies. These are well established in standard ten-frame hives and, at the time of writing, are well supplied with bees and in good shape for winter. An experiment has been started for the purpose of comparing outdoor wintering, in specially prepared cases, with wintering in the cellar.

Forage Crops

Forage crop experiments include the following lines of work: Variety tests with ensilage corn, sunflowers, field roots, clovers, grasses, annual hay crops and alfalfa; tests of various mixtures and combinations of grasses and clovers for hay production; red clover seed production, and breeding for increased productiveness with mangels, swede turnips and sunflowers. In all, eighteen projects are under way and the area used is approximately eleven acres.

Corn and Sunflowers. Owing to the cool weather frequently experienced, during the growing season, throughout part of the Eastern Townships, ensilage corn has not proven as reliable a crop as in other sections of the country. As a result of experiments conducted during the past four years, it has been found that sunflowers may be very profitably used as a forage crop, and that, when mixed and planted together with corn, the probability of securing a crop for ensiling is greatly increased. At present this mixture is used almost entirely at the Station, for the production of ensilage, and the example thus set has been instrumental in inducing many farmers throughout the district to adopt its use.

Grasses and Clovers. Although a number of mixtures and combinations of grasses and clovers for hay production have been tried out from year to year, the results thus far obtained indicate that the most profitable crops may be obtained from the popular mixture of red clover, timothy and alsike. Up to the present, experiments with clover seed production have not been successful in indicating a method whereby a profitable crop may be produced.

Alfalfa. So far, alfalfa has not proved to be entirely successful. This is apparently due to unfavourable soil and climatic conditions, as most soils throughout the district are more or less acid and the winter and early spring intensely cold, followed by uncertain weather during April. Where soil acidity has been corrected, the hardiest varieties are sometimes successful. A variety test with alfalfa was started at the Station in 1922 and is being continued.

Field Roots. Field roots, especially swede turnips, usually produce a dependable crop throughout the Eastern Townships, and in the more eastern portion, where corn is uncertain, they are grown to a considerable extent as feed for live stock. The work with field roots at the Station consists of variety tests with mangels, turnips and field carrots, and breeding for increased productiveness with a variety each of the first two named.

Flax for Fibre and Hemp

Small plots of flax and hemp were grown at the Station in 1917, and, in the years 1920 and 1922, two varieties of flax were grown for comparison. In 1923, a fairly comprehensive group of experiments, with both hemp and flax, was started. These include variety tests of flax, dates of seeding flax, and tests of hemp. Each experiment is duplicated and the ranges checked with regularly-spaced plots of one variety. After harvest, the entire crop is shipped to the Central Experimental Farm, for threshing, retting and scutching. Up to the present, the results obtained indicate that flax may be successfully grown in the district but hemp is uncertain.

Field Husbandry

Very little experimental work was done in field husbandry at this Station prior to 1921, when sixteen new projects were incepted. These include a comparison of different rotation systems, work with drainage, renovation of worn-out pasture lands, a comparison of different crops for the production of succulent roughage, besides fertilizer and cultural experiments in plots.

Rotations. On many eastern farms there is, at the present time, no definite system of rotation practised. The result is that a great amount of hay land becomes run-out before it is turned over for grain or a hoed crop. The three main requirements of a good rotation are: (1) the production of the proper balance of dry roughage, succulent roughage and grain for the feeding of stock, (2) the maintenance of soil fertility, (3) the control of weeds. On large farms, where certain fields are too far from the farm buildings to be put economically in hoed crop, a good plan would be to practise two systems, one with an intertilled crop for the fields nearest the barn, and another made up of grain and hay, or grain, hay and pasture, for the outlying fields. In order to ascertain the most suitable system, or systems, for this section of the country, the following rotations are being tested at this Station.

Three-Year Rotation.—First year, corn, 12 tons of manure per acre applied in winter for corn; second year, grain, seeded down to clovers and timothy; third year, clover.

Four-Year Rotation.—First year, corn, 16 tons of manure per acre applied for corn; second year, grain, seeded down to timothy and clovers; third year, clover hay; fourth year, timothy hay.

Five-Year Rotation.—First year, oats; second year, corn, 20 tons of manure per acre applied for corn; third year, barley seeded down to timothy and clovers; fourth year, clover hay; fifth year, timothy hay.

Six-Year Rotation.—1st year, oats; second year, corn, 16 tons of manure per acre applied on oat stubble for corn; third year, barley, seeded down to timothy and clovers; fourth year, clover hay; fifth year, timothy hay 8 tons of manure per acre applied as top dressing on timothy sod; sixth year, timothy hay.

Hay and Grain Rotation.—First year, oats, manure applied at the rate of 8 tons per acre and seeded down; second year, clover hay; third year, timothy hay, 8 tons of manure per acre applied as top dressing; fourth year timothy hay.

In all, eighteen acres of land are used for this work each crop occupying three-quarters of an acre.

A four-year rotation, consisting of corn, grain and two years' hay is followed on the Station. The seeding mixture used for all rotations is made up of timothy 10 pounds, red clover 8 pounds and alsike 2 pounds per acre.

DRAINAGE EXPERIMENT. In order to show the advantage, if any, of underdrainage, from the standpoint of profit on capital invested, an experiment was begun in 1921 with two 22-acre fields. Field No. 1 was underdrained in 1919, the drains being 60 feet apart. Field No. 2, which is used as a check, has practically the same slope and soil conditions and is not underdrained. The soil on both fields is practically all clay loam overlying a clay subsoil. A four-year rotation, consisting of corn, grain and two years' hay, is practised on both fields. The experiment has not been conducted long enough yet to give conclusive results.

PERMANENT PASTURE RENOVATION. Throughout Eastern Canada are large areas of permanent pasture land which have had nothing done to them since the forest was removed. The result is that weeds, moss and scrub bushes are replacing the grass and making such areas practically worthless for grazing. With the object of ascertaining the quickest and cheapest method of bringing such lands back to a condition of productivity, experiments with ploughing, discing, seeding and fertilizing are being carried on. As the soil in those pastures is usually acid, some work with agricultural lime is also being done.

SUCCULENT ROUGHAGE EXPERIMENT. In order to compare the cost of production of root and ensilage crops, an acre each of swedes, corn, sunflowers, and oats, peas and vetches are grown side by side under uniform soil conditions. Each crop received 16 tons of manure per acre. Dry matter determinations are made and the crops compared on the basis of total digestible nutrients produced.

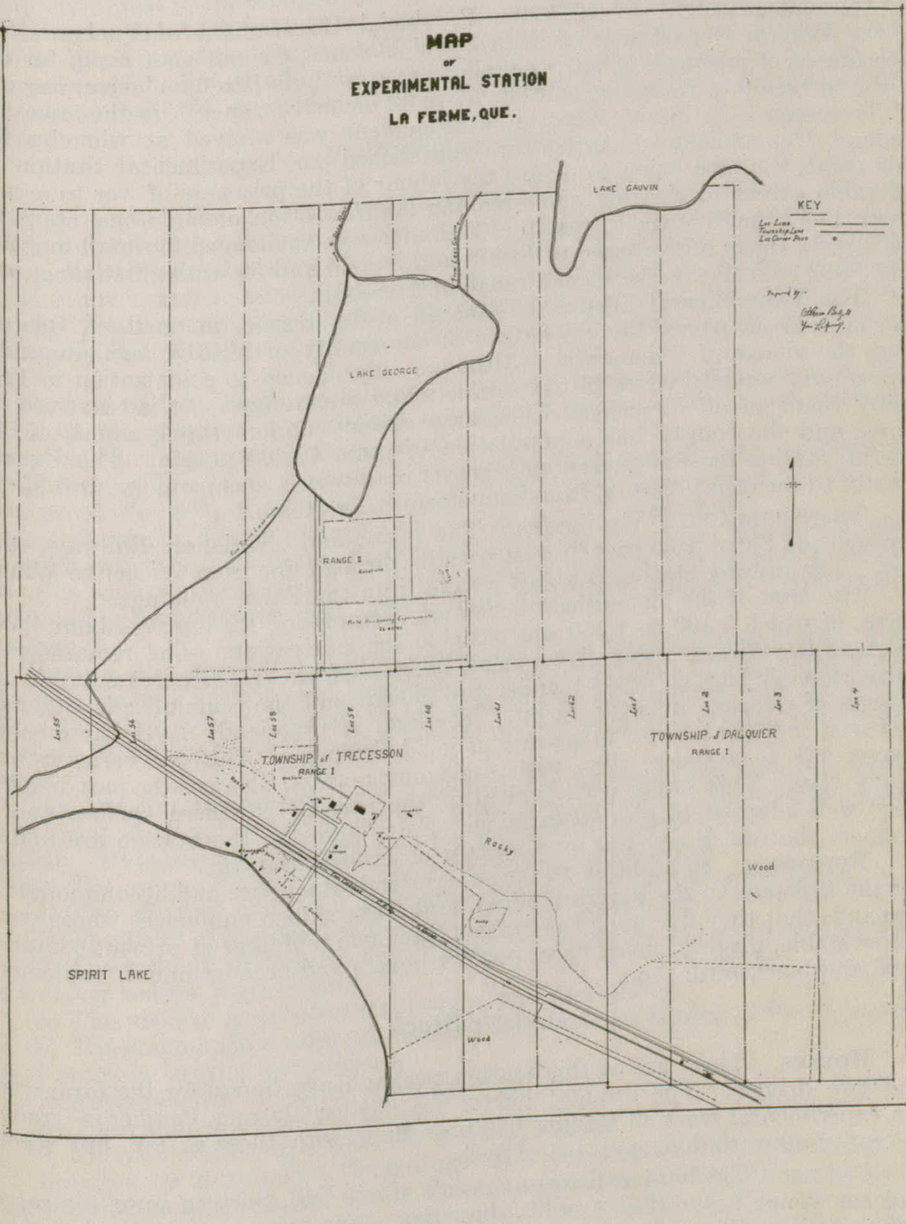
PLOT EXPERIMENTS.—The cultural and fertilizer experiments in plots are being conducted in a fairly uniform field containing about twenty-six acres. The soil is nearly all a light loam with a gravelly sub-soil. The plots are one-twentieth of an acre in size and are separated by a four-foot pathway with a twenty-foot roadway between the ranges. In order to eliminate, as much as possible, any error due to variation in soil fertility, the work is all being done in duplicate, with check rotations for each experiment. The following are the experiments conducted in 1923:—

Cultural Experiments.

(1) Preparing sod land for corn.
(2) Deep versus shallow ploughing.
(3) Seeding grass seed.
(4) Preparing sod land for grain.

Fertilizer Experiments.

(1) The use of lime.
(2) Reducing manure.
(3) Fertilizing hay.
(4) Green manure crops.
(5) Fertilizers for potatoes.


MAP
of
EXPERIMENTAL STATION
LA FERME, QUE.
LAKE GAUVIN
KEY
Lot Line
Township Line
Lot Corner Post
LAKE GEORGE
RANGE II
Lot 55
Lot 56
Lot 57
Lot 58
Lot 59
Lot 60
Lot 61
Lot 62
Lot 1
Lot 2
Lot 3
Lot 4
TOWNSHIP of TRECESSON
RANGE I
TOWNSHIP of DALQUIER
RANGE I
Rocky
Wood
SPIRIT LAKE
Wood

THE EXPERIMENTAL STATION FOR NORTHERN QUEBEC

PASCAL FORTIER, *Agr., Superintendent*

ESTABLISHMENT. In 1915 the Provincial Government of Quebec ceded to the Federal Department of Militia and Defence, for use as a camp for the internment of prisoners of war, the following area: Lots 1 to 6 inclusive, range 1, in the township of Dalquier, and lots 57 to 62 inclusive, range 1, in the township of Trecesson. In June, 1916, an arrangement was arrived at whereby the Federal Department of Agriculture established an Experimental Station at this point, the idea being to utilize the labour of the prisoners of war to a considerable extent in clearing and breaking land, erection of buildings, etc., etc. Later, lots 5 and 6 of the township of Dalquier were exchanged for lots 1 and 2 in the second range of the same township and lots 55 and 56 in the first range and lots 56-62 inclusive in the second range of Trecesson.

The Experimental Station is situated at La Ferme, in northern Quebec, five miles from Amos, the chief town of the county of Abitibi, and nine miles from the village of Villemontel. Although only opened to colonization in 1912 this county already offers to the settler many advantages. It is traversed by many roads in all directions. The area already under crop is about 45,080 acres, and the county has a population of some 16,000 people. The Experimental Station itself is crossed by a gravel road which runs from one end of the county to the other, that is, from Senneterre to La Reine.

TRANSPORTATION FACILITIES. The Canadian National Railway runs through the Farm from east to west with its through line from Quebec to Winnipeg. The railway station is about a mile from the Farm buildings.

The area of the Experimental Station, comprising 22 lots, is about 2,200 acres, of which 1,100 to 1,200 are suitable for cultivation. The remainder of the land is stony or covered by small lakes. Of the 1,200 acres suitable for cultivation, 238 are at present under the plough and the remainder is either in process of clearing or yet in forest. The land is practically level, there being, however, sufficient slope to permit of good drainage. The soil varies from a heavy clay to a sandy clay, with some muck areas, the greater part being a heavy clay. This soil is very typical of the soils of Northern Quebec and is very well adapted to general farming. Forty acres on the Station are underdrained, the rest is covered by a system of surface drainage.

BUILDINGS. In addition to the superintendent's house and accommodation for the assistant to the superintendent, and a few skilled employees whose work demands that they live upon the Station, the farm buildings at present comprise a cow stable, piggery, sheep barn, poultry houses and brooder house, implement shed and blacksmith shop.

Live Stock

HORSES. There are at this Station twelve heavy horses for the farm work and two drivers. The draught horses are Clydesdale and Percheron grades. No experimental work in feeding has been done with these so far, but record is kept of all work done and cost of feeds.

CATTLE. The herd at present consists of one bull, thirteen cows, ten calves and one young bull, all of Ayrshire breeding, some being pure-bred, the others being grades. The following experiments are under way with this herd: (1) Cost of raising calves; (2) Improving of a grade herd by the use of a pure-bred bull, the production of whose ancestors is known; (3) Cost of milk production.

Swine. There are at present on this Station five sows, one boar, and thirty-three young pigs. They are of the Yorkshire breed and of the bacon type. Feeding experiments are now carried on with some of the young stock, and others are sold to the settlers of the district for breeding purposes. Some of the experiments under way with swine are: (1) The cost of feed to raise a sow to one year of age; (2) Comparison of barley meal, a home-grown feed, with Indian corn meal for fattening swine; (3) Cost of pork production.

Sheep. The flock is at present made up of fifty-four lambs, fifty-one grade ewes, and two pure-bred registered Cheviot rams. The following experimental work is being conducted with these: (1) Grading up of the flock by the use of a pure-bred male; (2) Breeding at different ages; (3) Best time for marketing lambs.

Field Husbandry

Rotations. The general rotation followed on the Experimental Station is one of six years, as follows: first year, hoed crop; second year, grain seeded down, followed by four years of hay and pasture. There are, however, other rotations under trial to ascertain the one or ones best suited to conditions in the district. A rotation of three years is being tested: first year, sunflowers, manured at the rate of 12 tons per acre; second year, oats seeded down; third year, hay.

(2) One of four years, as follows: first year, sunflowers, manured at the rate of 16 tons per acre; second year, oats seeded down to clovers and grasses; third year, clover hay; 4th year, grass hay.

(3) One of five years, made up of: first year, oats; second year, sunflowers, manured at the rate of 12 tons per acre; third year, barley seeded down to clover and grasses; fourth year, clover hay; fifth year, grass hay.

(4) A rotation of six years, made up of: first year, potatoes, manured at the rate of 16 tons per acre; second year, wheat; third year, barley, seeded down to clover and grasses; fourth year, clover hay; fifth year, grass hay; sixth year, grass hay.

There is also a rotation of five years, including the following grains: first year, oats, seeded down to red clover; second year, summer-fallow; third year, half of the area sown to winter wheat with clover and grasses and the other half sown to winter rye, clover and grasses; fourth year, clover hay; fifth year, grass hay.

The area devoted to rotations is divided into as many acre fields as there are years in each rotation. Record is kept of the returns and costs on each rotation. Data are being gathered on the following points:—

(1) The value of a short rotation in restoring soil fertility

(2) The effect of one, two, and three-year-old sod on following crops.

(3) The yield of hay for the first, second and third year.

(4) The yield of sunflowers following sod, vs. following fall grain and following a clover sod vs. a grass sod.

(5) The yield of grain after sunflowers, hay and grain.

(6) The comparative value of different rotations containing different varieties of crops in varying proportions.

(7) Autumn sown vs. spring sown grain.

(8) The value of a summer-fallow.

(9) The profit to be expected from potato growing.

Growing of Roots and Ensilage. This experiment was commenced in 1922, in order to ascertain the yields of sunflowers, Indian corn, and oats, peas and beans, for ensilage, compared with roots. The rotation in this experiment is as follows: first year, one-quarter of the area is sown to various field roots, one-quarter to sunflowers, one-quarter to Indian corn, one-quarter to peas, oats and beans; second year, oats seeded down to clovers and grasses; third year, clover hay; fourth year, grass hay.

Green Manuring Experiment. This is to compare the ploughing under of sweet clover followed by summer fallow vs. followed by buckwheat.

The rotation is as follows: first year, oats seeded down to sweet clover; second year, half the area ploughed under and summer-fallowed, the other half ploughed under followed by buckwheat, half of which is ploughed under, and the other half harvested for grain, if possible; third year, barley seeded down to clover and grasses; fourth year, clover hay; fifth year, grass hay.

In connection with these experiments, check plots are employed on which no manure or fertilizer of any kind is used. These plots are under the rotation of first year, oats; second year, barley seeded down to clover and grasses; third year, clover hay; fourth year, grass hay.

Experiment with Barnyard Manure.—This experiment is for comparison with the two preceding rotations and is as follows: first year, oats (16 tons of manure per acre applied); second year, barley seeded down to clover and grasses; third year, clover hay; fourth year, grass hay.

Experiment with Chemical Fertilizer.—This is for comparison with the three preceding experiments; the rotation is as follows: first year, oats; second year, barley, seeded to clover and grasses (100 pounds of nitrate of soda per acre applied;) third year, clover hay; fourth year, grass hay (100 pounds nitrate of soda, 300 pounds superphosphate per acre applied).

Experiment with Pulverized Limestone.—This is to be studied in comparison with the four preceding experiments; the rotation used is as follows: first year, oats (16 tons of manure per acre applied); second year, barley (two tons of pulverized limestone per acre applied); third year, clover hay; fourth year, grass hay.

Drainage Experiment.—This experiment has in view a comparison between areas ploughed in wide lands and in narrow ones. There is no doubt that the narrow land is conducive to good drainage, but the comparison will be interesting.

Cereals

A field of twenty acres has now been drained for experimental work with cereals which will be commenced in 1924, and will comprise tests of varieties of wheat, oats, barley, peas, buckwheat and rye. Some selection work will also be carried on.

Forage Crops

Tests of varieties of mangels, turnips, carrots, forage beets, Indian corn and sunflowers, comprising about one hundred varieties in all, were commenced in 1922, and a field has just been drained in order to commence in 1924 the following comparative tests of different varieties of white clover, red clover, alsike clover and sweet clover; comparison of yields of grasses sown with clover and alone, of late and of early maturing clovers, with late and early maturing grasses and tests of alfalfa.

Horticulture

In 1912, 785 apple trees were planted and of this number 512 were still living in the fall of 1922. The winter of 1923 was particularly severe on trees, and 178 were killed, and a large number of the remainder were severely damaged, only 19 in all passing through the winter without showing any damage whatever. Experiments have been commenced with certain trees in methods of ripening the wood early in the autumn in order to lessen winter injury.

Bush Fruits.—Currants, red and black, gooseberries, and raspberries are being tested and all have proved hardy. Some difficulty has been experienced with strawberries, which are winter killed every year. A new plantation was set out in the spring of 1923.

Vegetables.—Over 200 varieties are under test every year and notes are taken on date of sowing, date of germination, date of setting out, date of flowering, when first in use, height and weight of harvest, etc., etc. A large number of experiments are also being conducted on various cultural methods with garden crops.

Flowers.—From 175 to 200 varieties of flowers are tested each year. Although many of these do not prove hardy, yet a good portion do well and furnish evidence that as attractive a flower garden can be made in Northern Quebec as in any other part of the province.

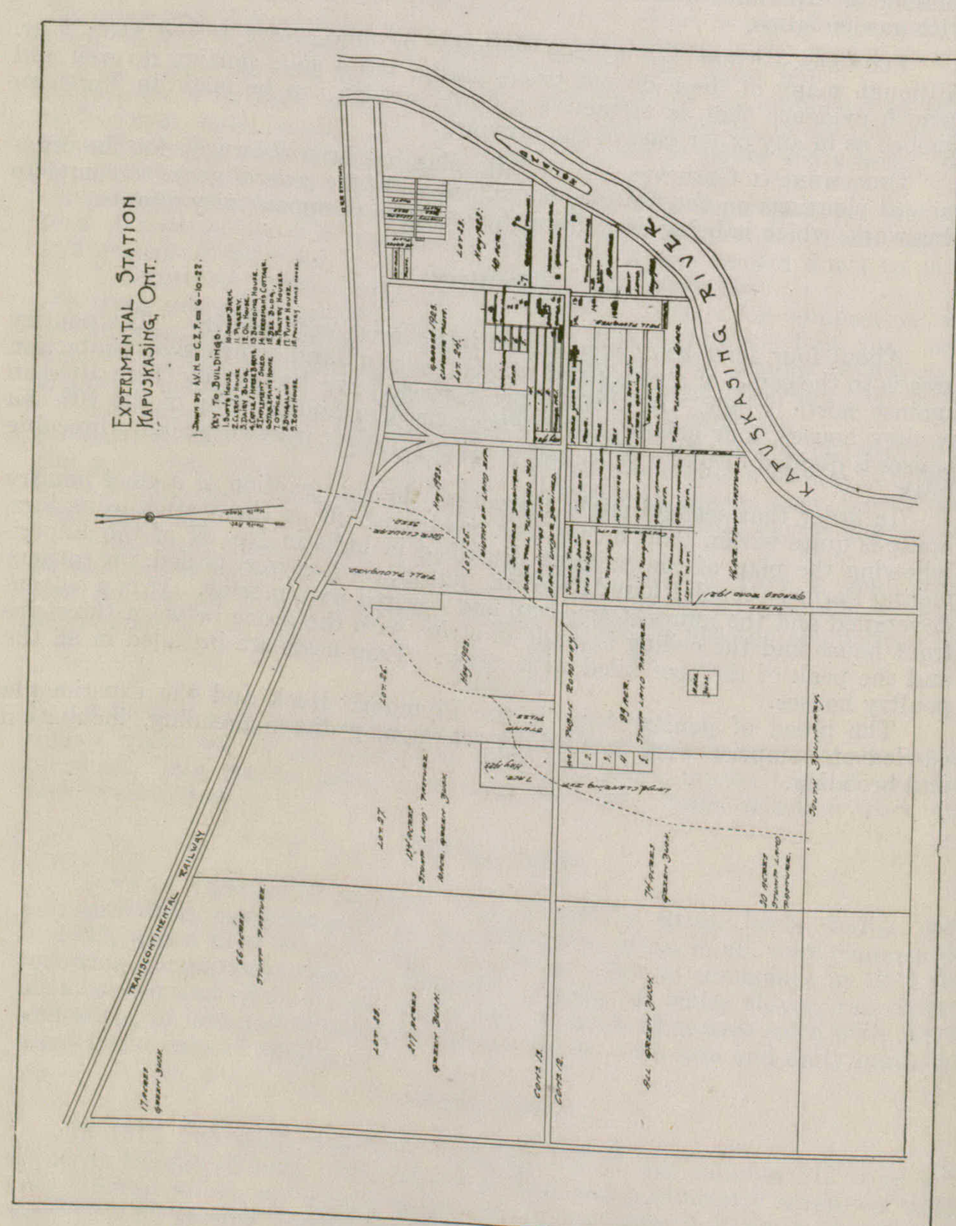
Ornamental Grounds.—A definite plan has been drawn up for the ornamental plantings on the Station, but it will still take several years to complete this work, which is being done from time to time as opportunity affords.

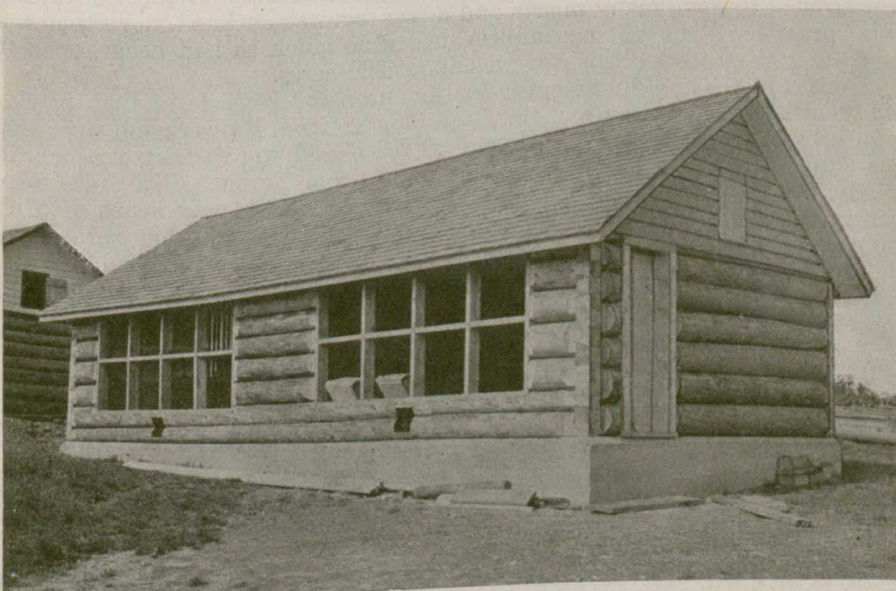
Poultry

About four acres have been fenced in for work with poultry. The poultry area is to the south of a rocky and wooded piece of land, which gives protection against north winds. In this enclosure there have been built three 100-hen poultry houses, four colony houses and a brooder house. One of the 100-hen houses is divided into two pens, and another into four pens for pedigree breeding work.

In order that settlers might learn that the construction of a good poultry house is quite within their means, one has been built on the Station using logs, following the plan of the building described in bulletin No. 87 of the Experimental Farms. A solid foundation was put in, the logs were peeled, the corners dovetailed and the joints stopped up and covered with mortar. It is a cotton-front house and the ceiling is made of strips with the space between the strips and the peak of the roof filled with straw. Trap nests are installed in all the poultry houses.

The breed of poultry kept is the Plymouth Rock and the experiments carried on comprise work in feeding, selection, pedigree breeding, incubation and brooding.


EXPERIMENTAL STATION
KAPUSKASING, ONT.
Drawn by A.V.H. and C.Z.F. on 6-10-22.
KEY TO BUILDINGS.
1. Supt's House.
2. Clerk's House
3. Dairy Bldg.
4. Cattle / Horse Barns.
5. Implement Shed.
6. Stableman's House
7. Office.
8. Bungalow
9. Root House.
10. Sheep Barn.
11. Piggery.
12. Oil House.
13. Boarding House.
14. Herdsman's Cottage.
15. Bee Bldg.
16. Poultry Houses.
17. Pump House.
18. Poultry mans house.
TRANSCONTINENTAL RAILWAY
KAPUSKASING RIVER
ISLAND
17 acres Green Bush.
66 acres Stump Pasture.
Lot 28.
217 acres Green Bush.
Lot 27.
124 acres Stump Land Pasture.
Lot 26.
May 1923.
Lot 25.
Lot 24.
Grassed 1923.
Lot 23.
May 1923.
Con. 13.
Con. 12.
Public Roadway.
29 acr. Stump Land Pasture.
All Green Bush.
74 acres Green Bush.
20 acres Stump Land Pasture.
South Boundary.
Kapuskasing River 1921
16 acr. Stump Pasture.
Fall Ploughed 6 acr.



Log Poultry House, Experimental Station, Kapuskasing, Ont.

THE EXPERIMENTAL STATION FOR NORTHERN ONTARIO

SMITH BALLANTYNE, *Superintendent*

ESTABLISHMENT.—The Experimental Station for northern Ontario located at Kapuskasing was selected in December, 1914, by Dr. J. H. Grisdale, present Deputy Minister of Agriculture and then Director of Experimental Farms. Arrangements were made with the Provincial Government for possession of the land and negotiations were entered into with internment operations of the Department of Militia and Defence, whereby the Station would be utilized as a prison camp for interned aliens, the first train load of whom arrived on December 25, 1914.

The plan was that the prisoner labour would be employed for the removing of the timber and the clearing of the land, so that a large area would become available for experimental work at the earliest possible date. While this arrangement seemed to have many merits and advantages as outlined, nevertheless, in actual practice, it did not accomplish nearly as much as had been hoped for. The total area cleared in this way was about 300 acres.

LOCATION.—The Experimental Station property consists of that block of land lying immediately south of the Canadian National Railway and west of the Kapuskasing river, in the township of O'Brien and the district of Cochrane. It is situated 548 miles nearly straight north from Toronto, 706 miles nearly straight east of Winnipeg and about 175 miles nearly straight south of Moose Factory at James bay. The large pulp-mill operated by the Spruce Falls Company is located on the east side of the Kapuskasing river and the south side of the railway, immediately across the river from the Experimental Station, while the new townsite of Kapuskasing is located immediately across the railway from the pulp-mill and the new railway station, which is on ground that is 49° 23′ N. latitude and 82° 29′ W. longitude with an elevation of 720 feet above sea level.

This whole section of country is situated on the James bay slope, which adds materially to its suitability as a location for a Northern Ontario Experimental Station, because it is located about as far north as any farming is being done, at present, in northern Ontario and consequently any success or results which are obtained at this location should be within easy reach of settlers in the whole northern district served by the Station.

AREA.—There are some 1,270 acres of land occupied by the Experimental Station, which is made up of lots 23, 24, 25, 26, 27 and 28, in both the twelfth and thirteenth concessions of the township of O'Brien. At the present time 500 acres of this have been cleared and put under cultivation, 225 acres of which have been established in permanent rotations and other experimental work. Besides the 500 acres under cultivation, there are 300 acres which have been timbered and burned over. This area was seeded with timothy and clover soon after it had been burned and has been furnishing excellent pasture for all live stock kept on the Farm.

SOIL.—The soil in most parts of northern Ontario is a fairly heavy clay, with occasional muskeg areas and, in a few instances, sand and sandy loam may be found. The Kapuskasing Station is very representative of the first two, as heavy clay is the predominating type of soil found on the Station, with occasional shallow muskeg areas which are not large and are easily drained.

In general, it may be stated that the soil has good natural drainage, as the eastern section has a good slope towards the Kapuskasing river, while the main central area of the farm is served by two small creeks which are about one-half mile apart and run north and south. The land on either side of these is ploughed east and west, so that the creeks form a natural and very efficient outlet for spring freshets and high water at any other times of the year.

If, in clearing, the soil does not get too heavy a burn, a fair amount of humus is available on new land, for crop production. If the land is not to be completely cleared within the next year after it is burned over, it has been found advisable to seed it out with timothy and clovers, the latter predominating, as the clover soon forms a good sod which makes luxuriant pasture; prevents the growth of weeds; hastens the further decay of any roots which may remain in the soil and, above all, adds materially to its nitrogen and humus content, so that when it is eventually cleared and ploughed, there is plenty of plant food to produce excellent growth of cereal and forage crops. Some of the heaviest crops ever produced on the Station have been grown on new land during the first season following the treatment outlined above.

Chemical analysis has shown that the most outstanding feature of the subsoil at the Station is its high lime content, which, doubtless, accounts to a large extent for the marked success with which leguminous plants of all kinds are grown, including red clover, alsike clover and alfalfa.

Climate.—No one disputes the excellence of the soil in the northern Ontario clay belt. Like all other similarly situated regions, however, climatic conditions are the final determining factor as to what crops can profitably be grown.

At the Kapuskasing Station careful weather records have been kept since 1918 and valuable data are being gathered as aiding the settler to adopt his farming operations to the limitations of the country.

The average precipitation for the five-year period 1918-1922 has been 23·64 inches, almost half of it falling during the growing season, May 1 to September 30.

The following average minimum temperatures for the above five-year period are a fair indication of the lowest temperature which may be expected during each month of the year: January, –42·4 degrees; February, –41 degrees; March, –30·8 degrees; April 3·2 degrees; May, 20 degrees; June, 26·6 degrees; July, 32·8 degrees, August, 29·6 degrees; September, 25·8 degrees; October, 11·2 degrees; November, –15·6 degrees and December, –35·8 degrees.

Buildings.—The Station has been fairly well equipped with modern buildings grouped on an elevated area of the farm less than one-half mile from the railroad and from which there is an excellent view to the Canadian National Railway Station, the pulp-mill and the townsite.

The houses are all painted white with green trimmings. The regular Farm buildings are mostly frame, painted red with white trimmings, and comprise a cattle barn, 38 by 87 feet; a horse barn, 36 by 100 feet, the north end of which is used for cattle in box-stalls; these two are connected by a feed room, 16 by 24 feet. An implement shed, 26 by 130 feet, a piggery, 30 by 90 feet; a new log sheep barn, 30 by 50 feet; two silos, 16 by 36 feet; a bee house, 16 by 20 feet, painted white; a dairy, 14 by 32 feet, with an ice-house attached 14 by 20 feet, both painted white. The Farm office is a white frame building 26 feet square. There are also three standard 100-bird poultry houses 16 by 32 feet, two of which are constructed of logs, one breeding house 16 by 40 feet, besides six colony houses, 10 by 12 feet each. The horticultural department has a large root cellar 24 by 50 feet in size.

Animal Husbandry

Horses.—A sufficient number of horses are kept to carry on the necessary farm work. No pure-breds have been kept to date and no breeding work has been attempted. The animals on hand are mostly Clydesdale grades with a few Percheron grades. Records are kept of the cost of maintenance and the cost per hour of horse labour.

Dairy Cattle.—The dairy herd in the past has mostly consisted of grade Ayrshire cattle with a few Holstein grades. This summer, however, a start has been made with pure-breds, when five Ayrshires were purchased in a good Ayrshire centre of Quebec and added to the herd. The dairy herd sire, of course, has always been a pure-bred with both individual and pedigree merit.

Considerable experimental work has been carried on with dairy cattle, including the cost of rearing, the cost of producing milk, sunflower vs. silage for growing calves and for the milking herd.

We have found that milk can certainly be produced at a profit in northern Ontario and that both sunflower and o.p.v. silages are quite suitable as the major portion of the roughage for dairy cattle.

Beef Cattle.—The raising of beef cattle has also received considerable attention at this Station. The beef herd has consisted of good, typey Shorthorn grades and the herd sire has always been a pure-bred with good breeding. No record is kept of their milk production, as the majority of the calves are allowed to nurse their dams, and the whole herd is given a large run of stump-land pasture which has been seeded out and gives an excellent growth of grasses and clovers.

The beef herd has been utilized for considerable experimental work, which has included winter feeding of beef calves and sunflower vs.o.p.v. silage for beef cows and growing calves. As with the dairy cattle, we have found each of these silages to be very suitable for feeding beef cattle, both old and young.

Sheep.—A nice flock of pure-bred sheep is kept and used to some extent for experimental work along the lines of cost of feeding and comparison of feeds. The male offspring are sold to settlers at a nominal figure as breeders, as will also the ewe lambs, once the station flock is increased to a sufficient number.

Swine.—A large herd of breeding sows is maintained. They are all pure-bred Yorkshires and their offspring are used for experimental work or sold to settlers as breeders. In many cases they are sold as gilts or, in some cases, as young sows carrying their first litters.

The experimental work to-date has largely been along the lines of comparing feeds and methods of feeding, for the most economical and satisfactory production of the bacon hog. We have found, for instance, that the use of the self-feeder and of clover pasture tends to lower the cost of production, particularly when the cost of labour is included.

Field Husbandry

Rotation of Crops.—When a new country is first being cleared and opened up, it would practically be impossible for the settlers to follow a definite and permanent system of rotation of crops. Nevertheless, as the country develops and larger areas are brought under cultivation, the need for such a system will become more and more apparent. In order to be in a position to furnish the settlers with reliable data on this phase of farm management, an elaborate experiment in crop rotations was commenced at this Station in 1922.

The area allotted to each rotation is one acre for each year that the rotation covers, that is a three-year rotation would occupy an area of three acres and a four-year rotation an area of four acres and so on. The areas are not as large as might be desired; but they are large enough to make possible the keeping of records on cost of production and in this way they are representative of average field conditions.

The soil on which these rotations are located might be described as a clay loam with some shallow muck areas which cross all rotations established and therefore should not affect the basis of comparison. Some of the main points on which it is hoped to get data on from these rotations are as follows:—

1. The value, if any, of a short rotation in building up the fertility of the soil.
2. The effect on the following crop of a sod, one, two, and three years old.
3. The yield of hay from first, second, and third year meadows.
4. The yield of sunflowers, following sod or grain and following clover or grain.
5. The yield of grain after (1) sunflowers, (2) hay, (3) grain.
6. The success of various rotations involving various proportions of the different types of crop.
7. The success of fall vs. spring grain.
8. The value of summer-fallow as compared with a cleaning crop like potatoes or sunflowers.
9. The value of potatoes as a money crop.

The following are the rotations under test at this Station:—

Rotation A (Three Years' Duration).—First year, sunflowers; second year, oats; third year, clover hay;

Rotation B (Four Years' Duration).—First year, sunflowers; second year, oats; third year, clover hay; fourth year, timothy hay.

Rotation C (Five Years' Duration).—First year, oats; second year, sunflowers; third year, barley; fourth year, clover hay; fifth year, timothy hay.

Rotation D (Six Years' Duration).—First year, potatoes; second year, wheat; third year, barley; fourth year, clover hay; fifth year, timothy hay; sixth year, timothy hay.

Rotation E (Five Years' Duration).—First year, oats seeded to clover; second year, summer-fallow; third year, fall wheat; fourth year, clover hay; fifth year, timothy hay.

Cultural Experiments.—There are numerous cultural problems which confront every farmer in connection with the methods of treating the various farm crops. This is particularly true in a new country where the local experience of even the oldest farmer in the district dates back for only a comparatively short period of time. With the object of collecting some reliable data on a number of the more important cultural problems, a number of experiments have been established including the following:—

1. Rates of seeding sunflowers.
2. Rates of seeding ensilage crops.
3. Dates of seeding ensilage crops.
4. Ensilage and root experiment.
5. Ploughing down sweet clover and summer-fallowing.
6. Ploughing down sweet clover and buckwheat.
7. No green manure crop ploughed down, with peas in the rotation.
8. No green manure crop ploughed down, without peas in the rotation.
9. Farm manure experiment.
10. Lime experiment.
11. Drainage experiment.
12. Surface drainage experiment.
13. Methods of applying barnyard manure.
14. Treatment of virgin soil.
15. Land clearing experiment.

Although none of these experiments has been in operation for more than three years and the majority of them for only one and two years, yet considerable very valuable data have already been colected.

Horticulture

Horticulture has always been considered of great importance at this Station and a lot of valuable work has already been accomplished.

Orchard.—In the southwest corner of the horticultural grounds, some 203 specimens representing 48 different varieties and strains of the more hardy apples, plums and crabs, were set out in 1918. Of the original 203 trees set, 107 are still alive and a few of them bore fruit in 1923. The 96 which have died from winter-killing and other causes have nearly all been replaced, so that at the present time there are 179 trees in the orchard which are alive. A laurel-leaved willow hedge is being established around the horticultural grounds and it is hoped that the shelter from this will have a marked bearing on the success of the fruit trees.

Small Fruits.—The experimental work with small fruits has consisted of variety tests as follows: Red currants, seven varieties; black currants, fourteen varieties; gooseberries, fifteen varieties; raspberries, eight varieties; and strawberries, eighteen varieties.

Fairly good results have been obtained from most of these tests and the information gathered should be of great value to northern settlers when they come to select varieties for their home plantations.

Vegetables.—Many experiments have been conducted with a large number of varieties of vegetables, with particular attention given to the determining of the relative values of varieties from the standpoints of earliness, yield and quality. Some of the vegetables under test are beans, broad beans, beets, carrots, cabbage, cauliflower, celery, corn, cucumber, kohl rabi, kale, lettuce, onions, parsley, parsnips, peas, potatoes, pumpkins, radish, spinach, squash, salsify, sage, tomatoes and turnips. With nearly all of these fair success has been obtained, showing that a reasonably good garden may be grown by any settler in the north country.

Flowers.—To people who take a pride in flowers, the beautiful display of bloom from early spring until late fall is an outstanding feature on the Station. The choicest varieties of tulips, narcissi, crocuses, hyacinths, and freesias make an attractive contrast each spring from the winter so recently past.

A wide border, in the shape of a half-moon, is located on either side of the superintendent's house along the driveway and presents a very pleasing appearance to those who visit the Station.

Trees and Shrubs.—The question of shelter belts and hedges has been given some attention and the laurel-leaved willow and Russian poplar are among the best for quick growth and windbreaks. For lawn decoration and clumps, the lilacs, honeysuckles, Caragana, Rosa rugosa and Golden currants are among the hardiest. For hedges, the Caragana and laurel-leaved willow seem to be among the best tried.

Cereals

Many varieties are being tested out in uniform one-fortieth acre plots in order to determine the most suitable ones to grow in northern Ontario. Among those tested are fall wheat, fall rye, spring wheat, spring rye, oats, barley, peas, and flax, the latter for fibre. There have also been some tests carried on in connection with the best dates of seeding for fall wheat and fall rye.

The cereal work is in process of expansion, as it is the intention to include at least 100 extra strains and sorts another year in rod-row plots, each in quadruplicate, in order to test additional material originated at the Central Farm.

Forage Crops

If one particular kind of work is of greater importance than any of the others in northern Ontario it is that with forage crops; because live stock is bound to play a very important part in future farming operations in this section, and good crops of forage will be necessary to feed that stock. Accordingly this work has been more largely developed than any of the others at this Station. Land for over 2,000 experimental plots has been laid out in definite ranges and the experiments cover a wide and varied field as follows: Variety test of sunflowers; variety test of corn; variety test of oats as annual hay and to determine the best dates of cutting same; variety test of peas as annual hay; vetches as annual hay; sweet clover as annual hay; variety test with mangels; variety test of swede turnips; variety test of fall turnips; dates of seeding fall turnips; variety test of field carrots; a comparison of hay production from grasses alone and in combination with clovers; timothy and clovers for hay production; Brome grass; perennial red clover; nitro culture on red clover; methods of seeding alfalfa for hay production; nitro culture on alfalfa; red clover seed production; alsike seed production; timothy seed production; variety test with red clover; late and early clover with late and early grass; late and early clover in standard hay mixture; variety test with white dutch clover.

Fertilizer Experiments

The experimental work in agricultural chemistry has received a good deal of attention at this Station. Owing to unforeseen circumstances, however, the experiments as established have been seriously interfered with. The first experiment was established in 1920, consisting of thirty-four plots and arranged with the idea of determining the effect of various fertilizers in a four-year rotation as follows: First year, potatoes; second year, barley; third year, clover hay; and fourth year, timothy hay. This whole area was completely covered with water in 1922, owing to the construction of a new dam by the Spruce Falls Company and the consequent rise of the river. The rotation as formerly outlined had not been completed, consequently the results obtained were only partial.

In 1921 a second experiment was established along similar lines only on a more extensive basis, covering a manured and a non-manured area. The manured area was divided into thirty-two one-twentieth-acre plots for a four-year rotation as follows: First year, oats, peas and vetches; second year, oats; third year, clover hay; fourth year, mixed hay.

The non-manured area was divided into twenty-eight one-tenth-acre plots for a five-year rotation as follows: First year, oats, peas and vetches; second year, oats; third year, sweet clover, which is to be ploughed down as a green manure on one-half of each plot; fourth year, oats; and fifth year, red clover. This experiment was conducted for two years; but the season of 1922 was so extremely dry that the sweet clover and red clover failed to catch and, as a result, the returns of the experiment were partly lost.

It is the intention to establish a more comprehensive and elaborate fertilizer experiment than either of the two discarded and endeavor to follow it through to some ultimate conclusion as to just what fertilizers and what combinations of fertilizers give the best results on new land.

Poultry

Poultry work on this Station was not established until 1921, when the first permanent 100-bird poultry house, 16 by 32 feet, and three portable colony houses, each 10 by 12 feet, were constructed. Since then, the plant has been enlarged until now there is ample accommodation for 500 birds.

The Barred Plymouth Rock is the only breed kept to date and seems to be quite suitable to our northern climate and market conditions. They are birds of good size, reasonably hardy and make a good showing in egg production.

The experimental work of the plant has been along the lines of comparing breeding, feeding, housing and general management methods. Some of the experiments under way are: Skim-milk vs. beef scrap; crate fattening cockerels; sprouted oats vs. clover leaves as a green feed; comparison of early pullets; late pullets, yearling hens and two-year-old hens as winter layers; also use of artificial lights vs. no lights.

We have found that skim-milk is superior to beef scrap and that a fair profit may be obtained by crate fattening cockerels and also that home-grown grains such as wheat, oats and barley are quite suitable for this purpose.

A start has been made in pedigree work. From the trap-nest records the highest producing females are selected and mated with pedigreed males and, in this way, some excellent stock will be obtained for distribution among the farmers of northern Ontario.

Bees

The apiary is really only in the process of establishment. A queen mating yard was operated this year and to this may later be added a queen rearing yard.

The experimental work with bees has been along the lines of noting the effect of various types of weather on the honey flow and a comparison of inside and outside wintering, both of which have given very good satisfaction.

Extension and Publicity

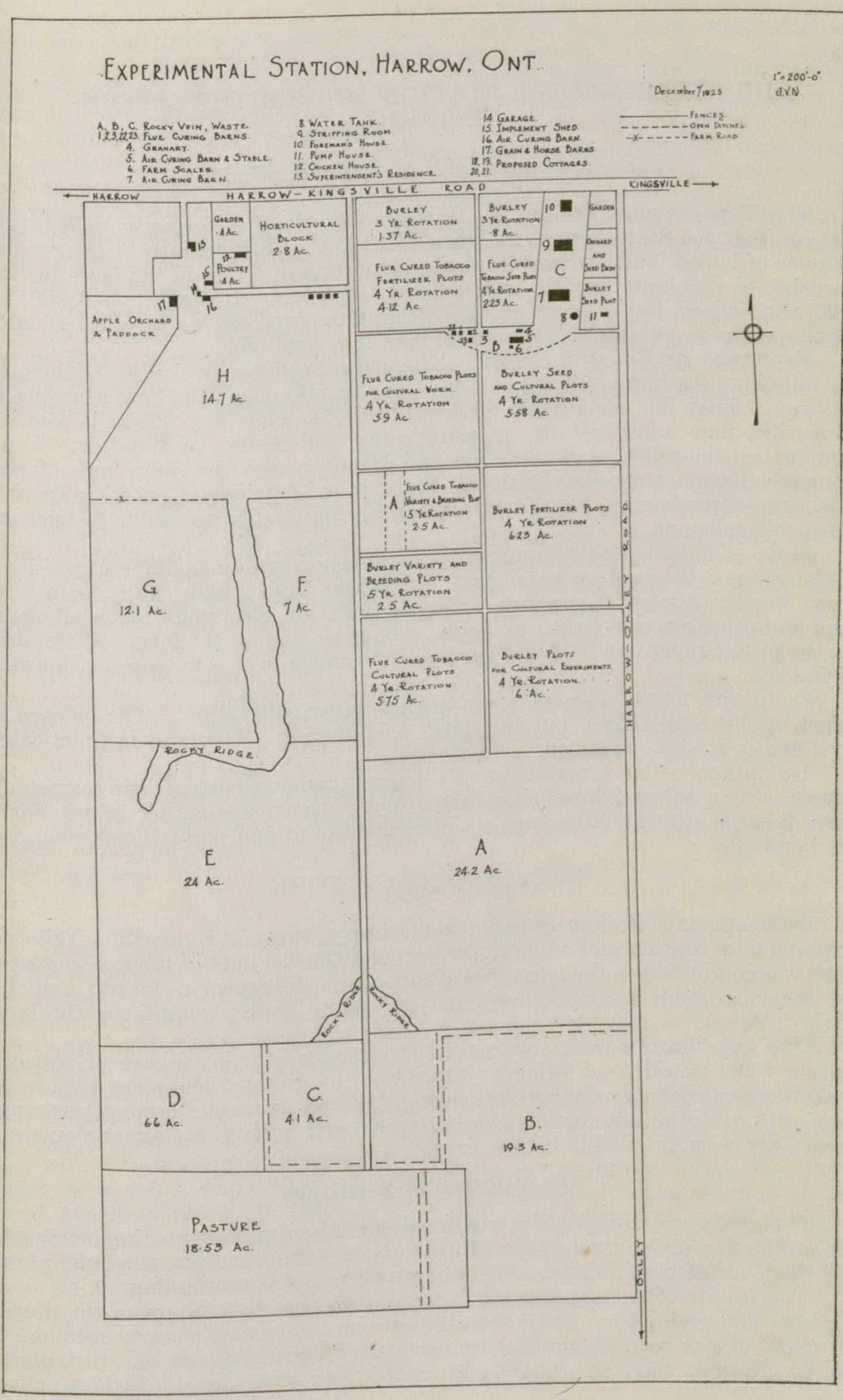
Several of the larger fall fairs are visited each year by an exhibit put up from this Station. The exhibit has been made as interesting and educational as possible and has proven an efficient way of getting into touch with northern Ontario settlers.

The officials of the Station are frequently available to attend farmers' meetings and other agricultural gatherings and are always ready and willing to assist in any way possible in the agricultural development of this new farming section of the province of Ontario.

From the above it may be noted that a good foundation has been laid for the rendering of excellent service to the agricultural interests of northern Ontario, for while the Station is yet quite new there are already 137 distinct projects under experimentation as follows: Animal husbandry, 10; field husbandry, 30; horticulture, 50; cereals, 10; forage crops, 25; chemistry, 3; poultry, 7; bees, 2, and the list is gradually being enlarged. The results of all these investigations should prove of great value to the people whom this Station is intended to serve.

Illustration Stations

Five of these have recently been established in Northern Ontario, where work will be conducted under the general supervision of the superintendent of the Experimental Station at Kapuskasing.


EXPERIMENTAL STATION, HARROW, ONT.
December 7 1923
1" = 200'-0"
A.V.N.
A, B, C. Rocky Vein, Waste.
1,2,3,22,23. Flue Curing Barns.
4. Granary.
5. Air Curing Barn & Stable.
6. Farm Scales.
7. Air Curing Barn.
8. Water Tank.
9. Stripping Room.
10. Foreman's House.
11. Pump House.
12. Chicken House.
13. Superintendent's Residence.
14. Garage.
15. Implement Shed.
16. Air Curing Barn.
17. Grain & Horse Barns.
18, 19, 20, 21. Proposed Cottages.
Fences
Open Ditches
Farm Road
HARROW
HARROW - KINGSVILLE ROAD
KINGSVILLE
Garden .4 Ac.
Poultry .4 Ac.
Horticultural Block 2.8 Ac.
Burley 3 Yr. Rotation 1.37 Ac.
Burley 3 Yr. Rotation .8 Ac.
Garden
Orchard and Seed Beds
Burley Seed Plot
Flue Cured Tobacco Fertilizer Plots 4 Yr. Rotation 4.12 Ac.
Flue Cured Tobacco Seed Plots 4 Yr. Rotation 2.23 Ac.
C
B
Apple Orchard & Paddock
H 14.7 Ac.
Flue Cured Tobacco Plots for Cultural Work 4 Yr. Rotation 5.9 Ac.
Burley Seed and Cultural Plots 4 Yr. Rotation 5.58 Ac.
A
Flue Cured Tobacco Variety & Breeding Plot 5 Yr. Rotation 2.5 Ac.
Burley Fertilizer Plots 4 Yr. Rotation 6.23 Ac.
Burley Variety and Breeding Plots 5 Yr. Rotation 2.5 Ac.
G 12.1 Ac.
F 7 Ac.
Flue Cured Tobacco Cultural Plots 4 Yr. Rotation 5.75 Ac.
Burley Plots for Cultural Experiments 4 Yr. Rotation 6 Ac.
HARROW - OXLEY ROAD
Rocky Ridge
E 24 Ac.
A 24.2 Ac.
Rocky Ridge
Rocky Ridge
D 6.6 Ac.
C. 4.1 Ac.
B. 19.3 Ac.
Pasture 18.53 Ac.
OXLEY

THE EXPERIMENTAL STATION FOR SOUTHWESTERN ONTARIO

D. D. DIGGES, M.S.A., *Superintendent*

The Experimental Station at Harrow, Ontario and formerly called the Harrow Tobacco Station, was established in 1909. Until recently it comprised 50 acres of leased land and was located on a portion of lot 15 in the Gore in the township of Colchester South, in the county of Essex. However, on April 23, 1923, the Federal Department of Agriculture purchased the whole of lot 15 and the Station now consists of 200 acres of land in a solid block.

FACILITIES OF COMMUNICATION.—The nearest railway station is at Harrow, one mile from the Farm buildings, on the Canadian branch of the Pere Marquette Railway. That line runs from Walkerville to St. Thomas. There is also at Kingsville, nine miles distant, an electric line which runs to Windsor. Connections can be made at Walkerville and Windsor with the main lines of the Canadian Pacific, Canadian National, Wabash and Michigan Central railroads. Good gravel roads make the Experimental Station readily accessible to farmers many miles distant.

SOIL.—The soil, of medium fertility, varies considerably on different portions of the Farm. While the greater part of it ranges from a light sandy loam to a heavy sandy loam, with a sandy sub-soil, there are also small areas of black sand and other areas of light clay loam. Thus we find on the farm soil suitable for the production of all field and garden crops grown in the southwest peninsula of Ontario.

Of the 200 acres, approximately 180 are under cultivation. The balance is taken up by rock ridges, building sites and ditches. The land is practically level and is not underdrained.

BUILDINGS.—The superintendent's house, foreman's cottage, one teamster's cottage, three tobacco air-curing barns, four tobacco flue-curing barns, horse barn, tobacco storage barn, granary, implement shed and pump house comprise the buildings.

EXPERIMENTAL WORK

In the past, as its former name would imply, this was primarily a Tobacco Experimental Station and, until the season of 1923, the bulk of the experimental work was conducted on the two types of tobacco chiefly grown in Ontario, namely, the flue-cured type and the air-cured type, White Burley comprising the bulk of the latter.

The experiments with tobacco cover practically every phase of tobacco culture which could be of value or interest to the grower; and since tobacco is a short-season, intensively cultivated crop, giving, as a rule, large returns per acre, with its value dependent upon both yield and quality, the experiments are necessarily very detailed in character.

Production of Seedlings

A plentiful supply of early, vigorous plants is of paramount importance in the production of tobacco, and until recently the number of growers who annually made a failure of this phase of tobacco culture was astounding.

The results of our experiments have proven that by employing the proper methods and giving the beds reasonable care an abundance of early seedlings is assured. It has been shown that by using a glass-covered, semi-hot bed, plants can be grown as early as in a greenhouse to which no artificial heat is supplied.

For the small grower the canvas-covered, semi-hot bed is most economical and will produce plants just as early as the glass-covered cold bed. The results further indicate that the soil of the bed must be friable, fairly fertile and well supplied with humus; that for the control of weeds and diseases, the soil in the bed must be sterilized by steaming for thirty minutes with 100 pounds pressure on the boiler; that earlier and more vigorous plants can be produced on sterilized soil than on unsterilized soil; that the rate of seeding must be governed by the germinative power of the seed, seed germinating 80 per cent being sown at the rate of one-seventh of an ounce per 100 square feet; and that either the cold or the semi-hot bed may be made and steamed in the fall with just as good results as when made and steamed in the spring.

That the dissemination of the above results has had a marked effect on the culture of tobacco in Ontario is evidenced by the steadily decreasing number of plant bed failures each year; by the earlier date upon which transplanting becomes general; and by the fact that, for the past few years, sterilization of the beds has been universal while only eight years ago it was exceptional.

Variety Tests

Since its inception, a large number of varieties of the flue-cured type and of the Burley and other air-cured types have been tested on this Station, as regards both yield and quality. The results strongly indicate that, for the general run of soils, the Warne is the best flue-cured variety and, at present, it is by far the most widely-grown variety. The Hickory Pryor has proven to be the second best and is recommended for the heavier types of soil.

The varieties of Burley giving the best results are the Broadleaf, Station Standup and Resistant. For both yield and quality, the Broadleaf Burley is recommended for undiseased gravelly soils; the Station Standup Burley for undiseased sandy loams, light clay loams and other dark types of soil; and the Resistant Burley for all doubtful or diseased soils. The bulk of the Burley crop is made up of these three varieties and, by planting as recommended, the quality of the crop is being improved.

For the production of Green River, an air-cured type which has been introduced during the past year, the Little Hill and Greenwood are apparently the best varieties.

Fertilizer Tests

Very exhaustive experiments with fertilizers are being conducted on all types of tobacco grown in the province. In these tests the best formulæ from the standpoints of economy, and yield and quality of crop, are being sought; the effect of various sources of nitrogen and potash studied; home-mixed fertilizers are compared with ready-mixed commercial fertilizers as regards economy and effect on yield and quality; and the best methods for applying fertilizers are being sought.

The results have been outstanding and have proven that liberal applications of fertilizer, even on fairly fertile soils, are highly profitable. The net return per acre with flue-cured tobacco has ranged from \$119.10 to \$238.35 during the past seven years. During the same period the net profit on Burley has ranged from \$56.06 to \$223.35 per acre. The results indicate that, on the average soil, the best and most economical formula for the flue-cured type would consist of 140 pounds of sulphate of ammonia, 600 pounds of 16 per cent acid phosphate and 200 pounds of sulphate of potash, per acre. The results also indicate that one-half of the nitrogen in the above formula may be supplied by dried blood with just as satisfactory results and a more readily drillable fertilizer thus obtained. On Burley, the best and most economical formula is apparently 320 pounds of sulphate of ammonia, 400 pounds of acid phosphate and 200 pounds of sulphate of potash, per acre.

Home-mixed fertilizer has proven cheaper and apparently just as good as a ready-mixed commercial fertilizer of the same formula.

Drilling the fertilizer in the row is apparently the most profitable method of application.

That these results are exerting a very decided influence on the growers is evidenced by the steady annual increase in the amount of fertilizer used, some of them mixing their own, and by the fact that the growers are studying the fertilizer problem and attempting to learn and understand the various factors which determine the value of a fertilizer and have a bearing on the results obtained.

In addition to the fertilizer experiments conducted on the Station, co-operative fertilizer experiments are being carried on with growers, on different types of soil throughout the tobacco belt, with the purpose of determining the best formulæ as well as of giving a practical demonstration of the effect of proper fertilization.

Manure Experiments

Extensive experiments with barnyard manure have been made. The object of these has been to determine the effect of direct as compared with indirect applications of manure to Burley; to learn the quantity of manure needed in conjunction with a good artificial fertilizer; and to compare fall and spring applications of manure for tobacco.

The results indicate that indirect applications of manure to Burley are more satisfactory from the standpoint of quality, and equally as good as regards yield, as direct applications. Apparently, manure may be applied either in the fall or in the spring with equal results. An application of twelve tons of manure per acre in conjunction with a good fertilizer is apparently sufficient.

Rotation Experiments

Three rotations with the flue-cured type of tobacco and four rotations with the air-cured type have been tested. The rotations were as follows:—

Flue-Cured Type

Four-year—Corn, tobacco, cereal, grass.
Four-year—Tobacco, corn, cereal, grass.
Five-year—Tobacco, corn, cereal, grass (two years).

Air-Cured Type

Three-year—Tobacco, corn, cereal.
Four-year—Tobacco, corn, cereal, grass.
Four-year—Corn, tobacco, cereal, grass.
Five-year—Tobacco, corn, cereal, grass (2 years).

In the above rotations some crop received an application of manure during the period of rotation, and green cover crops were used wherever possible.

The results plainly showed that any of the above rotations could be followed [illegible] fertility of the soil increased; that the increase in soil fertility was [illegible]arked [illegible]here the rotation was longest; that the rotation followed exerted [illegible]tly in[illegible]fluence on the quality of the tobacco produced; and that on soils [illegible]uded in[illegible]ed with root rot, a four-year rotation in which red clover was not [illegible] was sufficient to eradicate the disease. From the standpoint of both [illegible] quality [illegible], the best rotation for the flue-cured type was the four-year [illegible]orn preceded the tobacco. The five-year rotation and the four-year rotation with tobacco preceding the corn resulted in the production of too coarse a leaf and a poorer colour. Considering yield, economy and quality, the four-year rotation is best for Burley and, apparently, the one in which corn precedes the tobacco is to be preferred.

One field has been cropped to Burley continuously for eight years and despite the fact that it has received heavy applications of manure and fertilizer annually, the crop becomes poorer in yield and quality and more diseased every year.

The above results, together with decreased yields and increased disease infections, are convincing the growers that a good rotation is essential and much advice is being requested and given regarding suitable ones.

Cultural Experiments

These include distances of transplanting, depth of cultivation, time of ploughing, height and time of topping and methods of harvesting.

The results indicate that the distance at which the tobacco is transplanted in the field has a very marked influence on both the yield and the quality. The fact is constantly being more fully realized by the growers and closer planting than was formerly practised is becoming the rule. Under average conditions, the best distance for transplanting the flue-cured varieties is 24 by 36 inches and for Burley 28 by 44 inches.

Apparently the best method of cultivation is to cultivate the crop deeply at first and gradually diminish the depth as the plant increases in size, until at the last only the crust is being broken.

In this district, conservation of soil moisture is generally one of the most important factors in tobacco growing. For that reason the light sandy soils should be ploughed as early as possible in the spring. On heavier soils used for growing Burley, fall ploughing has given increased returns, varying from $24 to $100 per acre, over spring ploughing.

It has been found that the height and time of topping exert a marked influence on the yield and quality of the crop. Late or high topping retards maturity, results in poorer quality without increasing the yield, and increases the percentage of stalk to leaf. While there is still a tendency on the part of some growers to top too high, this defect is gradually being overcome by demonstrations, etc., and most of the growers are now topping the plant as soon as needed and taking into consideration the various factors which determine the height at which the plant should be topped.

The experiments have shown conclusively that the split stalk method of harvesting results in a quicker cure, lessens danger of damage in the curing barn, and gives a product of better quality. While some growers still employ the original method of spudding, the split stalk method is gaining in popularity and there are districts in which it is employed universally.

Growing Tobacco Seed

Until the past few years, almost all of the tobacco seed used by the growers was imported. Since changes in soil and climate were known to have a marked effect on tobacco, experiments were started to determine the value of acclimatized seed as compared with imported seed. It was found that acclimatized seed not only produced earlier seedlings but also produced plants which ripened earlier and more uniformly, thereby indirectly affecting yield and quality. This fact was quickly grasped by the growers and for seven years large quantities of tobacco seed have been grown on the Station to satisfy the demand for acclimatized seed.

Disease Control

Much investigational work has been done towards the control of diseases both in the seed bed and in the field. Disease-resistant strains have been tested and improved and the effectiveness of various fungicides and different methods of soil sterilization tested. Those investigations strongly indicated that preventive measures were more effective than control measures and that by transplanting only healthy, vigorous seedlings, a long step had been taken towards the prevention of diseases in the field. Such plant bed diseases as mosaic, root rot and damping off are best prevented by thorough soil sterilization, careful aeration of the beds and changing the soil therein at least every three years. However, should the root rot appear after taking those precautions, the soil of the plant bed must be changed for the succeeding crop and, if at all possible, the site of the beds should be changed. With such diseases as wildfire, the seed must be sterilized with a bichloride of mercury solution before being sown, in addition to the above measures.

Sterilization by steaming has proven superior to sterilization with chemicals.

In the field, most of the diseases commonly found are controlled best by using absolutely healthy plants, employing a systematic crop rotation, and, in the case of mosaic, pulling out and destroying infected plants before the topping and suckering operations begin.

Insect Control

Investigations along this line have shown that spraying the tobacco with arsenate of lead is the safest, most effective and most economical procedure.

Late fall ploughing has proven most effective as a control measure for cut-worms; however, the use of poisoned bran mixtures just before transplanting is fairly satisfactory.

Curing Experiments

Since the value of tobacco depends solely upon its quality, and since colour is a very important element of quality, much work has been done towards colour improvement, in the curing process. It has been found that, to produce the best colour, the tobacco should be permitted to get fairly ripe before harvesting. After harvesting, the flue-cured type must be hung in the barn immediately and the fires started. In fair weather, the air-cured types may be scaffolded, or piled in the field, for about three days with a resultant improvement in colour and less danger of pole burn and other barn damage. However, if the weather is unsettled it is best to hang the crop in the barn immediately.

Small charcoal fires, built every nine feet on the floor of the air-curing barn during continued muggy periods, have proven very effective in preventing pole burn and hastening the curing process, thereby improving quality.

Flue-curing experiments have included tests of various types of curing furnaces and apparatus for using various types of fuel as well as investigations to determine the proper humidity to maintain in the barn at different stages in the curing process.

The Johnson Patent curing furnace for burning coal or wood has been tested and found inadequate for the average size of curing barn.

Tests of the Beckett-Covill wood and coal burning furnace have proven it fairly satisfactory for the average-sized barn and more economical than the original brick arches burning wood.

Fuel oil burning apparatus has proven fairly satisfactory so far as the colour obtained was concerned, but not as economical as the coal burning apparatus.

Steam as a source of heat in curing has been tested for two years and found highly satisfactory. A more uniform temperature can be maintained with steam than with any other heating apparatus tested, fire risk is eliminated, and the system is much more economical as regards fuel than the original wood burning furnaces. This Station is the pioneer in flue-curing tobacco with steam heat and, as wood and natural gas become scarcer and higher in price, the steam curing system will doubtless be installed on many farms.

The experiments have proven that the relative humidity in the curing barn will vary somewhat according to the character of the tobacco being cured and that, while no real, definite formula will apply in all cases, the humidity should be about 79 per cent when the bottom leaves begin to yellow, 72 per cent when the middle leaves begin to yellow, 60 per cent when the tips begin to yellow, and 47 per cent when the tobacco is yellow enough to fix the colour.

Fertilizer Experiments with Corn and Tobacco

While, on the Station, corn and oats, have followed tobacco crops which had been highly fertilized and manured, it has frequently been found that, even under such conditions, applications of 300 pounds per acre of 16 per cent acid phosphate would give sufficient increase in yield to pay for the fertilizer. These results indicate that, on general forms in the district on which no commercial fertilizer is being used, moderate applications of acid phosphate to those crops would be profitable.

Extension Work

Aggressive extension work is being done among the growers through personal visits, press articles, bulletins and co-operative experiments. Exhibits are shown at the local fairs, at which the superintendent also serves as a judge.

Expansion

While this Station will continue to be one of the principal tobacco Experimental Stations, its enlargement will permit of a great broadening in scope of work, which will include experiments in horticulture, field husbandry, forage crops, cereals, etc. During the past season, breeding work, variety tests, and cultural experiments with corn and other forage crops were begun on a large scale. Over 240 different varieties and strains of corn were included in the experiments and hundreds of ears of corn were hand pollinated. A number of varieties of soy beans were also tested.

Over 1,600 tulip, narcissus and hyacinth bulbs were planted for work in floriculture and beautifying the grounds.

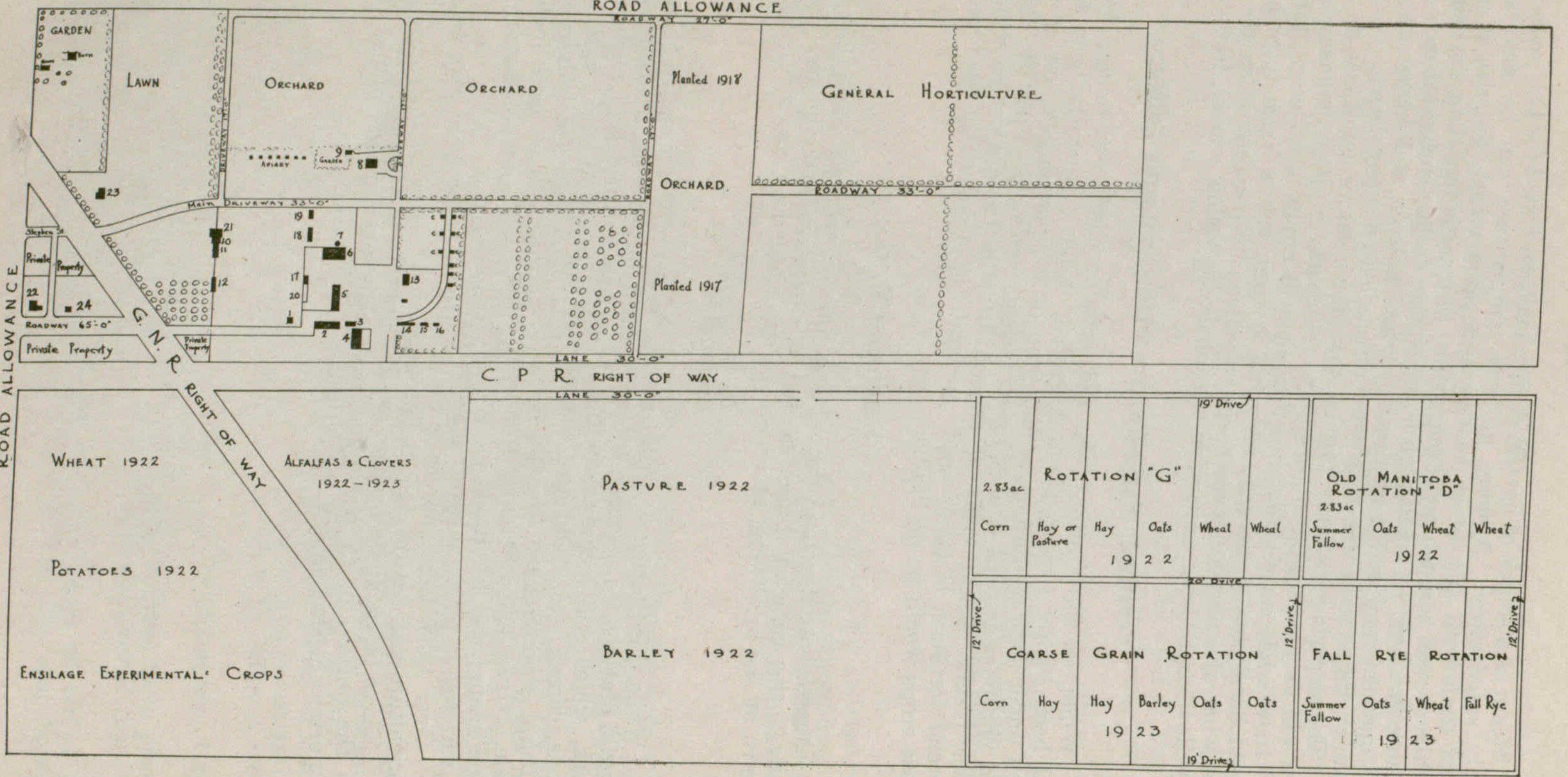
There is an apple orchard of fifty-four trees comprising twelve varieties on the portion of the farm recently taken over, which offers a nucleus for important experiments in the future.

EXPERIMENTAL STATION MORDEN MAN

1. OFFICE
2. SHEEP SHED
3. GRANARY
4. STEER SHED
5. IMPLEMENT SHED
6. BARN
7. SILO
8. RESIDENCE
9. GARAGE
10. POTTING SHED
11. GREENHOUSE
12. ROOT CELLAR
13. POULTRY ADM. BLDG.
14. POULTRY
15. POULTRY
16. POULTRY
c. COLONY HOUSES
17. BARN
18. ROOT HOUSE
19. ROOT HOUSE
20. BOARD WALL PADDOCK
21. OFFICE
22. RESIDENCE
23. RESIDENCE
24. GARAGE

THE STATION COMPRISES THE N. ½ OF SEC 4, TP. 3, R. 5, W. OF THE 1ST M. LESS AREAS MARKED PRIVATE PROPERTY, TOTALLING 300 ACRES, MORE OR LESS

C.E.F.—A.V.N.—23/8/23.



THE EXPERIMENTAL STATION FOR SOUTHERN MANITOBA

W. R. Leslie, B.S.A., *Superintendent*

Location and Description.—The Experimental Station at Morden, Man., was purchased in 1914. The farm had been run by private owners for over forty years and had become badly infested with weeds. To clean up the land it was well fallowed in 1915 and some experimental work was commenced in the spring of 1916. Each succeeding year has seen expansion in the numbers of projects carried on.

The area of the Station is about 300 acres. It comprises the north half of section 4, township 3, range 5, west of the 1st Meridian, less some twenty acres taken off by the two railways, the Canadian Pacific, which runs through the centre of the farm from east to west, and the Great Northern, which traverses diagonally the western end in a northwesterly direction.

The Station is adjacent on the east to the town of Morden, which prides itself upon being in the centre of "the Apple-Growing District" of Manitoba. The soil is mostly fine sandy loam, but a few acres are clay loam. The soil is characteristic of the district and of a great deal of the province. The soil of the Red River Valley to the east is a much heavier clay, but that famous area is served by the Experimental Station of the Manitoba Agricultural College at Winnipeg. The Morden Station's subsoil is a pervious clay and at a depth of from eight to fourteen feet, gravel or sand is encountered. The wells are only from fourteen to twenty feet and afford a large supply of water, which, although somewhat alkaline, is used generally for stock and household, including drinking purposes. Water from deep wells is apt to contain much salt and to be decidedly unpalatable.

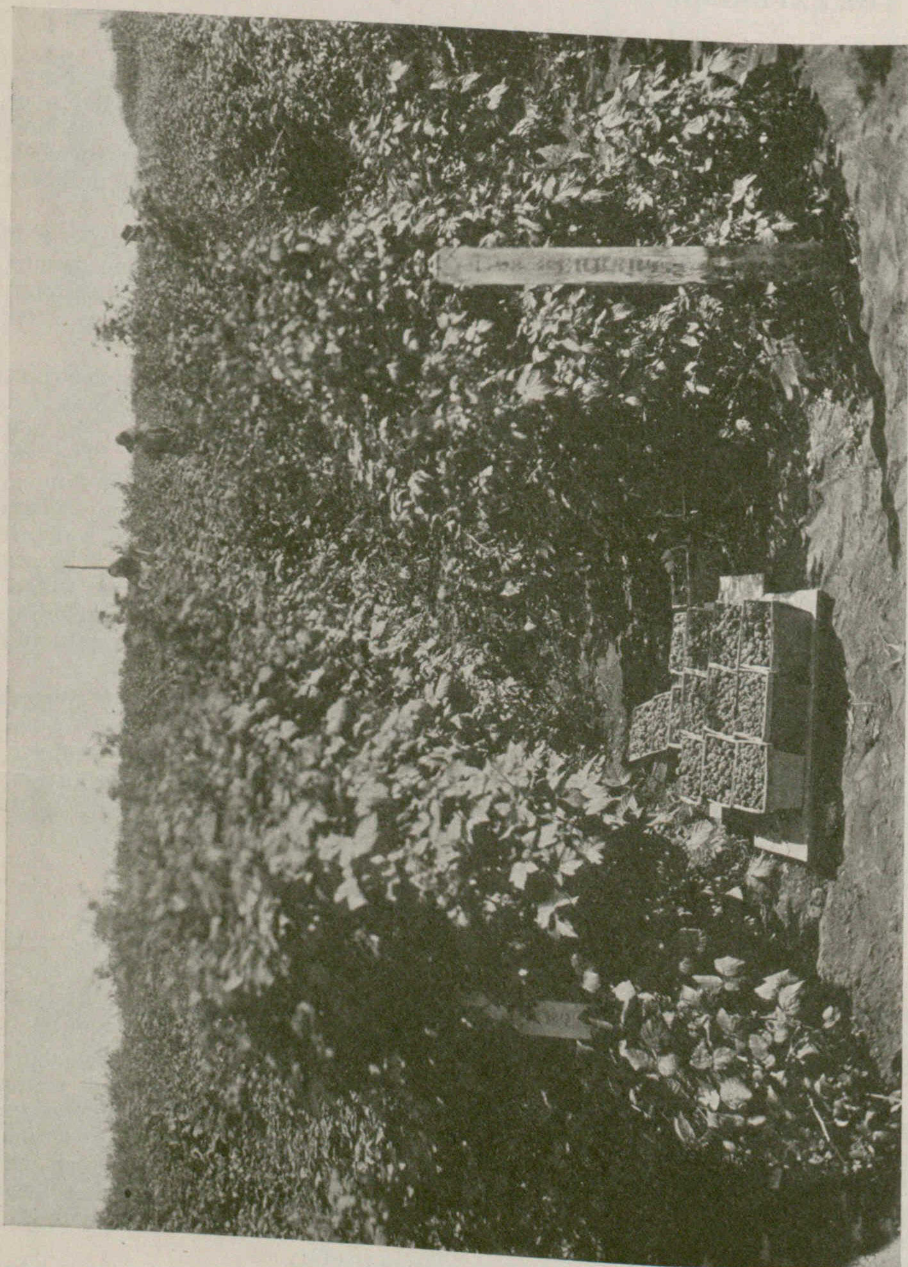
While the Morden Station aims to serve southern Manitoba in a general agricultural sense, it specializes in horticultural work. For this reason, of the Station's total of 300 acres, 105 acres are reserved for horticultural projects. Of the remaining acreage 55 are in pasture, 100 in field husbandry rotations and 40 acres are used for growing field crops for the production of seed to be distributed to farmers.

Animal Husbandry

Horses. The Experimental Station at Morden has been equipped with Percherons. There are three pure-bred mares to be used as foundation stock for breeding purposes. The other eight horses are grade Percherons and are used for doing most of the farm work not performed by tractor.

Cattle.—The Station has a small but thriving herd of Ayrshire dairy cattle. In all there are thirteen. The herd is fully accredited and young bulls are disposed of readily at moderate prices to farmers. As the cows freshen they are entered in the Record of Performance test. Six have completed their tests and four of these qualified. The other two were young cows, which will probably qualify under subsequent tests. The best record to date has been made by Greenbank Lottie 2nd in her twelfth year, with a production in 365 days of 12,241 pounds milk and 568 pounds butterfat.

Feeding tests are carried on, in which sunflower silage is compared with corn silage as a feed for dairy cows. Roots are fed as a partial replacement for silage.



Raspberries are almost a "sure crop"—Experimental Station, Morden, Man.

Corn is in greater favour than sunflowers as a silage crop at Morden. Sunflower silage freezes readily, causes much more than an average flow of urine, and seems to be less palatable than corn silage. As southern Manitoba can grow very satisfactory crops of corn, it is improbable that sunflowers will be planted to any great extent.

Mangels produce excellent crops in this district and are a useful fodder for dairy cows. The labour in growing root crops is not in their favour, but a small plot of mangels affords a palatable change in succulent feed for the dairy herd.

Experimental steer feeding is usually conducted each winter.

Sheep.—A small flock of sheep fits well into farming in southern Manitoba. These animals thrive on rough feeds and are of real value in keeping weeds in check and in preventing plant growth from becoming too far advanced before cultivation begins. They do well on stubble land after threshing. The Station flock is proving fairly profitable.

From 1916 to 1923, a grading-up experiment was conducted. A nondescript lot of prairie ewes was purchased. These and their female progeny, have been bred to registered Hampshire rams and the flock in 1923 is a fine example of the efficacy of the continued used of good pure-bred sires. The grade Hampshire flock is uniform and of good type.

In the spring of 1923, a group of six pure-bred ewes was secured and, in future, foundation stock of this breed will be available at the Morden Station.

Field Husbandry

Because of weeds, soil drifting, insect pests and diseases, labour problems, etc., strictly grain farming is apparently nearing its close in Southern Manitoba. The field work on this Station is devoted to crops and cropping systems of value in a diversified type of farming.

An important phase of the work carried on in this department is the experiments with crop rotations. However, cultural treatment for various crops and pure seed production are two further projects gaining in scope each year.

Rotations.—On this Station, crop rotations were planned and based on previous experience obtained by the older Western Experimental Farms, particularly that of Brandon, Man. A careful study of their merits caused the following to be adopted at Morden.

Rotation "C" is of four years' duration. It is adaptable by the stock farmer who desires to rid his farm of weeds by a cleaning crop system. In it, summer-fallow is displaced by an intertilled crop of corn and sunflowers, this latter being for comparison with corn. Wheat is grown on the corn and sunflower land and is seeded down with a mixture of Western Rye grass and sweet clover on one-half the area, and Western Rye grass on the other half. This crop of wheat has proved quite profitable. In the third year a hay crop is obtained. Directly after the hay is removed, the field is ploughed and disced in preparation for a crop of oats and peas in the fourth year of the rotation. This latter crop is seeded at the rate of one bushel of peas to two bushels of oats, and results from it, both as to profit and feeding value, have been gratifying. The pea and oat stubble is skim-ploughed in the fall, manured during winter and spring, and ploughed six inches deep in spring time for corn.

Rotation "D", commonly called the "Old Manitoba Rotation," is conducted as a check in comparison with the newer rotations. It is of four years' duration. Wheat is the first crop. This wheat land is ploughed in the fall for wheat the second year and either fall or spring ploughing of the wheat stubble is done for a crop of oats the fourth year. This provides one-half the area on a cash crop, one-quarter in a feed crop, and one-quarter idle as a summer-fallow.

Rotation "G" is of six years' duration and lends itself to a more intensified and soil improving system of farming. After having been profitable through a number of years on the Brandon Farm, it was included in the rotations at this Station to determine its local applicability.

There is no summer-fallow in this rotation. Corn substitutes fallow land. The corn stubble is thoroughly disced for wheat. The wheat stubble is fall-ploughed for wheat the second year, and fall or spring ploughing is done for oats the third year. This oat crop is utilized as a nurse crop. One-half is seeded to a mixture of Western Rye grass and alfalfa and one-half to Western Rye grass alone, which provides hay crops the fourth year, and hay or pasture crops the fifth year. In the fall of the fifth year, this land is broken up by ploughing three inches deep. Manure is applied to this field the following spring, after which it is ploughed to a depth of six inches in preparation for corn, which occupies the sixth year in the rotation.

Fall Rye Rotation.—This is of four years' duration. Fall rye is the first crop. Wheat is the second. In the third year fall rye is sown on one-half the area and oats on the other half. Summer-fallowing is done the fourth year. It is conducted to determine the profitableness of fall rye on summer-fallow in comparison with wheat on summer-fallow in the "Old Manitoba Rotation," and the influence of a second crop of fall rye in the rotation when seeded on wheat stubble. After the first crop of fall rye, the land is ploughed for wheat. On half the area of wheat stubble in the second year, fall rye is seeded and the other half of this area is ploughed for oats, giving in the third year these two crops.

A Coarse Grain Rotation, of six years' duration, is included, with the aim of determining a suitable cropping system for the farmer who desires to get value from his crops through feeding them to live stock. It will also benefit farmers on land where wheat growing is attended with difficulty. The first two years of the rotation are devoted to oats. The third year, barley is seeded and used as a nurse crop, one-half for Western Rye grass and the other half for a mixture of Western Rye grass and alfalfa. These produce hay crops in the fourth year and hay or pasture the fifth year. During the fall of the fifth year, this field is manured and ploughed deeply and the following spring is prepared for corn by discing and harrowing.

Registered Marquis wheat is grown on the rotation fields. Kubanka wheat is used in "D" rotation for comparison with Marquis on summer-fallow and on fall ploughing.

Registered Banner oats are used and the surplus sold for seed to surrounding farmers.

O.A.C. 21 is the barley used on the rotations.

Russian Mammoth sunflowers are used and Northwestern Dent corn. The Station grows and selects its own seed corn. The foundation stock was Illinois-grown seed. An attempt is being made to get an early-maturing, heavy-yielding corn, true to the Northwestern Dent type and results so far have been good. The demand for seed corn grown on the Station increases yearly.

Horticulture

The establishment of the Morden Station in southern Manitoba has permitted the commencement of wider and more scientific research and experiment in horticulture than was possible under the climatic and other conditions prevailing in those prairie regions where Experimental Farms had hitherto been located. Under former conditions, most, if not all, of the problems of research in horticulture were studied at the Central Farm, Ottawa. Results obtained there were frequently found not to apply to prairie conditions. It is now possible to work out problems for the prairies on the prairies.

A greenhouse for aiding in the work of plant breeding with fruits and vegetables was built in 1922. Many tree fruits and bush fruits are growing in tubs for use in this work and good equipment is on hand for the active prosecution of the task of developing new varieties well adapted for culture on the prairies.

Of the 105 acres for horticultural work, eighty acres are for fruit culture and nurseries, five acres are for vegetable growing, and twenty acres are devoted to ornamental grounds and the establishment of a systematic arboretum.

Fruits.—In the tree fruit plantations are found over 200 named varieties of standard apples and crab apples, over forty varieties of plums and plum hybrids and also several varieties of sour cherries and of edible nuts.

Besides the named varieties, there have been over 30,000 seedling apples set out for test. Of the ones fruiting to date, eighty-two trees have been selected to be propagated for further test. Some of these are of real promise in point of quality and most of them seem to possess an excellent degree of hardiness at Morden. There are also about 1,000 seedling plums and 300 seedling cherries.

Controlled fruit breeding began in 1922, and in 1923 a good set of apples and plums of known parents was harvested and the seed planted. Some raspberry breeding was also performed.

Test orchards have been commenced in which are being tried productions of the Central Experimental Farm, the South Dakota Experimental Station, the Minnesota State Fruit Breeding Farm, and fruit productions from Iowa and other Stations as well as from private plant breeders. Another orchard is planted only with selected wild fruits collected from many different northerly points of this continent.

Different planting methods are being tested, such as inter-planting fruit trees with individual spruce trees, planting trees closely in rows, planting trees in clumps, and planting trees in different degrees of exposure in regard to shelter belts.

Variety testing and cultural experiments are extensively involved in growing small fruits such as strawberries, raspberries, blackberries, dewberries, red, white, and black currants, and gooseberries. Hardy varieties of grapes thrive when given moderate care.

It has been clearly proven that prime considerations in growing fruits on the prairies include: (1) The use of a snow-trap, which will check the drifting snow so that it will not fill in the orchard to crush the trees in springtime, (2) The absolute necessity of much shelter. This is best supplied by tree windbreaks and hedges. Excellent material for shelter are the native white spruce and the *Caragana arborescens*. Corn or sunflowers provide helpful temporary and auxiliary shelter. (3) It is unwise to set out fruit trees unless they are on hardy roots. It is well to have apples on roots of Siberian crab and plums on native plum roots. (4) A southern slope or exposure is decidedly an adverse condition; a north-eastern slope is to be chosen where possible. (5) Well-drained soil is requisite. (6) Apple trees are unfairly handicapped where they are not protected from sun-scald, rabbits and mice. (7) Low-headed trees are most likely to have satisfactory careers. (8) One-year whips should be planted in preference to older nursery stock. (9) Wild plums and crab apples can rapidly be converted into producers of good quality fruit by top-grafting to hardy named varieties. (10) The fruit crops most likely to succeed in all localities are raspberries, currants, and plums.

Vegetables. Many projects are annually embarked upon in variety testing and cultural methods with vegetables. Vegetable breeding was commenced in 1922 and efforts are being made to improve the list of adapted melons, sweet corn, pop corn, tomatoes and beans.

A number of "warm season" crops, such as corn, tomatoes, melons and peppers do well at this Station. Such early maturing varieties are sought by plant breeding and selection, as will better withstand the cooler nights characterstic of the more northwesterly parts of the prairies.

To encourage increase in the number of varieties of vegetables commonly grown in home gardens, such comparatively rare vegetables as okra, New Zealand spinach, peanuts, artichokes, broad beans, pole beans, kohl rabi, leeks and cress are grown in demonstration plots.

Considerable stress is put on potato culture. Different treatments are given to prevent loss from diseases. Various cultural systems are employed. About twelve acres of certified seed potatoes are grown annually for distribution among growers.

Ornamentals. Since 1916, projects have been conducted in growing annual flowers, herbaceous perennials and ornamental shrubs. There is a splendid range of all three classes adapted for growing generally.

Roses have been given attention since 1921 and some breeding work was done in 1923. A new rose garden has been made and shortly one half acre of roses will be growing in this area. The Station has the co-operation of Manitoba's leading breeder of roses, Mr. F. L. Skinner of Dropmore, in this work. Mr. Skinner has supplied specimens of his most valuable productions.

Specimen climbing plants are arranged along the border of the rose garden.

Specimen hedges are in view from the central driveway.

An iris border, a pæony border, and a mixed herbaceous border flank shrubberies along the ornamental driveway.

An arboretum is planned and planting will begin in 1924. A collection of 500 varieties of trees and shrubs are to be planted. These are grouped according to their plant family relationships. It is expected that the lists of shrubs and trees suitable for the prairies will be considerably enriched because of this test of numerous species, which will receive their first trials on the Canadian prairies in this arboretum.

Cereals

Under this head, tests of new strains and varieties and further experimentation with older strains and varieties are conducted. The respective merits of the leading wheat, oats, barley, and flax varieties are determined in trial plots.

Believing that field peas are to play an important part as a grain and forage crop in Western Canada, variety tests of these are conducted. This Station grows several acres each year for seed for which the demand is good. Varieties tested include Mackay, Arthur, Chancellor, Marrowfat, and Canada Field.

Since field bean culture may be successfully carried on in this locality, tests with these are being made, including such varieties as Early Wonder, Robust, Darling, Hunter, Norwegian, Navy Pilot, and Great Northern. These seven varieties of white beans, after wide testing, were chosen as the best suited to local conditions. Navy Pilot and Great Northern are somewhat late in maturing.

Forage Crops

With the inevitable change from grain growing leading to an increase in numbers of live stock kept on western farms, fodder crops are rising from a position of comparative obscurity to be prominent in Manitoba agriculture. Realizing this fact, experiments with such crops have been commenced on this Station.

Variety experiments with turnips, mangels, and field carrots are carried on. Varieties of such perennial grasses as Western Rye, timothy, the fescues, and brome grass, are being tested with a view towards getting suitable strains of hay and pasture plants for the prairies.

Variety and strain experiments with alfalfa and sweet clover are conducted. In 1923, the Grimm strain alfalfa yielded a splendid hay crop early in June and in September a second crop was harvested for seed, which yielded nearly seven bushels per acre.

Besides testing varieties of alfalfa, cultural methods in its production are being conducted, such as seeding with or without nurse crop, and seeding on summer-fallow and on fall-ploughed land.

Strains of white and yellow blossom sweet clover are tested for pasture, hay, and seed production.

The experimental work with red clovers has so far been confined to variety and strain tests. Only the hardiest strains of these prove suitable for Southern Manitoba.

Annual forage crops, such as millets, Sudan grass, vetches, and soiling crops such as rape and sorghums, are under test. Siberian and common millet strains have proved of value. Sudan grass as hay or pasture has given good results and Amber sugar cane, feterita, and Kaffir corn are very useful as soiling crops.

Corn is taking a leading place among forage crops in Southern Manitoba. Because of this, tests are carried on with the leading varieties to determine their value for silage, dry fodder, and for seed production. Included in these are varieties such as Northwestern Dent, Manitoba Flint, Minnesota 13, Leaming, Wisconsin No. 7, Longfellow, Compton's Early and Gehu.

Sunflowers are being tested, in comparison with corn, for silage purposes. Varieties such as Mammoth Russian, Manchurian, Mixed Mennonite, and several C.P.R. selections are being grown.

Poultry

Flocks of two utility breeds are maintained. These are the Barred Plymouth Rock and the Single Comb Rhode Island Red. All hens are trap-nested and pedigree work is carried on to the end that strains with high egg-production may be developed and their stock made available to farmers.

Very satisfactory improvement in egg production has been experienced. The two breeds kept have many merits and both prove to be profitable. Cost accounting is done and the keeping of poultry seems to offer an attractive side line for the farmer.

Feeding experiments are run with laying hens and with chicks and cockerels. Results of these are published in annual reports and in press articles.

Bees

The tendency is for the prairie farmer to grow more and more of his own food. The keeping of two or more colonies of bees is along this line. Manitoba is a good honey-producing territory. Honey sells readily and surplus colonies of bees find quick sale at a fair price.

There is a good field of service in securing information on the care of bees in Manitoba. The Station has projects dealing with different methods of wintering, of swarm control, of size of brood-body, of increasing colonies, and of securing honey. The information being thus gained renders much assistance in answering the inquiries which are steadily becoming more numerous.

Tobacco

Commercial varieties of tobacco grow rapidly at Morden and would seem to offer an additional side-line if it were not for one serious drawback. It is difficult to prevent the wind doing damage to the leaves as they near the stage of maturity. The large leaves are easily ripped and broken. In a well-sheltered enclosure such varieties as Comstock Spanish and Canelle would probably give good results.

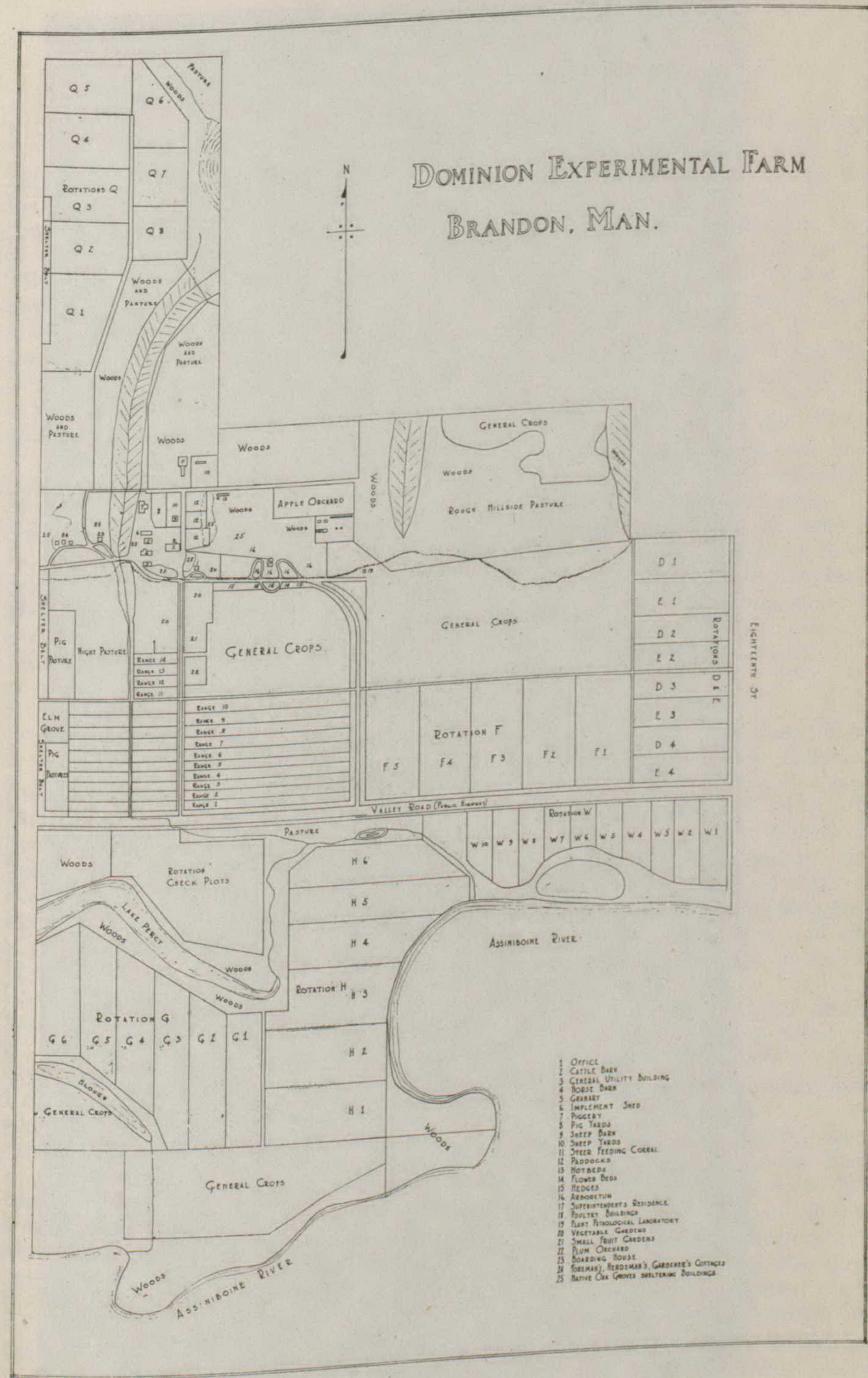
General

The Morden Experimental Station has now underway a total of 135 experimental projects. These are divided among the different divisions as follows: Animal Husbandry, six; Field Husbandry, twelve; Horticulture, seventy-eight; Cereals, seven; Forage Crops, twelve; Poultry, nine; Bee-keeping, ten; Tobacco, one.

Success is being met in fruit growing, in vegetable work, in producing seed of cereals, including corn and white beans, in dairying, in sheep-raising, and with poultry and bees. The very real benefits derived from advocated systems of crop rotations are being confirmed.

Public picnics are held at the Station from time to time. Exhibits are made at various agricultural fairs and garden shows. Assistance is frequently given Agricultural Society meetings.

The staff of the Station are much encouraged in their work by the constantly increasing number of inquiries and requests for assistance being received from farmers and other home-makers in rural districts.


DOMINION EXPERIMENTAL FARM
BRANDON, MAN.
N
Q 5
Q 4
Q 6
Q 7
Q 8
Rotations Q
Q 3
Q 2
Q 1
Shelter Belt
Woods and Pasture
Woods
Pasture
Woods and Pasture
Woods
General Crops
Rough Hillside Pasture
Apple Orchard
D 1
E 1
D 2
E 2
D 3
E 3
D 4
E 4
Rotations D & E
Eighteenth St
General Crops
Pig Pasture
Night Pasture
General Crops
Elm Grove
Pig Pasture
Rotation F
F 5
F 4
F 3
F 2
F 1
Valley Road (Public Highway)
Pasture
Rotation W
W 10
W 9
W 8
W 7
W 6
W 5
W 4
W 3
W 2
W 1
Rotation Check Plots
Lake Percy
H 6
H 5
H 4
Rotation H
H 3
H 2
H 1
Assiniboine River
Rotation G
G 6
G 5
G 4
G 3
G 2
G 1
Slough
General Crops
General Crops
Woods
Assiniboine River
1 Office
2 Cattle Barn
3 General Utility Building
4 Horse Barn
5 Granary
6 Implement Shed
7 Piggery
8 Pig Yards
9 Sheep Barn
10 Sheep Yards
11 Steer Feeding Corral
12 Paddocks
13 Hotbeds
14 Flower Beds
15 Hedges
16 Arboretum
17 Superintendent's Residence
18 Poultry Buildings
19 Plant Pathological Laboratory
20 Vegetable Gardens
21 Small Fruit Gardens
22 Plum Orchard
23 Boarding House
24 Foreman's, Herdsman's, Gardener's Cottages
25 Native Oak Groves sheltering Buildings

Wheat following Corn. This field yielded 27.3 bush. per acre in 1921 when the average of the district was about 12 bushels. Experimental Farm, Brandon, Man.

THE EXPERIMENTAL FARM FOR MANITOBA

W. C. McKillican, B.S.A., *Superintendent*

The Experimental Farm for Manitoba was established at Brandon in 1888. It is located chiefly on section 27, township 10, range 19, west of the Principal meridian but also includes parts of sections 22 and 37 of the same township. The farm buildings are about 2½ miles from the business centre of the city of Brandon. Most of the Farm is within the corporation limits. The area of the Farm is 652 acres, about two-thirds of which is on the level bottom land of the Assiniboine valley. Some 350 acres of the valley land are available for agricultural purposes, the remainder being roadways, woods, watercourses, sloughs and a small lake. There is an area of about fifty acres of very light arable land on the high level; the remaining portion of the Farm is rough, steep land forming the bank of the Assiniboine valley and suitable only for building sites, tree plantations and permanent pasture.

The valley land is heavy, rich soil. That part down near the river is very heavy, tenacious clay. That nearer the foot of the hill which forms the bank of the valley, contains more sand and is more easily worked. The arable land on the upland is very poor, light, sandy soil, with gravel and sand subsoil.

Shelter belts and avenues of trees, and a beautiful collection of trees and ornamental shrubs about the superintendent's residence, were planted shortly after the Farm was started. These have grown well and now provide a splendid shelter from the winds, and, with the natural beauty of the location, make the Farm a beauty spot well worth a visit for that reason alone.

Animal Husbandry

Dual Purpose Shorthorn Cattle. The Brandon Farm has been allotted the dual-purpose strain of Shorthorn cattle. The herd is largely descended from an importation from England brought to the Central Farm at Ottawa over twenty years ago. The herd was transferred to Brandon in 1911. The use of sires of good beef type and good milking inheritance and the selection of the herd by culling out those not conforming to the desired standard, have resulted in the development of a very creditable herd of good beef type and with a reasonable ability to milk. Individual records of over 12,000 pounds of milk in a year have been made and herd averages of over 6,000 pounds have been made in some seasons. The herd is "Accredited" by the Health of Animals Branch as being entirely free from tuberculosis.

Feeding Experiments. The breeding herd has been used for feeding experiments from time to time. A wide range of feeds has been tried out. Recent work has been along the line of the comparison of corn and sunflower silages, in which the value of sunflower silage has been shown, but also the superiority of corn silage.

Steer Feeding Experiments. Experiments have been carried on in regard to the feeding of steers over winter since the early years of the Farm. These experiments have covered the testing of practically all the feeds that are available for this purpose in Manitoba, the comparison of steers of different ages and types, methods of housing, tying or feeding loose, dehorning, etc. Special publications have been issued from time to time informing the public in regard to the steer feeding results. This Farm has been the pioneer among agricultural institutions in proving the possibility of feeding stock successfully in the open air in our Canadian winter. Repeated tests have been made comparing feeding in the bush or in open sheds, with warm stable shelter.

HORSES. The Clydesdale breed is kept on this Farm. A few colts are raised each year and some very creditable representatives of the breed are in the stud. A small amount of experimental feeding with horses has been done, but they are kept chiefly to perform the work of the Farm. Figures on cost of maintenance of work horses are compiled.

SHEEP. The sheep are mostly grades, with a few pure-bred Oxford Downs. An experiment in grading-up a mongrel range flock by the use of pure bred Oxford Down rams was carried on from 1911 to 1918, with very striking results in the improvement of the flock. Since then, a breed test has been operated in which rams of the Oxford Down, Shropshire and Suffolk breeds have been used on the grade Oxford ewes resulting from the previous experiment, and observations made on the size and type of lambs resulting. Experiments have also been made in regard to the housing and feeding of sheep.

SWINE. The Yorkshire breed of swine is kept, and breeding operations are directed toward the production of the bacon type, together with prolificacy, vigor and easy feeding qualities. About twenty sows are bred each season. Some of the best young pigs are sold to breeders and the remainder used for feeding tests and marketing as bacon hogs.

Experiments have been conducted covering a very wide range of feeds for swine. Practically all the feeds available for swine production in Manitoba have been included in these tests. Particular attention has been paid in recent years to pasture experiments, the use of recleaned wheat screenings, and tests of substitutes for milk, such as digester tankage. Experiments in regard to the winter housing of swine have also been carried on.

Field Husbandry

Under the heading of Field Husbandry are carried on all the experiments dealing with the methods employed in the growing of field crops as distinct from the choice and improvement of varieties, which come under "cereals" and "forage crops".

CROP ROTATIONS. The experiments with crop rotations were started in 1910 and continued until the floods of 1922 and 1923 stopped their operation. These rotations were started to test out several types of mixed farming as compared with straight grain growing as generally practised in Manitoba. The following rotations were included in the test:—

Rotation D (Four years' duration).—First year, wheat; second year, wheat (manured); third year, oats; fourth year, summer-fallow.

Rotation E (Four years' duration).—The same as D, but without manure.

Rotation F (Five years' duration).—First year, wheat; second year, wheat; third year, corn (manured); fourth year, oats or barley (seeded with grass and clover); fifth year, hay.

Rotation G (Six years' duration).—First year, wheat; second year, wheat; third year, oats (seeded with grass and clover); fourth year, hay; fifth year, hay or pasture; sixth year, corn (manured);

Rotation H (Six years' duration).—First year, wheat (manured); second year, oats; third year, summer-fallow; fourth year, wheat (seeded with grass and clover); fifth year, hay; sixth year, hay or pasture.

Rotation Q (Eight years' duration).—First year, corn (manured) or fallow; second year, wheat (seeded with grass and clover); third year, hay; fourth year, pasture or hay; fifth year, fallow (breaking-up sod); sixth year, (wheat manured); seventh year, oats; eighth year, annual pasture crops;

Rotation W (Ten years' duration).—First year, wheat; second year, wheat; third year, corn (manured); fourth year, oats; fifth year, barley; sixth year, alfalfa, seeding without nurse crop; seventh year, alfalfa; eighth year, alfalfa; ninth year, alfalfa; tenth year, alfalfa (ploughed up after first cutting).

The mixed farming rotations have shown a distinct advantage over Rotation E., the straight grain growing one. There has been a better profit realized and the land has been kept in better condition. Other important information has emerged from the rotation experiments.

Cost of Production of Farm Crops.—In the rotation experiments, the cost of operation of each field is carefully recorded. These figures give data on the cost of production of each of the farm crops entering in to the rotations. These cost figures from a few representative fields are published each year in the Farm report.

Cultural Experiments with Grain Crops.—Ever since the starting of the Farm, there has been a considerable amount of experimental work on the methods of grain growing. Such experiments as tests of different grades of seed, kinds of seed drill, treatments for smut, amounts of seed per acre, dates of seeding and the use of the summer fallow for conserving moisture, have been undertaken and conclusive results obtained. In 1911, a more comprehensive set of experiments was inaugurated. These have been carried on since, with some modifications and alterations, and some additional tests have been started as need for them arose. The following are the tests of this type now being conducted or recently completed:—Depth of ploughing on summer-fallow, stubble land and sod land, depth of seeding for wheat and oats, treatment of stubble land in preparation for wheat and oats, dates of ploughing summer-fallow and one ploughing vs. two at various depths, intertilled crops as substitute for summer-fallow, pasture as substitute for summer-fallow, grain crops in rows as substitute for summer-fallow, fall cultivation before summer-fallow, application of barnyard manure for wheat and oats in regard to time and method of application, rotted manure vs. fresh and quantity to apply, the use of green crops ploughed in for manure, the preparation of corn and sunflower land for wheat growing, the influence of dates of seeding, quantities of seed, previous crops, and fertilizers on stem rust attacks on wheat, the use of commercial fertilizers for wheat and oats, dates of seeding fall rye, and quantities of seed of fall rye.

Cultural Experiments with forage Crops.—With the greatly increased interest in forage crops and mixed farming in recent years, has come a demand for information in regard to how these crops should be grown. To meet this demand, experiments have been inaugurated and each year the scope of the experimental work along this line is being widened. The experiments now being conducted include the following: Time and depth of ploughing for corn, methods and rates of planting corn, dates of planting corn, methods and degree of cultivation for corn both before planting and as intertillage, application of barnyard manure for corn in regard to methods and time of application, kind of manure, and rates of application, time and depth of ploughing for sunflowers, date of planting sunflowers, depth of planting sunflowers, methods and rates of planting sunflowers, cultivation of sunflowers, stage of maturity of sunflowers for cutting for ensilage, preparatory crops for seeding down grasses, nurse crop vs. no nurse crop for grasses, methods of breaking up alfalfa and grass sod, kinds of nurse crop with which to sow alfalfa, quantities of seed per acre of alfalfa, Western rye grass, timothy, biennial sweet clover, Hubam annual sweet clover, and mixtures of Western rye grass and alfalfa, dates of seeding alfalfa, growing alfalfa in cultivated rows, instead of close seeding, dates of seeding sweet clover, nurse crops for sweet clover, depth of seeding sweet clover, growing sweet clover in cultivated rows, dates of sowing oats for green feed, quantities of peas and oats for green feed.

Cereals

The testing of varieties of the common grain crops was one of the first lines of experimental work to be taken up and has also been about the most prominent ever since. No cereal breeding work has yet been done at Brandon but the new varieties originated by the Dominion Cerealist are tried out here and the way in which they react to Manitoba conditions, as shown in the Brandon tests, has much to do with their selection for propagation or their rejection. In the early history of the Farm, a very large collection of varieties was brought together from many different countries. After some years' trial, it was possible to discard practically all of these. Now, only such old varieties as have shown their merit are retained in the test and any new varieties that appear worth a trial are included, no matter what their origin. Variety tests are carried on with hard red spring wheat, durum wheat, winter wheat, oats, barley, fall rye, spring rye, flax, peas, and field beans.

Forage Crops

The procedure with forage crops is similar to that with cereals. Varieties that seem at all promising are obtained from all sources and tests are made of their value. Alfalfa has proven itself especially successful at Brandon, and many strains have been tested. Various kinds of grasses and other clovers, including sweet clover, are included in the test of perennial and biennial hay crops. Different mixtures of grasses and clovers are also compared. A test is made of annual hay crops suitable for the production of hay or green feed the same season as planted. Indian corn is the important ensilage crop of Manitoba and tests of varieties of this crop are always carried on. The production of home grown seed of corn suitable for ensilage has received some attention with success. Sunflowers and other possible crops for silage purposes are being investigated. Tests with field roots, especially mangels and turnips, have been conducted for many years.

Horticulture

The work of giving leadership in the development of beautiful home surroundings and in the production of home-grown foods for the farm table has always been an outstanding feature of Brandon Experimental Farm. In the pioneer days of Manitoba, a free distribution of trees, shrubs, and flower seeds was made to the settlers. In this way, many got started in improving their home surroundings who would not otherwise have done so. With the growth of commercial facilities for the distribution of this material, the free distribution from the Farm has been abandoned. However, the demonstration of the possibilities of tree, shrub and flower growing on the grounds surrounding the superintendent's house continues to be an inspiration to visitors. New varieties are added to this collection from time to time. Each year, annual flowers and flowering bulbs are used to make a display of bloom, and tests are made as to the varieties that are best able to withstand the vicissitudes of the climate without artificial watering.

FRUITS.—A large amount of work has been devoted to endeavours to find or develop a hardy apple for Manitoba. Up to the present these efforts have not been really successful. Some large apples are grown in specially favorable locations in Southeastern Manitoba, and some crab apples are found to be hardy here at Brandon and generally throughout this province, but no generally hardy apple of standard size has been produced. Thousands of trees of all the hardiest kinds have been planted at Brandon and tens of thousands of seedlings. The most useful apples so far produced are some of the hybrids made by the late Dr. Wm. Saunders between the wild Siberian crab (*pyrus baccata*) and standard apples. These apples, though small, are hardy and can be used for the making of preserves or jelly.

Considerable experimental work has been done with plums, both in selecting desirable strains of the native plum and in testing varieties introduced by plant breeders and nurserymen. Plums of good quality are grown here quite successfully.

Experiments in regard to the choice of varieties of small fruits, including red, black and white currants, gooseberries, raspberries and strawberries are carried on. There are also tests in regard to the best methods of handling these fruits and of protecting raspberries and strawberries in winter.

Vegetables.—The vegetable garden is one of the most popular features of the work of Brandon Experimental Farm. The crops are grown entirely without artificial watering, and a conspicuous success has been attained with several kinds not generally associated with Western conditions until recently. Variety tests are conducted with beans, beets, cabbage, carrots, cauliflower, corn, cucumbers, herbs, kohl rabi, lettuce, musk melons, onions, parsnips, peas, peppers, potatoes, pumpkin, marrow, squash, radish, rhubarb, salsify, spinach, turnips and tomatoes. All these are grown successfully and information on the best varieties is available to inquirers. Cultural experiments are conducted with several of the more important vegetables. With potatoes, tests are made in regard to date of planting, amount of cultivation, hilled vs. level cultivation, size of seed or sets, prevention of beetles, sprouting seed, depth of planting, width of spacing, and manuring. With beans and peas, tests are made in regard to methods of prolonging the season of green vegetables. With cabbage and cauliflower, tests are made in regard to the distance of spacing and methods of starting, i.e., hotbed vs. outdoor, and transplanting vs. thinning. With beets, carrots and parsnips, tests have been completed in regard to distance apart to thin the vegetables, and one on the date of planting is now under way. Dates of planting corn are being tested. Methods of starting musk melon are being tested. The growing of onion sets and a test of the size of onion sets are being experimented on. A test on the thinning of onions was recently completed. The method of growing tomatoes in Manitoba has largely been altered as a result of the tests in pruning and staking tomatoes which have been carried on here.

Poultry

The Barred Rock and White Wyandotte breeds of poultry are kept. The breeding operations are directed along the lines of utility. Type for meat production and ability to produce large numbers of eggs, especially in the winter, are the objectives aimed at. A very satisfactory degree of success has been attained in producing this type of fowl. Pedigree breeding is conducted so that progeny of each fowl raised in this way is definitely known. This is accomplished by individual matings, trap nesting, pedigree baskets for egg hatching, and marking each chick at birth.

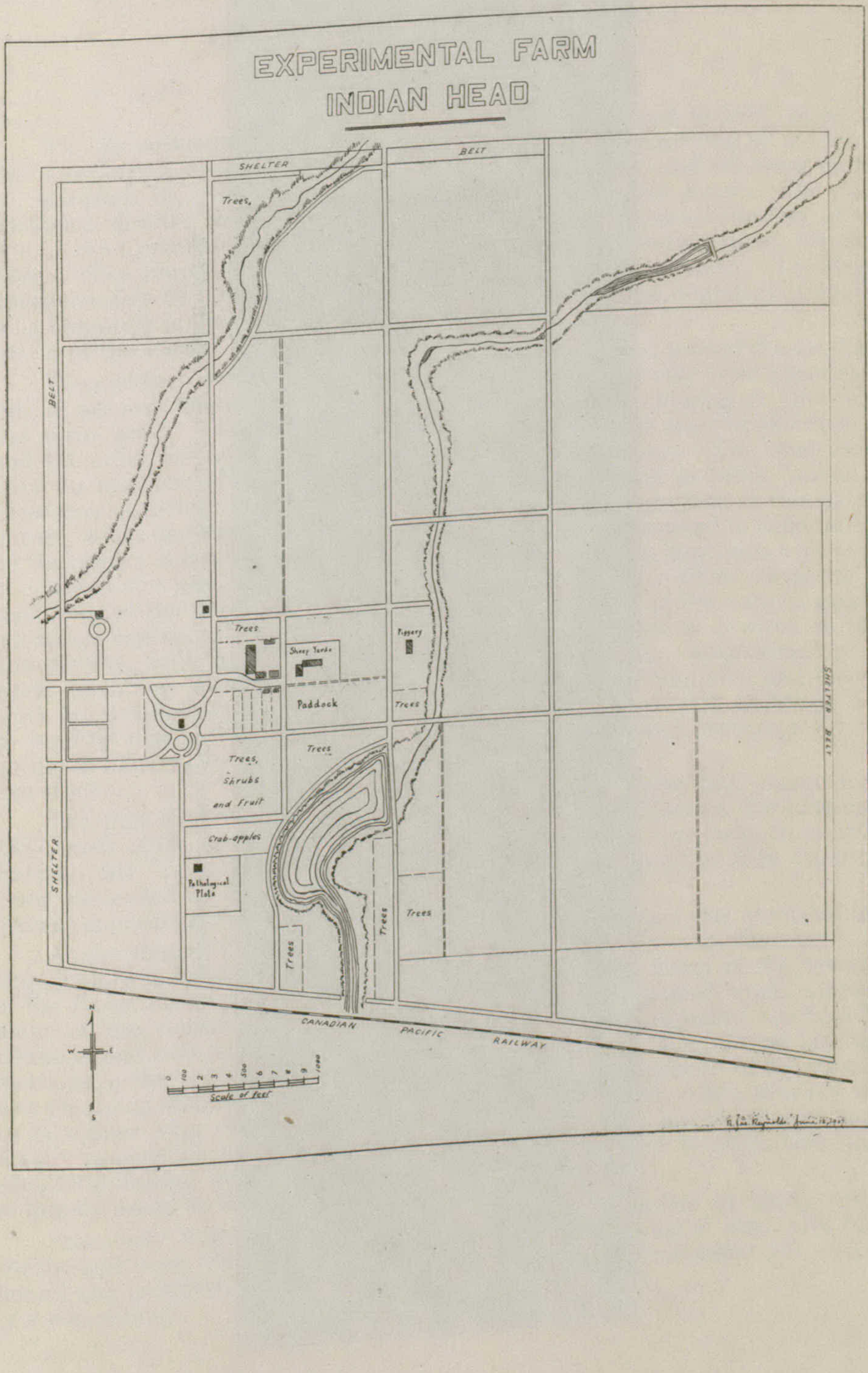
Experiments are conducted in regard to the best housing for poultry in this climate, methods and kinds of feed for laying hens, chicks, growing pullets, fattening cockerels, etc., methods of handling incubators, methods of brooding chicks, chick rearing, the effect of artificial lighting in winter egg production, and other points of interest to the Manitoba poultryman.

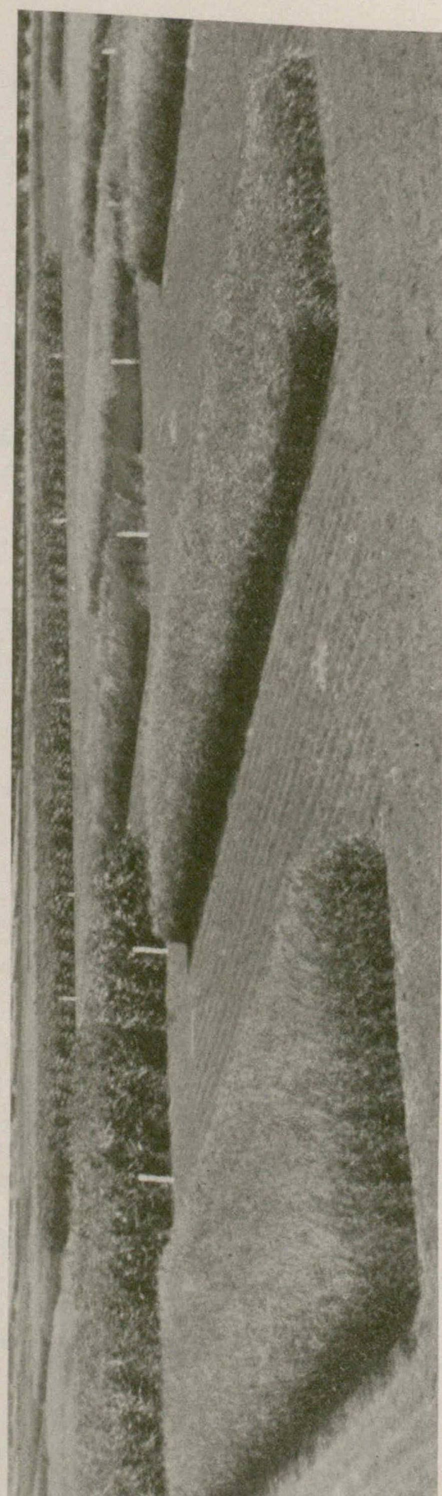
The Manitoba Egg Laying Contest is conducted by the Brandon Experimental Farm. Pens of ten pullets each are entered by breeders in Manitoba. The contest starts on November first of each year and continues fifty-two weeks. Reports are issued weekly as to the production up-to-date from each pen. Prizes are given for the best production. The contest work has stimulated general interest in poultry keeping and particularly in egg production as an ideal in breeding rather than purely fancy points.

Extension and Publicity

The work of the Farm is placed before the public by means of annual reports, each of which covers a calendar year. A large correspondence is carried on, the officers of the Farm holding themselves in readiness to reply to inquirers about their work or to advise on Manitoba farming. Articles are contributed to "Seasonable Hints", the publication of the Branch, and to the agricultural, daily and local press. Exhibits are sent each year to a few agricultural fairs to demonstrate the work of the Farm. Addresses are given, on request, to farmers' meetings throughout the province. During the summer "Field Days" are held on which the public are especially invited to come and examine the work of different departments of the Farm work, but the Farm is open to public inspection at all times.

Arrangements have been completed for the establishment of several Illustration Stations in the Province, the work on these to be under the general supervision of the Superintendent of the Brandon Farm.


EXPERIMENTAL FARM
INDIAN HEAD
SHELTER
BELT
BELT
Trees
Trees
Sheep Yards
Piggery
Paddock
Trees
Trees
Trees,
Shrubs
and Fruit
Crab-apples
Pathological
Plots
SHELTER
Trees
Trees
Trees
SHELTER
BELT
CANADIAN
PACIFIC
RAILWAY
N
W
E
S
Scale of feet



Cultural and Variety Plots of Cereals and Forage Crops. Experimental Farm. Indian Head, Sask.

THE EXPERIMENTAL FARM FOR SOUTHEASTERN SASKATCHEWAN

N. D. MacKenzie, B.S.A., *Superintendent*

History and Early Work.

The Experimental Farm at Indian Head was purchased in 1887, from the Bell Farming Company, and consists of some 680 acres, comprising all of section 19, township 18, range 12, west of the Second meridian, and 40 acres of the northeast quarter of section 18, of the same township and range. The main line of the Canadian Pacific Railway runs along the southern boundary of the Farm. The Farm lies immediately east of the town of Indian Head, which is approximately 47 miles east of Regina, the capital of the province. TheManitoba boundary is some 103 miles east, and the United States boundary 108 miles south, of the Farm.

The northern part of the Farm is a fairly heavy clay and toward the southern side it becomes more loamy in texture. The sub-soil is clay over practically the entire area. Two creeks run through the farm, one entering on the south and the other on the west, and provide good drainage for most of the farm as they do not flow all summer, except in occasional seasons. The land along these creeks, being uneven in texture and quality, as well as being broken in nature, is left as permanent pasture and constitutes the only area of this nature on the farm. A large proportion of the rest of the land is devoted to experiments in crop rotation and, in addition to this, in the main fields a large area is devoted each year to the multiplication of selected strains of seed. Other areas are on pasturage experiments to determine the carrying capacity of the various grasses and clovers, while a 50-acre field of the most uniform soil is devoted to plot work, including variety testing and cultural experiments. Approximately 17 acres are devoted to horticulture, including lawns, arboretum, etc., and 7 acres to poultry husbandry. The remaining area, not occupied with buildings and yards, is devoted to the growing of general farm crops and pasturage for the live stock.

The first superintendent was Mr. Angus Mackay, who had charge from 1887 until 1913, when he was appointed Inspector of Western Experimental Farms. Mr. T. J. Harrison, B.S.A., was then appointed, but resigned in 1915, being succeeded by Mr. W. H. Gibson, B.S.A., who resigned in 1919 when the present superintendent was appointed.

At the time of the establishment of the Farm, the West was unsettled and very little was known of its agricultural possibilities. The experimental work of the Farm, under its first superintendent, was a leading factor in the development of the country. As the result of careful experimental work, cultural methods and new varieties were introduced which revolutionized the farming methods in the province and, from precarious beginnings, the farming industry was placed on stable foundations which enabled the development of the country to take place very rapidly on a safe and constructive basis. Mr. Mackay was mainly responsible, through his work at the Farm, for the introduction of those summer-fallowing methods on which successful farming in Western Canada is so largely based at the present time.

Extremely valuable work was done in the introduction of hardy fruits, shrubs and trees, thus laying the foundation for the making of attractive farm homes and productive gardens which are so essential to the content and welfare of a community.

The main lines of work of the Farm at the present time fall under the various divisions indicated below and some one hundred and forty different experimental projects are now being carried on. When it is understood that practically all of these projects are on a large scale, some idea of the magnitude of the work may be conceived.

Animal Husbandry

Under this head, twenty-five projects are carried on. These include, in horses, the breeding of high-class, pure-bred Clydesdales. The stud of mares maintained is one of the largest and best among the institutional farms in Canada and the work of the Farm is performed almost entirely by these mares as well as the production of colts. Young stock bred here have taken excellent prizes when exhibited in competition with breeders from all over the continent at the largest shows of Canada and the United States. Valuable data on the control of navel-ill in foals are being collected through experiments with the brood mares. Accurate cost data are kept on the feeding of all the various classes of horses on the Farm.

CATTLE.—The breeding herd consists of high-class Shorthorns, the females of the herd having been, almost entirely, bred on the Farm. In the breeding operations, particular emphasis has been placed on the best beef conformation combined with a profitable production of milk, and marked success has been attained along these lines. Bulls from the herd are eagerly sought after by farmers in the Province and are so disposed of at moderate prices. Feeding experiments are conducted with these cattle as well.

In addition to the breeding herd, a number of steers, usually from two to three carloads, are fed each year, so that valuable data are obtained in this branch of live stock operations.

SHEEP.—Both pure-bred Shropshires and grades are carried, and are used, almost entirely, for experimental work. In the grading-up experiment which was concluded in 1921, the data obtained showed that, in three generations, the flock could be changed from a non-descript, mongrel lot into a high-class flock, practically indistinguishable from pure-breds. Experiments are also being carried on with feeding rations for ewes and fattening lambs and also in comparing the returns obtained from early, medium-early and late lambs.

SWINE.—Pure-bred herds of both Berkshire and Yorkshire swine are maintained and the progeny are used for experimental work in the production of bacon hogs. Methods of handling: dry lot vs. pasture; self-feeder vs. hand-fed; milk products vs. substitutes; and, in fall litters, methods of housing, are some of the projects being conducted.

The best of the pigs find ready sale as breeding stock.

Field Husbandry.

Some twenty-one projects are being carried on under this division and a large portion of the farm area is devoted to this work. Four rotations are being studied in direct comparison with one another, their combined area occupying approximately one hundred and fifty acres of the land. The rotations are as follows:—

	Rotation "C"	*Rotation "J"*	*Rotation "P"*	*Rotation "R"*
1st year—	Summer-fallow	Wheat	Wheat	Wheat
2nd "	Wheat	Oats	Oats	Oats
3rd "	Wheat	Corn	Corn	Summer-fallow
4th "		Wheat	Barley	Wheat
5th "		Hay	Hay	Oats
6th "		Hay and break	Hay or pasture	Hay
7th "			Hay or pasture	Hay or pasture
8th "			Hay and break	Hay and breaking
9th "				Corn

Of these rotations, "C" and "R" have been carried on since 1911 and average net returns have shown a marked difference in favour of rotation "R", this difference being especially marked since the decline in the price of grain from the high point reached during the war years. Rotations "P" and "J" have only been maintained in their present form for the past two years but give promise of being exceptionally profitable. Rotation "J" is one which, from the limited trial given as yet, promises to be suitable for adoption, either in its entirety or in modified form, over a very large proportion of this part of the province.

A large number of plots are used to investigate other field husbandry problems, such as dates of seeding fall rye; place in rotation to seed fall rye; cultural methods for growing sunflowers; dates of seeding sunflowers; commercial fertilizers; summer-fallow substitutes; rates of seeding alfalfa; rates of seeding sweet clover; rates of seeding brome grass; rates of seeding western rye grass; stubble treatment; summer-fallow treatment; application of barnyard manure; green manuring; methods of breaking brome grass sod; methods of seeding down to grasses and clovers.

These experiments have only been in operation one full year, so that no final results can be given from them as yet. They took the place of another equally large series which had been carried on for nine years and on which definite results had been obtained which enabled important information on cultural operations to be given to farmers.

Cereals

A total of fifteen separate projects are here under way. Variety testing work is carried on extensively in spring wheat, fall wheat, oats, barley, flax, peas and fall rye. New and established varieties are tested in comparison so that the value of the new sorts can be properly determined. A number of new early sorts are showing decided promise and will be multiplied and distributed as soon as they definitely prove superior to existing varieties.

Plans are under way for greatly increasing the scope of this work, which should make it even more valuable than it has been in the past to the farmers of Western Canada.

In addition to the testing of varieties, pure lines of seed of the best varieties are multiplied in larger areas and are available to farmers to improve the production of their farms. The seed produced in this way finds ready sale each year and is appreciated by farmers securing it. Large quantities of seed are also shipped to the Cereal Division of the Central Farm at Ottawa for distribution.

Forage Crops

Some twenty-one projects are carried on in forage crops. These include testing, in triplicate plots, varieties of the various classes of forage crops. Testing of oat varieties for the production of hay and the time to cut oats for hay are also under test as well as rates of seeding grasses and clovers, various nurse crops, depths of seeding clovers and various mixtures of clovers and grasses.

In addition, pasturing experiments have been started to determine the carrying capacity of various grasses and clovers, alone and in combination.

Horticulture

Forty-one projects are under way in this branch of the Farm operations. The work covers apples, plums, bush fruits of various sorts, annual flowers, perennial flowers, ornamental shrubs and trees and lawn grass mixtures as well as the various vegetable crops. Both cultural and variety testing work is carried on with practically all of these. Bush fruit cuttings are sent out each year to farmers in the province on condition that they pay carriage and packing charges. All available material is readily taken each year under this system.

Poultry

Under this division eleven projects are being carried on.

The breed used here is the White Wyandotte and a high-class flock has been built up, especially notable for egg-producing ability. Large numbers of hatching eggs and male breeding stock are disposed of each year with almost invariably good results. The Saskatchewan Egg Laying Contest is conducted at this Farm and marked improvement has been noted in the production recorded each year that it has been under way. Feeding experiments for chicks, laying hens and hatching pens are carried on, as well as extensive individual pedigree work with hens and pullets in egg-production and hatching ability. Various types of poultry house have been compared and unqualified recommendation can be given the cotton-front type of cottage-roofed, straw-loft house. This is being generally adopted by poultry raisers.

Fibre Division

Three projects are under way in this branch, including variety tests with hemp, flax and methods of handling the resultant products.

Chemistry

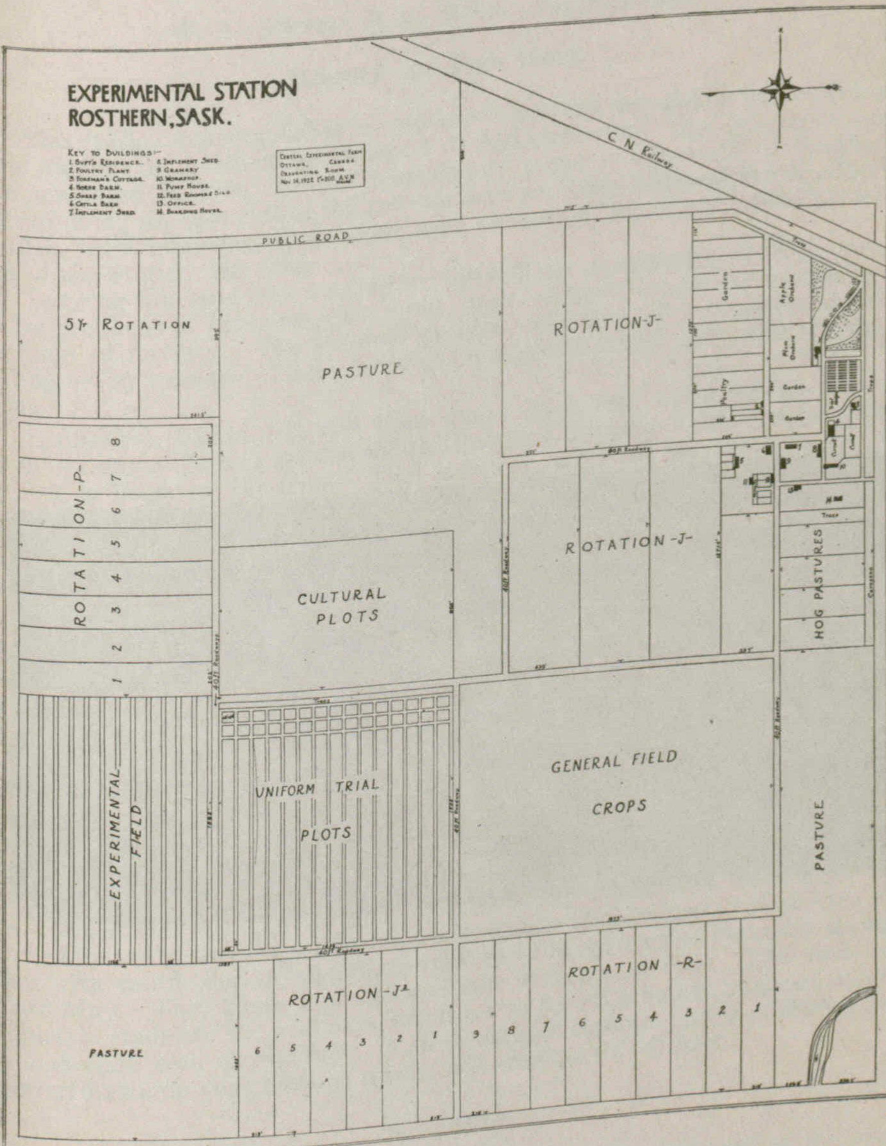
The effect of environment on the growth and development of wheat is a very important feature of the work under this division and extremely valuable data are collected each year through correlating the meteorological records on the Farm with semi-weekly observations of the wheat under test.

Extension and Publicity

Numbers of press and other articles are prepared each year for distribution. These are based on experimental results and are an invaluable method of bringing these results before the public.

In addition to this, a comprehensive exhibit is made at as many as possible of the smaller fairs throughout this part of the province each year so that farmers in these districts, who do not find it possible to visit the Farm will have an opportunity of seeing the results of some of the lines of work and also of securing information from the members of the staff in charge of the exhibit.

Specimens of the herds and studs are exhibited at some of the larger fairs to demonstrate the quality of these animals as compared with those in the hands of private breeders.


EXPERIMENTAL STATION
ROSTHERN, SASK.
KEY TO BUILDINGS:—
1. SUPT'S RESIDENCE.
2. POULTRY PLANT
3. FOREMAN'S COTTAGE.
4. HORSE BARN.
5. SHEEP BARN
6. CATTLE BARN
7. IMPLEMENT SHED
8. IMPLEMENT SHED.
9. GRANARY
10. WORKSHOP.
11. PUMP HOUSE.
12. FEED ROOM & SILO
13. OFFICE.
C N Railway
PUBLIC ROAD
5 Yr ROTATION
PASTURE
ROTATION -J-
ROTATION -P-
1 2 3 4 5 6 7 8
CULTURAL PLOTS
ROTATION -J-
HOG PASTURES
EXPERIMENTAL FIELD
UNIFORM TRIAL PLOTS
GENERAL FIELD CROPS
PASTURE
ROTATION -J2
6 5 4 3 2 1
ROTATION -R-
9 8 7 6 5 4 3 2 1
PASTURE

Part of Vegetable Garden, Experimental Station, Rosthern, Sask.

THE EXPERIMENTAL STATION FOR CENTRAL SASKATCHEWAN

W. A. Munro, B.A., B.S.A., *Superintendent*

History and Past Work

This Station was established in response to a strong demand for an institution of its kind in the northern settled part of Saskatchewan. One quarter-section was purchased in 1908, located immediately south of the town of Rosthern and adjoining the east side of the railway between Saskatoon and Prince Albert. In 1913, three more quarter-sections were purchased, making the total present area of the Station 649 acres.

To bring this land into a condition suitable for experimental work involved all the problems of bringing a worn-out, grain cropped, weedy farm back to a condition of fertility. The greatest problem was that of prevention of soil-drifting in dry seasons. Three methods have been devised, each with its limitations.

1. Shelter Belts.—It has been found by actual measurement that a clump of trees is effective against soil-drifting for a distance of fifty feet for every one foot in height of the trees. That is to say, there are no damaging effects from soil-drifting for a distance of fifteen hundred feet to leeward of a clump of trees thirty feet high. This method, however, is only feasible on comparatively small areas such as gardens or by utilizing natural bluffs, because of the difficulty of protecting the young trees from the ravages of stock.

2. Manure.—The application of a heavy coating of barnyard manure once in three years has proved effective against soil-drifting. This implies, of course, that live stock be kept.

3. Sod.—A well-established sod is effective against soil-drifting for six years after it is broken up. If grasses, either western rye or awnless brome, be introduced into a five-or six-year rotation, there will be no soil-drifting. But sometimes it is quite impossible to get a catch of grass seed because of the dry season. It has been found, however, that if grass seeding is done regularly every year in its place in the rotation, the bad years are not recurrent frequently enough to destroy the effectiveness of grasses as a means against soil-drifting.

Another difficulty to be overcome was that of weeds, and particularly wild oats. After trial of many methods of eradication, it has been found that the simplest means of treating wild oats is to work the land in the fall after harvest, either with double disc or plough, harrow early in spring and leave till middle or late May. Then shallow-plough and sow to barley or oats. This does not completely eradicate the wild oats, but it serves for all practical purposes except for high-class seed production. A well-worked summer-fallow, followed by an intertilled crop kept clear of weeds, will eradicate wild oats.

Live Stock

Horses.—There are seventeen horses kept on the farm and all the work on the land is done by these. For two seasons a tractor was used for ploughing but it was found that the work could be done much more economically by horses and the tractor is now used for belt work only. Record is kept of the amount of work done by each horse and of the feed consumed. Sufficient colts have been raised during the past ten years to keep up the standard and number of the horses.

Beef Cattle.—No beef cattle are raised at the Station, but for eight years a number of feeding steers have been purchased in the autumn and fed till spring. With the exception of the winter of 1919-20, when there were no steers fed because of poor crops the previous season and consequent feed shortage and the season of 1920-21 which was followed by an unexpected drop in the price of good cattle in the spring, every year since 1914 has shown good return from winter feeding operations. Following are some of the conclusions from investigations in this line:—

1. It permits of employment of labour during an otherwise slack time of year.

2. It disposes of rough feed such as oat straw, barley straw, screenings.

3. It utilizes wheat straw as bedding and returns fertilizer to the land.

4. It turns over, at a good profit, everything used, including hay, straw, grain, roots and ensilage as well as the cattle themselves.

In undertaking this work, the following points should be borne in mind:—

1. Expensive buildings are unnecessary. A set of corrals conveniently arranged and provided with a pole and straw shelter at the north end is sufficient accomodation.

2. Regular attention must be given the steers.

3. Comfortable sleeping quarters must be provided by cleaning out the shelter and bedding with fresh straw every second day.

4. Available water.

Dairy Cattle.—The dairy herd consists of twenty-three females besides the herd bull and eight bull calves. One cow, R.E.S. Madrigal Gypsy Keyes, has a record of 18,522 pounds milk as a three-year-old and the average production of nine cows that have completed yearly R.O.P. tests is 14,378 pounds of milk. Five two-year-old heifers at present under test are not likely to lower this average. This high average production is all the more remarkable in view of the fact that the herd has been developed from two heifer calves purchased in 1914 and no outside stock has been introduced except the herd bulls. The herd as it now stands is a striking example of what can be done from a small beginning by good feeding, careful management and the use of good bulls. The progeny of the original cows are, in most cases, exceeding, as two-year-olds and three-year-olds, the best records of their dams as mature cows.

The projects under way with dairy cattle include investigations into the relative merits of various home-grown feeds for calves, yearlings and mature cows, management and housing cows for maximum production, increase of average production of the herd by use of superior bulls, cost of raising calves, cost of feeding milch cows.

Sheep.—In 1915, a flock of one hundred range-bred ewes and a Leicester ram were purchased. The ewes were of mixed breeding showing a preponderance of merino blood. Repeated selections have been made every year for large well-fleshed ewes with compact fleeces. Only Leicester rams have been used, and the present flock of fifty breeding ewes are as large as typical Leicesters and have fleeces of a compactness approaching that of the Down breeds. The average weight of fifty-two fleeces in 1923 was 9.4 pounds.

Work with sheep includes investigations in the use of various feeds, cost of keeping a flock, improvement by breeding and selection and prevention of goitre in young lambs.

Swine.—The Berkshire and Tamworth breeds of swine are represented on the Station. Elaborate trials of ground feeds and pastures are being made in an endeavour to produce select bacon hogs. Selections are made from sows with large litters of pigs which mature most quickly and conform most closely to the desirable type. Comparisons are made in feeding trials between pigs of each breed and of crosses between the breeds.

Field Husbandry

In this division there are twenty-two projects, including sixteen cultural experiments and six rotations. The cultural work includes investigation into the value of manure and fertilizers and methods of applying them, time and depth of ploughing stubble and sod, rates, dates and depths of seeding the various grains, clovers and grasses, method of summer-fallowing, summer-fallow substitutes and value of ploughing under green crops such as peas and vetches.

The rotations under trial are 3-year, 5-year, two 6-year, 8-year and 9-year. Most of them have been under way since 1911 and some important conclusions have been arrived at.

1. A rotation involving only grain and summer-fallow brings about a condition, after a few years, favourable to soil-drifting and weed growth.
2. Grass introduced every four to six years and left in sod for two years prevents soil-drifting.
3. Apart from its beneficial effect on the soil, a hay crop is not usually profitable.
4. A corn crop grown as a substitute has almost as beneficial an effect on a succeeding wheat crop as has a bare summer-fallow, but turnips and sunflowers have a detrimental effect on the succeeding crop, apart from the opportunity they afford for the eradication of weeds.
5. An application of ten tons of manure per acre preceding a summer-fallow or an intertilled crop prevents soil-drifting for at least three years and shows a marked increase in the yield of the three crops succeeding the application.
6. A rotation involving roots or corn or sunflowers, hay, oats and wheat shows more profit per acre than one involving only hay and grain or grain alone.

Horticulture

There are sixty-three projects under way in horticulture, including investigations into cultural methods and tests of varieties of trees, shrubs, herbaceous perennials and annuals, lawn grasses, fruits and vegetables. There is no green house on the Station and the appliances and methods used are such as may be employed on any well-managed farm. In the ornamental work, trees shrubs and flowers are introduced from other countries to test their hardiness and many from Russia are proving not only hardy but very useful. Especially is this so of the Siberian pea tree or Caragana (*Caragana arborescens*) which is an ornamental shrub, one of the best hedge plants and is proof against insects, frosts, hail and drought. It affords excellent shelter around a garden.

It has been found that the first essential for a good garden is an adequate windbreak. Enclosures two hundred feet wide east and west and four hundred feet long, north and south, surrounded by caragana hedges, form adequate protection for tender fruits and vegetables. With such protection and a yearly application of rotted manure well worked into the soil, crabapples of the hardier varieties, Manitoba plums, currants, gooseberries, raspberries and strawberries have proved perfectly hardy and so have such tender vegetables as tomatoes, celery, pumpkins, squash, cucumbers and sweet corn. In the season of 1923, an acre was sown to cabbage, by means of an ordinary grain drill, in rows two and a half feet apart, and twenty-six tons were harvested.

Cereals

The field devoted to this work has had an area of 45 acres and is almost perfectly level. It is as nearly uniform in every respect as is possible and affords ideal conditions for the testing of varieties.

There have been under test at this Station 41 varieties of wheat, 28 varieties of barley, 19 varieties of oats, 16 varieties of peas, 32 varieties of corn, one variety of field beans and 3 varieties of flax. Many of these varieties had been developed at Ottawa and were sent to the branch Farms to prove themselves before being recommended to farmers. Many never reached the stage of being given a name. With Marquis and Red Fife wheats as a standard, it is difficult for another sort to equal them in yield, quality and earliness and if it does not do so it is not recommended to the farmer. The same applies to all other kinds of grain. The new sort must at least prove equal to the established standard varieties or it is discarded.

It has been found that the variety which is most suitable for summer-fallow is not always the most suitable under less favourable conditions, such as following one or two crops of grain.

Forage Crops

The work in forage crops consists of cultural methods and variety tests. There have been tried at the Station 44 varieties of swede turnips, 25 of fall turnips, 25 of mangels, 21 of sugar beets, 35 of carrots and 32 of field corn, besides a number of strains of grasses, clovers, alfalfa and sunflowers. A new variety introduced is tried out for five years before it is passed upon, favourably or otherwise.

Following the growing of the fodder crops various methods are tried out for their storage for winter use. Three kinds of cellar are in use for the storage of roots and three kinds of silo for the storage of ensilage. The ensilage crops are cut at various stages of maturity to determine the best time for cutting.

The growing of annual hay crops, particularly oats and barley for hay, is one of the latest projects. The selection of a variety of oats for maximum leaf growth holds out promising hopes for a satisfactory solution of the hay problem in this district.

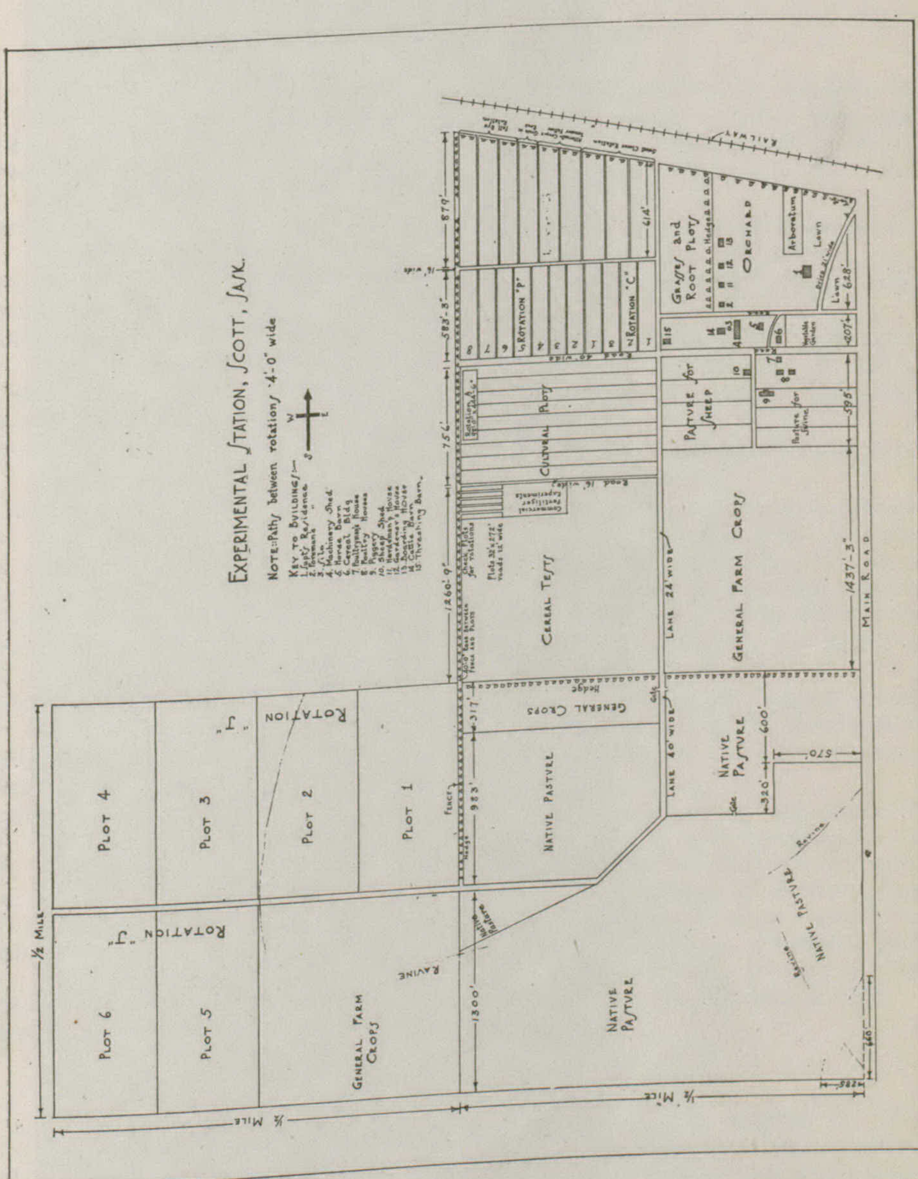
Poultry

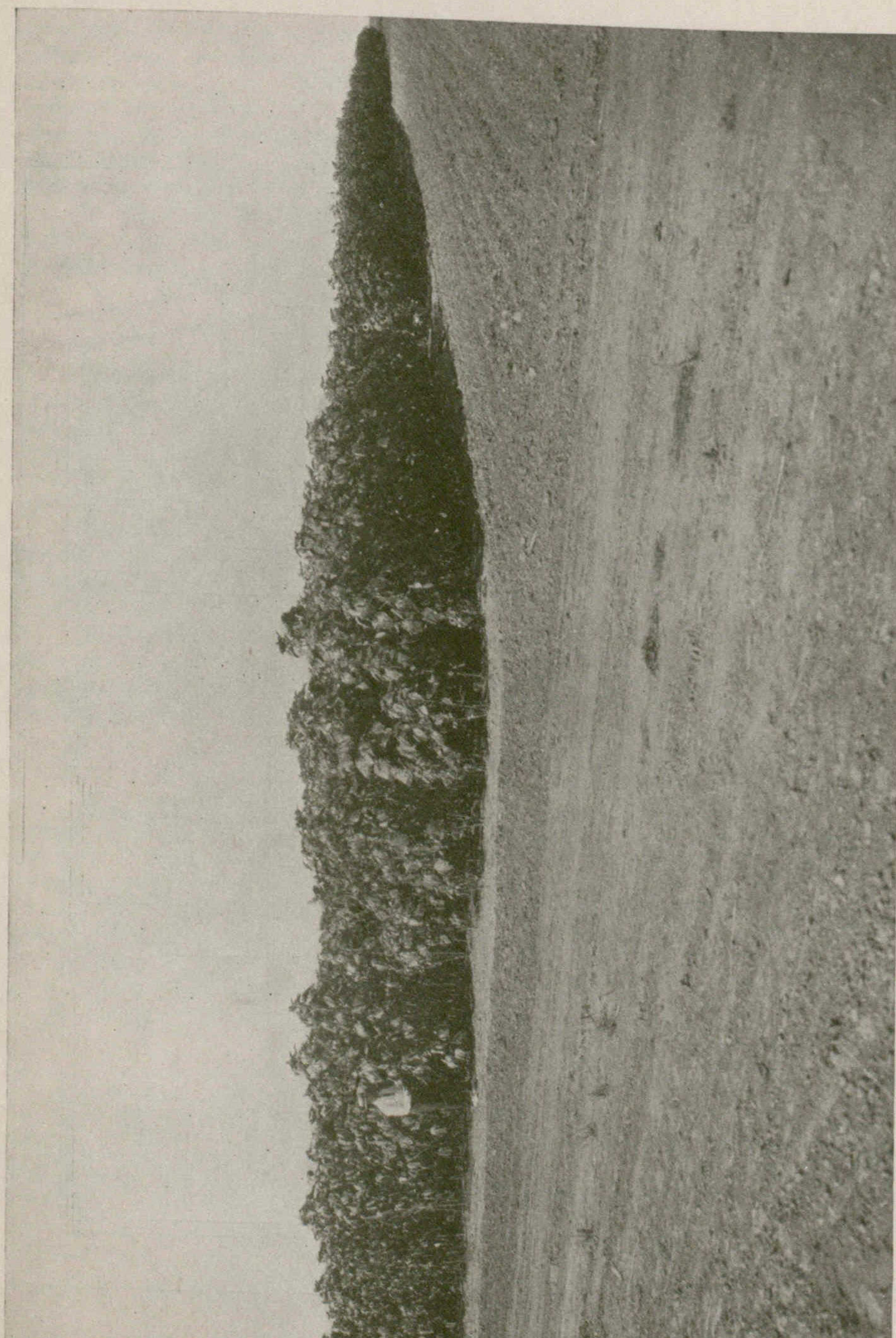
The work in poultry has not been conducted sufficiently long to afford much information based upon experimental evidence. There is being developed a flock of Barred Plymouth Rock hens of strong constitution and high egg production, many of the hens now having a record of over 200 eggs per year. Experiments are being conducted with various feeds in different proportions, with different kinds of houses, with incubators and brooders of different makes and with methods of fattening and disposing of surplus birds.

Besides this, there is some work carried on with Mammoth Bronze turkeys and Pekin ducks.

Apiculture

The latest line of investigation introduced on the Station is that of bees. Two colonies of bees were received from Ottawa in May 1923, and during the season they increased to four colonies and produced one hundred and twelve pounds of honey. Two colonies are being wintered outside and two in a cellar.


EXPERIMENTAL STATION, SCOTT, SASK.
NOTE: Paths between rotations 4'-0" wide
Plot 1
Plot 2
Plot 3
Plot 4
Plot 5
Plot 6
Rotation
General Farm Crops
Native Pasture
General Tests
Cultural Plots
General Crops
Pasture for Sheep
Grasses and Root Plots
Orchard
Arboretum
Lawn
Main Road
Railway
Ravine
1/2 Mile



Sunflower Crop on Rotation P. Yield per acre 11¼ tons in 1923—Experimental Station, Scott, Sask.

THE EXPERIMENTAL STATION FOR NORTHWESTERN SASKATCHEWAN

M. J. Tinline, B.S.A., *Superintendent*

The Experimental Station for northwestern Saskatchewan is situated at Scott, 100 miles west of the city of Saskatoon and about 50 miles from the eastern boundary of Alberta. The vast, treeless tract of prairie land on which the Station is located is broken only by occasional ravines and a few small lakes.

The first inrush of settlers into the district took place in 1906 when homesteaders moved in from Battleford, some 50 miles distant. The railway construction for the main line of the Grand Trunk Pacific reached Scott in July, 1908.

The Experimental Station at Scott was started in 1910, when 198½ acres of raw prairie was purchased and a part of the land broken up. In 1914, approximately 320 acres was added of which about 200 is arable land, the remainder being ravines suitable for pasture.

The soil is a chocolate-coloured clay loam, fairly uniform and representative of the soil over quite a large area of the open plain sections.

The meteorological records on the Station for a period of eleven years shows the total annual precipitation to average slightly less than 13 inches. In only one year has the precipitation recorded exceeded 20 inches and in two years it has been less than 8 inches. The problems confronting settlers and experimentalists are, therefore, essentially those of "dry farming." They differ from the problems confronting the farmers farther south in that here the growing season is shorter and the summer nights are cooler.

For the reason that the land could be cheaply and quickly brought under cultivation, the early settlers first turned their attention to the production of grain. Live stock and poultry were added to some farms and a few planted trees.

Some of the settlers were experienced farmers, while others were inexperienced, but all had much to learn regarding farming under the new conditions. It was necessary, therefore, that the Experimental Station conduct experiments not only with grain crops, which have been the main sources of revenue, but that experiments with live stock, forage crops, trees and shrubs, vegetables, etc., be undertaken. Experimental work with cereals, crop rotations and cultural investigations was commenced in 1911. The orchard, arboretum and lawn were established in 1912. Forage crop experiments were begun in 1913.

Live Stock

Breeding operations with grade Clydesdale mares was started in 1911 and sufficient colts were raised to furnish the additional horse labour required by the rapidly increasing work on the Station. Four pure-bred Percherons were secured in 1920 which, by natural increase, have multiplied until there are now eleven. The nucleus for a herd of Shorthorns was received from the Indian Head Experimental Farm in 1921. This herd has increased until now there are 32 head.

The flock of sheep, numbering 172 head, is composed of a few pure-bred Shropshires and Cheviots, and grade Shropshires, Cheviots and Rambouillets. In the eight years the flock has been on the Station, the cash returns have amounted to $6,335.50. A number of farmers have purchased foundation flocks from the Station.

The main lines of experimental work with sheep have been to determine their profitableness for the dry land farmer. Pasture experiments have shown sweet clover to have a greater carrying capacity than any other pasture crop. Investigational work has shown that the heavy loss resulting from goitre in lambs can be elimitated by feeding a small quantity of potassium iodide to the ewes.

The swine on the Station have proven profitable. The experiments have included cross-breeding. Methods of feeding have been tested, such as feeding whole grain vs. crushed grain: rye vs. barley; self-feeding vs. trough method of feeding; pasture vs. no pasture; buttermilk vs. tankage; and method of feeding and breeding to produce select bacon.

Winter feeding of steers has been conducted for a number of years and the results have been summarized in Pamphlet No. 17. This branch of farming is being encouraged as much as possible, since it provides employment for the surplus farm labour during the winter period. It affords a method of marketing coarse grains profitably and provides fertilizer that can be returned to the land.

In the animal husbandry division there are twenty-three projects under way.

Poultry

Only one breed of poultry, the Barred Plymouth Rock, is kept. The experimental work includes eight projects. The plant is of sufficient size to permit experimental work and to keep three hundred laying birds. These are all trap-nested and a part of the flock is pedigreed. The best of the cockerels are kept for use on the Station and for selling to poultry breeders.

Many poultry houses throughout the district have been modelled after some of the houses on the Station and considerable interest has been taken in the methods of feeding and housing for egg production.

Forage Crops

During the first years of settlement, native upland grasses provided ample hay and pasture, but breaking the native sod proceeded rapidly, with the result that hay became scarce and close grazing decreased the carrying capacity of pasture land. This has resulted in stock owners disposing of part of their herds.

Grain farming proved profitable for a time, but an increase in weeds in every district, soil drifting in some sections and insect pests and crop diseases in others, have compelled farmers to turn their attention to diversified farming. which includes the keeping of live stock. Foreseeing that a single crop system could not continue, the Experimental Station inaugurated numerous experiments with forage crops until, at present, there are 27 projects under way with a total of 612 plots.

These experiments include determining the best method of seeding down to grass, the best crops to grow for pasture and the best crops to provide roughage for winter feed. It has been proven that it is possible to seed down Western Rye grass with a nurse crop, that the introduction of grass into a rotation will increase the yields of grain following grass but that it is not profitable as a pasture crop. The experiments have shown sweet clover to be an outstanding pasture for most kinds of stock. For swine, rape is of outstanding merit. The Station began investigating the growing of sunflowers for ensilage shortly after the Montana Experimental Station pronounced them satisfactory. For the storage of this crop one of the first silos constructed in northwestern Saskatchewan was erected at the Scott Station. Good yields of Western Rye grass seed have been obtained and from a five-pound sample received in 1921 from the Forage Crop Division of the Central Experimental Farm, 3,461 pounds of seed have been obtained in two years. This strain has within the last year been given the name of Grazer and the first year's crop has been distributed.

Information regarding experimental work with forage crops was summarized in Circular No. 107, published in 1922, which may be obtained by applying to the Scott Station or to the Publications Branch, Department of Agriculture, Ottawa.

Field Husbandry

The field husbandry work may be divided under three main headings, crop rotations, cultural investigations and other crop management experiments. The latter include such experiments as rates and dates of seeding grain and forage crops, etc., and testing out farm machinery.

Crop Rotations

Crop Rotations.—Three of the rotations established in 1911 are still in operation, while three new rotations were added in 1921.

The following is an outline of the rotations under way at the present time on this Station:

Rotation "C" (Three Years' Duration).—First year, summer-fallow; second year, wheat; third year, wheat.

Rotation "J" (Six Years' Duration).—First year, summer-fallow; second year, wheat; third year, oats; fourth year, oats (seeded down 12 pounds Western Rye); fifth year, hay; sixth year, pasture.

Rotation "P" (Eight Years' Duration).—First year, summer-fallow; second year, wheat; third year, wheat; fourth year, summer-fallow, 15 tons per acre of rotted manure ploughed under; fifth year, sunflowers; sixth year, barley, seeded down 10 pounds Western Rye 6 pounds sweet clover; eighth year, pasture.

Sweet Clover Rotation (Three Years' Duration).—First year, summer-fallow; second year, wheat (half the field seeded to 15 pounds sweet clover seed per acre).

Of the three rotations that have been in existence since 1911, rotation "J" is undoubtedly the most promising and has been followed with considerable interest both by farmers and by experimentalists on other Stations. From the information received it would appear that quite a number of farmers have started this rotation on their farms. Of the newer rotations, the one including sweet clover is quite promising but it has not been under way a sufficient length of time to warrant recommending it. During the two seasons it has been in full operation, good stands of sweet clover have been obtained, and in harvesting the sweet clover crop a goodly percentage of the weeds have been harvested therewith.

Cultural Investigations.—The cultural investigation work including fourteen projects, is as follows:—Prairie breaking; depth of ploughing; summer-fallow treatment; stubble treatment; seeding to grass and clover; breaking sod from cultivated grasses; applying barnyard manure; green manuring; seedbed preparation; soil packers; depth of seeding; harrowing growing grain; summer-fallow substitutes; soil moisture determinations.

Cultural investigations generally may be summarized under four divisions: breaking new land; treatment of summer-fallow; summer-fallow substitutes; and the treatment of stubble in preparation for crop. The data obtained from the summer-fallow treatment and the methods of preparing stubble land for crops have been of particular interest to the farmers in northwestern Saskatchewan. The following gives some of the information obtained and disseminated.

Summer-Fallow.—That the early-ploughed summer-fallow will give higher yields than later ploughed land and that ploughing more deeply than six inches is not profitable.

That fall cultivation of the stubble previous to summer-fallowing has not increased the yields. Twice ploughing of summer-fallow has not given as good results as the early-ploughed fallow kept cultivated.

The use of the soil packer on summer-fallow does not seem to warrant the labour and expense. Green crops grown on the summer-fallow and ploughed under have been decidedly unprofitable, indicating that a weed crop, contrary to common belief, takes more available plant food from the soil in growing than is returned when ploughed under. Excellent catches of grass have almost invariably been obtained on summer-fallow either with or without a nurse crop.

The growing of grain and other crops in rows on land that is being summer-fallowed was only commenced in 1921, consequently no definite information is yet available.

Treatment of Stubble Land in Preparation for Grain.—Repeated tests have shown that any operation which destroys the stubble in the fall decreases the yield of the following crop. Spring ploughing of stubble has invariably given a higher yield than fall ploughing. Under average conditions at this Station, the depth of seeding which has given best results has been about two and one-half inches. Good catches of grass and clover, both with and without a nurse crop, have always been before visitors at the Station, even with or following the third crop of grain after fallow. An eight-year average shows an increased yield of nearly six bushels of wheat per acre resulting from the applications of 12 tons of rotted manure per acre applied on the first-year stubble before ploughing. The soil packer has been beneficial when used on spring-ploughed land.

A new line of work recently started is that of making soil moisture determinations. This has been commenced with a view to ascertain, as far as possible, the effect of several cultural treatments on the amount of moisture stored in the soil.

Cereals

Testing varieties and strains of cereals has always been given special attention and there are now thirteen projects under way. During the early years, it was considered essential that early maturing varieties only be tested, in order to have the crop ripen without frost damage. Repeated experiments have proven that later maturing varieties invariably give heavier yields. This information has been placed before the farmers and in one instance it is known to have prevented farmers in a certain district from sowing some hundreds of acres to an early maturing variety of oats, which, according to the results on the Station that year, would have meant a loss to them of from 10 to 15 bushels of grain per acre. Every season, a collection of cross-bred selections of grain from the Central Experimental Farm have been tested and plans are now under way to include in the tests all strains that have any promise of proving useful on the prairies. Samples of grain sent in by the farmers are tested and, this year, strains of the Red Bobs variety received from several different sources have been included in the tests.

Testing newly-introduced varieties has a good effect in preventing multiplication of these by the process of giving them a new name. Grain of specially selected stock received from the Central Experimental Farm has been increased and has proven of great assistance to seed growers in providing them with foundation stock of northern grown seed at reasonable prices. During the years the Station has been in existence, choice seed has been sold farmers in practically every section of northwestern Saskatchewan.

Horticulture

The need of trees, shrubs, flowers and vegetable gardens in the home-building process under way on the prairies has made it essential that the station conduct numerous experiments in horticulture and at the present time there is a total of fifty-one horticultural projects.

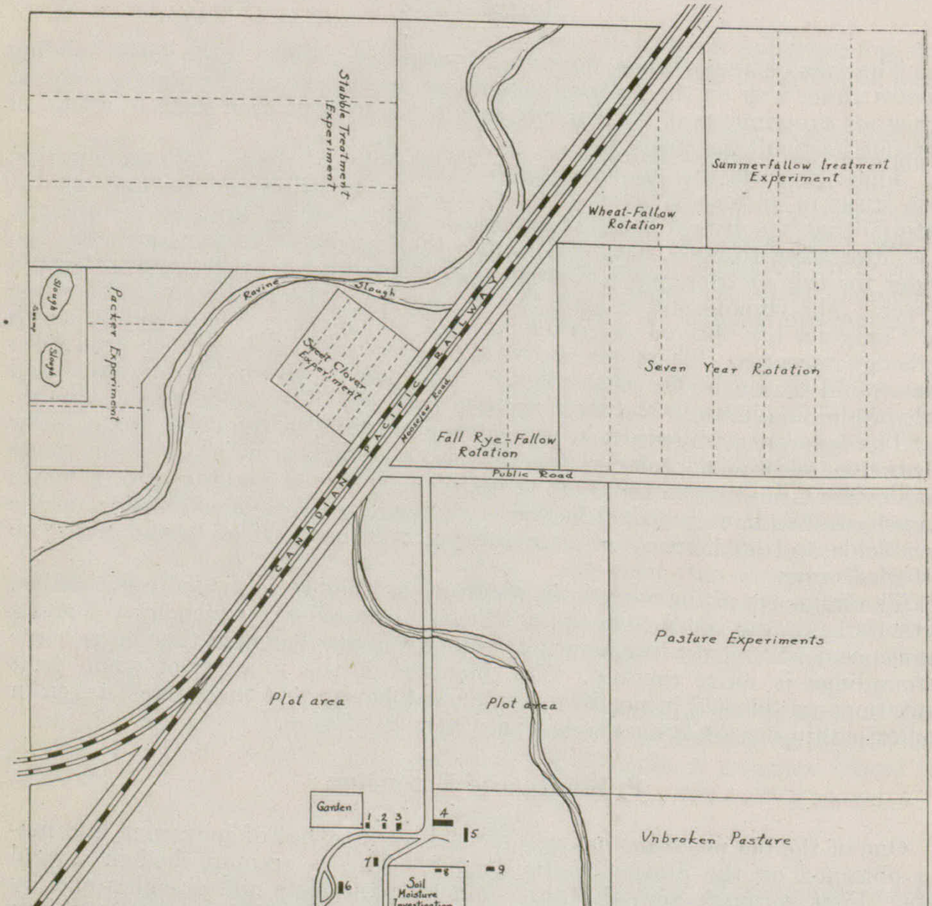
These projects include the testing of varieties of apples, plums, cherries, bush fruits of various kinds and strawberries. The arboretum includes all the material that has proven hardy on the older Experimental Farms on the prairies. It is interesting to note that cottonwoods that are hardy farther south are too tender for this district, while Russian poplar has proven hardy and is a rapid grower. The climate and soil are too dry for good results from willows, while the Caragana has thrived exceptionally well and makes an outstanding shrub for hedge purposes. There has always been some doubt as to whether evergreen trees would thrive in the clay soils on the prairies. Both White spruce and Lodge Pole pine, even in the most exposed positions, have made a good growth.

The value of windbreaks in protecting crops and in the collecting of snow to provide additional moisture for the next season's growth has been made quite evident during the last four years. The yields of potatoes grown inside an enclosure made with hedges has been compared with yields of potatoes in the open fields and an increase of over 100 per cent has been obtained from the protected crops.

The influence of the work in horticulture on the Station is quite noticeable, particularly in the small towns and villages, a number of which have made a commencement at street tree planting, while the improvement in the village home surroundings is quite marked. The increase in the number of small fruit plantations established in northwestern Saskatchewan and the interest taken in the horticultural work generally has been very gratifying.

Publicity and Extension

One of the big problems in experimental work is that of conveying information obtained on the Station to the people. This is accomplished in several ways. First, through annual reports and by pamphlets and circulars and by means of articles in the rural and agricultural press; second, through the medium of an exhibit made up at the Station and sent to the summer fairs, with attendants in charge who discuss the various lines of experimental work; third, by means of lantern slides illustrating the work on the Station and accompanied by a lecturer, who gives as much information as possible; fourth, through correspondents writing for information. The fifth way in which the information is disseminated is through visitors who come to the Station, see the experiments and have the results explained to them. The sixth method is one that is not often thought of, but it is nevertheless important. It consists of one person receiving information from the Station and passing it on to his neighbour. In district such as the one at Scott, where the settlers drive, in many instances, sixty and seventy miles to visit the Station, it is difficult to estimate just how far beyond this the influence of the Station radiates.



EXPERIMENTAL STATION
SWIFT CVRRENT, SASK

Sec 29, Tp 15, R 13, W of 3rd M.

1. House
2. House.
3. House
4. Barn.
5. Implement Shed
6. Supt's Residence
7. Cottage.
8. Laboratory.
9. Poultry.

THE EXPERIMENTAL STATION FOR SOUTHWESTERN SASKATCHEWAN

J. G. Taggart, B.S.A., *Superintendent*

The Dominion Experimental Station for southwestern Saskatchewan was established late in 1920. The site chosen for the Station was a section of school land adjoining the east side of Swift Current. As now laid out, the Farm buildings are just two miles from the centre of that town.

Until October 1, 1921, the work of establishing the Station was carried on under the direction of Mr. N. D. MacKenzie, Superintendent of the Experimental Farm, Indian Head, with T. T. Chalmers as foreman in immediate charge of the work. On October 1, 1921, the present superintendent, was appointed. During the spring and summer of 1921, some 400 acres of land were broken and put into shape to be cropped in the following year, the Farm was fenced and a house and a barn erected.

In 1922, the Station was equipped with horses and implements; experimental work in field husbandry, forage crops and cereals was established; a boarding house, superintendent's house and some smaller buildings were erected and a small herd of Shorthorn cattle was established by transferring some breeding stock from the Indian Head Farm.

During the season of 1923, the experimental work has been greatly increased; an additional 80 acres broken; two cottages and an implement shed have been built and a considerable improvement effected in the grounds by grading roads and planting trees.

Some of the important lines of work now under way are briefly described as follows:—

Field Husbandry

(Total number of projects, thirty-four)

Experimental work in field husbandry is carried out, both on fortieth-acre plots and on fields of from five to twenty acres each. The work on the larger fields consists of studies of (a) methods of summer-fallowing, (b) methods of preparing stubble land for a second wheat crop, (c) a comparison of rotations including corn and grass with straight grain-growing rotations. A portion of the Farm which is not suitable for experimental work is used for growing feed crops such as oats, barley, corn, sunflowers and hay.

On the plot area, which now covers sixty acres, all field work described above is laid out in triplicate plots. Many additional methods are under test on the plots which could not be tried in the fields owing to lack of space. Over three hundred plots are devoted to experiments with corn. Almost every phase of corn growing in southwestern Saskatchewan is under investigation. Such matters as varieties, both for fodder and grain, methods of preparing land, methods of planting and spacing in rows and in hills, date of planting and the influence of corn on other crops are being carefully studied.

Methods of preparing land for grass crops and methods of seeding grasses and clovers are being investigated with a view to discovering whether there are any economically successful methods of growing these crops under conditions which prevail in this district.

Digging a trench silo (the Fresno saves Time)—Experimental Station Swift Current, Sask.

Another type of field husbandry work which, heretofore, has not been systematically undertaken on the Experimental Farms, is the testing of new farm implements as well as some of the older implements about the use of which there is still some dispute. Some of the new implements now under test are a combined reaper-thresher, a stubble burner, corn listers, and special types of cultivators and harrows. Of the implements commonly used by farmers, the only ones being specially tested are seed drills of different types and two types of land packer.

Forage Crops

The work in forage crops includes a total of twenty-two projects. It has been laid out to secure information for those farmers who are in, or contemplate going into, some phase of animal production. The first phase of the work consists of the introduction and testing of as many species and varieties of forage crops as have shown, elsewhere, any probability of being useful here. Then, with what are obviously the most important forage crops, methods of production, particularly in rotation with grain crops, are being investigated. The purpose of the forage crop work is to secure information which may be used by farmers in developing a more stable and better-balanced system of farming.

Cereals

(Total number of projects, eight)

A number of well-known varieties of each of the important cereals, together with several new sorts, are being compared. Most of these are being grown on both fallow and second-crop land. Plans are now being prepared for starting, in 1924, the testing of a large number of pure-line strains and hybrids of wheat, oats, and barley. No cereal breeding work has yet been attempted.

Horticulture

(Total number of projects, thirty-seven)

In vegetable gardening, experiments were started in the spring of 1923 to determine the best varieties, methods of planting, spacing, dates of planting and cultural methods of all of the standard garden vegetables.

The only work undertaken with trees, shrubs and flowers has been for decorative purposes; no systematic experiments have yet been put under way.

Poultry

A flock of 100 Rhode Island Red hens is maintained, but no experimental work is yet conducted.

Animal Husbandry

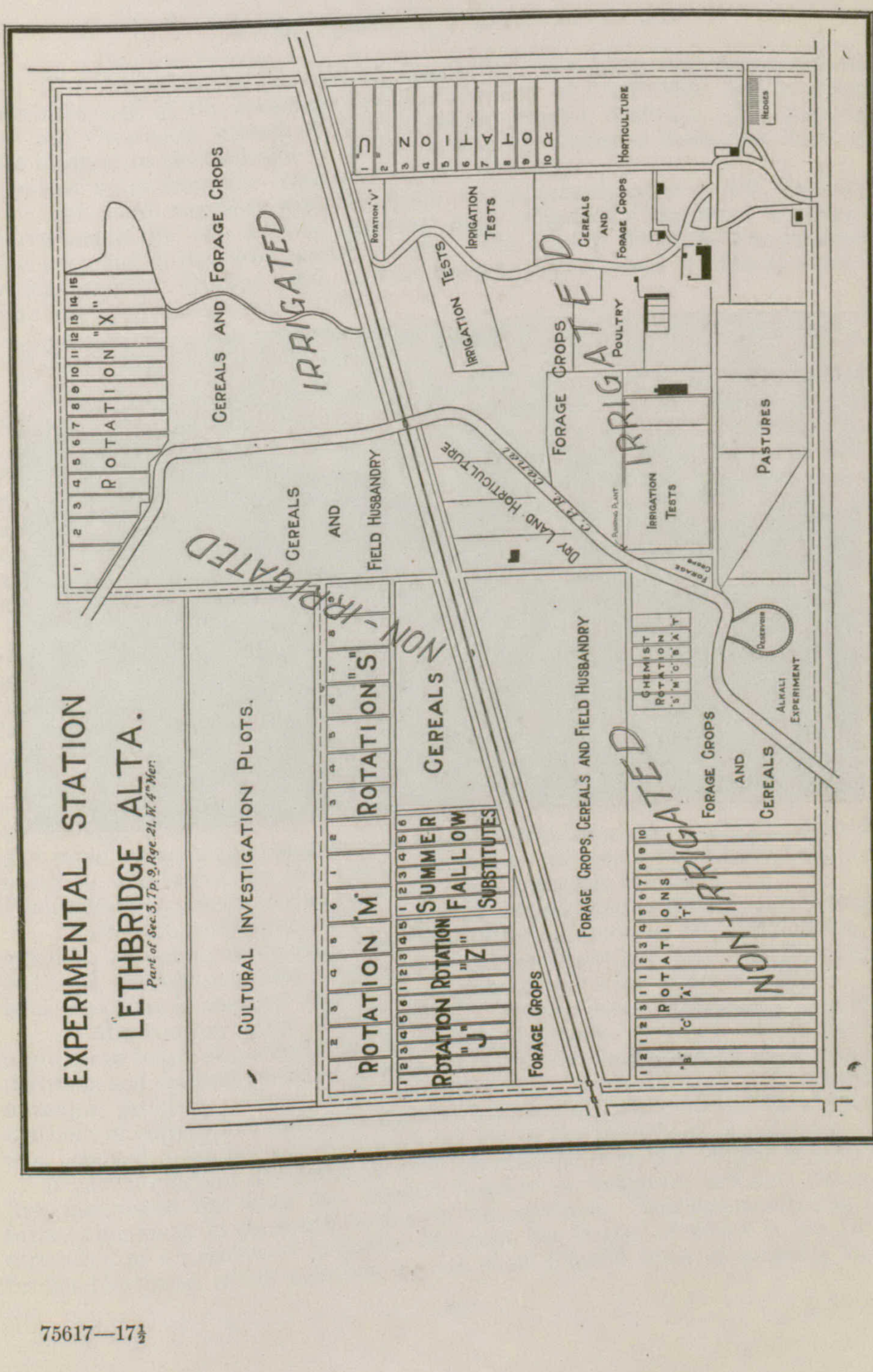
(Four projects)

There are on the Farm eighteen work-horses and colts, chiefly grade Clydesdales. No horse breeding work has yet been done. The cattle consists of 21 head of dual-purpose Shorthorns, part of which were transferred from Indian Head in May, 1922, the remainder having been bred on the Farm. The purpose is to breed animals of a fair beef type and milk-producing ability, so that stock may be sold to farmers who want animals of this type. Forty range steers, mostly of Hereford breeding, have been purchased for feeding experiments in the winter of 1923-24.

Silos.—An upright crib silo with a capacity of 115 tons and a trench silo of 150 tons' capacity are in use on the Station, primarily for the purpose of storing feed for the stock and secondarily to assist in gathering information as to the most economical methods of storing winter feed.

Illustration Stations

Illustration Station work was commenced in the province of Saskatchewan in 1915, and twenty such Stations are now carrying on demonstrational work, and these are under the general supervision of the Superintendent of the Experimental Station, Swift Current, who works in co-operation with the Chief Supervisor of the Division of Illustration Stations at Ottawa. Results already obtained in this work have been extremely valuable.


EXPERIMENTAL STATION
LETHBRIDGE ALTA.
Part of Sec. 3, Tp. 9, Rge. 21, W. 4th Mer.
CULTURAL INVESTIGATION PLOTS.
ROTATION "M"
ROTATION "S"
ROTATION "J"
ROTATION "Z"
SUMMER FALLOW SUBSTITUTES
CEREALS
FORAGE CROPS
ROTATION "X"
CEREALS AND FORAGE CROPS
IRRIGATED
NON-IRRIGATED
CEREALS AND FIELD HUSBANDRY
DRY LAND HORTICULTURE
C.P.R. Canal
FORAGE CROPS, CEREALS AND FIELD HUSBANDRY
ROTATIONS "B" "C" "A" "T"
CHEMIST ROTATION 'S' 'M' 'C' 'B' 'A' 'T'
FORAGE CROPS AND CEREALS
ALKALI EXPERIMENT
RESERVOIR
PASTURES
IRRIGATION TESTS
PUMPING PLANT
FORAGE CROPS
POULTRY
CEREALS AND FORAGE CROPS
ROTATION 'V'
ROTATION "U"
HORTICULTURE
HEDGES

Type of Pasture in the Forest Reserve—Lethbridge, Alta.

THE EXPERIMENTAL STATION FOR SOUTHERN ALBERTA

W. H. Fairfield, M.S., *Superintendent*

The Experimental Station at Lethbridge comprises 400 acres, situated one mile east of the corporate limits of the city of Lethbridge, and is crossed by the Crowsnest branch of the Canadian Pacific Railway. The buildings are located on the east side of the Farm and are distant a little over three and one-half miles from the business centre of the city.

This land, together with the water rights, was donated to the Dominion Government by the Alberta Railway and Irrigation Company. Possession was obtained in the late summer of 1906. The land at that time was unfenced, virgin prairie. During 1907 it was broken, fenced, and buildings erected. The first crop was grown in 1908.

Two Farms

There are two distinct types of farming carried on in southern Alberta, irrigation farming and farming without irrigation or "dry farming." The problems connected with these two are often as distinctly different as those found in widely separated parts of the country. When the Station was established, this fact was realized and a farm chosen where both types of agriculture could be carried on under one management. There are, therefore, really two farms operated here—one half the Station as a dry farm and the other half as an irrigated farm. The object is not to compare the relative merits of the two systems, but to study their individual problems.

The farm is intersected, approximately through the centre, by a main distributing canal of the irrigation system. The land to the west of this canal is slightly higher and cannot be irrigated. There are roughly 200 acres of each. The soil is quite uniform throughout, being a chocolate-coloured sandy-clay loam and is representative of a great deal of the soil in the district, although perhaps slightly lighter in character than some.

The establishment of the Station was coincident with the beginning of extensive wheat farming in southern Alberta. Previous to this time, stock raising under range conditions was the principal agricultural pursuit. With the general and rapid settlement of that part of the province from the international border north to, and including, the districts served by the main line of the Canadian Pacific Railway, stock raising gave way rapidly to grain growing.

During the early years of the Station's establishment, special attention was given to experiments dealing with grain growing, such as the preparation of sod land, suitable varieties of spring and winter wheat, and various other problems that arise in any new district but that take only a few years to solve.

As the country grew older, some dry seasons were experienced in which grain crops failed or partially failed. The weed menace increased, and, in certain districts, soil drifting occurred to such an extent on summer-fallow as to become a major problem. These new difficulties have been studied and remedial methods of cultivation and cropping have been investigated, the results of which, it is believed, have been of very material aid to the farmers in the district.

A very important development that has resulted from the adverse conditions just mentioned has been the marked interest in irrigation aroused amongst farmers generally in the southern part of the province. This has resulted in the formation of a number of irrigation districts, the largest of which is the Lethbridge Northern, which contains no less than 105,000 acres of irrigable land.

Prior to the organization of these irrigation districts, there had been developed the even larger irrigation projects of the Canadian Pacific Railway Company at Lethbridge and east of Calgary, also the project partially completed of the Canada Land and Irrigation Company, located northeast of Medicine Hat.

In viewing, therefore, the history of southern Alberta since the establishment of the Station at Lethbridge, it will be seen that, in the settlement of the land, a transition from pure stock raising under range conditions to grain growing has taken place, and along with this a very extensive development in irrigation. The area of land on which the irrigation works have been erected and which actually can be irrigated in southern Alberta is 1,138,000 acres.

On the irrigated part of the Station, investigations dealing with the problems peculiar to the irrigation farmer have been carried on. Some of the problems dealt with have been the preparation of the land, the proper use of irrigation water, and the determination of the most suitable crops to grow. The importance of making alfalfa a major crop, and its ability to enrich the soil for other crops, has been featured. Experiments in the winter feeding of steers and lambs, to demonstrate the profitable returns that may be had by marketing the hay in this manner, have been consistently carried on. Experiments along horticultural lines have been given considerable attention. The possibilities of growing small fruits and garden truck commercially have been established, and a very concrete illustration of what can be done in the growing of trees and shrubs, as well as flowers, to make attractive farm homes, is to be seen in the present development of the grounds surrounding the buildings.

Live Stock

The livestock work comprising some nine experimental projects, has been confined chiefly to experiments in the winter feeding of steers and lambs. Due, in the main, to practically all of the land, both on the dry and irrigated farm, being taken up with plot experimentation, it has not been found feasible to carry stock on the farm during the summer months.

Horses.—These usually number about twenty-five, and they are kept primarily for work purposes. No special breeding work has yet been undertaken, although some good work-horses from the grade mares have been raised. It has been clearly demonstrated that alfalfa is a satisfactory hay for farm horses under heavy work and the prejudice held by some horsemen against this feed is not well founded.

Steer Feeding Experiments.—In any new irrigated district, the problem of disposing of the alfalfa by feeding on the farm rather than by baling and shipping it, is always a live issue, and consequently this has been the chief object of investigations so far carried on. While alfalfa has been the sole main roughage fed, it has been compared alone and in combination with roots, oat-sheaves, cut oat straw, corn fodder, corn silage and sunflower silage.

The results of the feeding tests to date indicate that,—

(1) Alfalfa when fed to steers can be profitably marketed on the hoof rather than by baling and shipping it.

(2) It can be profitably fed alone or in conjunction with other feeds that are commonly available on the irrigated farm.

(3) It is profitable to feed oat straw when it is cut and fed in conjunction with cut alfalfa.

(4) Alfalfa alone does not fatten and it is necessary to feed liberally with grain during the finishing period.

Sheep.—Some 900 head of grade Merino ewes are kept at the Station, the object of such a large band being to determine, if possible, the feasibility of alfalfa growers on irrigated land carrying fairly good-sized flocks of sheep on their farms and for summer pasture using the forest reserve nearby in the

Rocky Mountains. The experiment has not been carried on for sufficient length of time to determine definitely whether sheep can be profitably handled in this manner, owing to the large item of expense in the railroad charges to and from the forest reserve.

In addition to the above, some breeding work is being carried on. The chief object is to get a class of sheep of better mutton type then the Merino but retaining a tight fleece of good quality and enough of the Merino characteristics to make them good range sheep. This has been attempted by crossing the Rambouillet ram with the Lincoln ewe, and the Lincoln ram with Rambouillet ewe and breeding the offspring to the Corriedale. This work has not been carried far enough to warrant deductions being drawn.

Sheep Feeding Experiments.—Sheep feeding experiments have been carried on for a number of years, using alfalfa as the main roughage in conjunction with other feeds available on the irrigated farm. The investigations to date warrant the following deductions:—

(1) It is profitable to stubble graze and fatten range lambs in the fall and winter months.

(2) It is more profitable to dispose of alfalfa by feeding it to fattening lambs than to bale it and ship it off the farm.

(3) Owing to the high cost of production, roots are not likely to be raised for fattening range lambs. When fed as an extra in the form of an addition to alfalfa, slightly higher gains were secured than when alfalfa was fed as a sole roughage. Roots are, therefore, valuable as a supplement.

(4) When a ration of two-thirds alfalfa and one-third oat-sheaves was fed, the lambs ate more roughage and made greater gains than on the straight alfalfa.

(5) Screenings (No. 1 stock food) are a valuable substitute for grain. When alfalfa was the sole roughage fed, it was found that it took 105.9 pounds of screenings to equal 100 pounds of grain (equal parts barley and oats); that is, recleaned screenings are 94.4 per cent as efficient as grain.

(6) Screenings, owing to their low price, produce cheaper gains than grain.

(7) In order to finish lambs satisfactorily, it is necessary to feed grain in addition to alfalfa.

(8) The only protection necessary for fattening lambs is shelter from winds and a dry place to bed.

Horticulture

(Comprising 73 projects)

In the spring of 1908, there were set out in the irrigated orchard, twenty-six different varieties of standard and crab, and twelve varieties of cross-bred, apples, and, in the non-irrigated orchard, sixty-eight standard and crab and seventeen cross-breds. Although all of these did fairly well for a few years and most of them fruited, there are none now left except the cross-breds. These varieties are the result of work done by the late Dr. Wm. Saunders, first Director of the Experimental Farms system, in crossing the native crab of Russia (*Pyrus baccata*) with some of the standard varieties of apple. The trees appear hardy and bear freely but, owing to the small size of the fruit, they are of doubtful commercial value.

In the spring of 1909, permanent plantations of red, white, and black currants, gooseberries and raspberries were set out on both dry and irrigated land. The currants have all been quite hardy and prolific. Many of the gooseberries set out have died. The raspberries have grown well and have been productive, but with them it has been found necessary to bend the canes over and cover with earth each fall before winter sets in.

Strawberries have shown themselves well adapted to Alberta conditions. Under irrigation they are a profitable commercial crop.

Of the plums, only the very hardiest have been a success and, so far, no variety of any real commercial value has been discovered.

In the vegetable garden considerable attention has been given to the testing of suitable varieties. Experiments in cultural methods have been carried on with success.

Perhaps one of the most outstanding results obtained has been the demonstration of the rapid and satisfactory growth it is possible to get from trees planted for windbreaks. In an absolutely treeless country this is an important feature.

Field Husbandry

On account of the light rainfall in southern Alberta, special attention on dry, i.e.,non-irrigated, land has to be given the cultural methods employed in order to obtain maximum results. Much has yet to be learned in regard to details but, speaking broadly, it is necessary for a farmer to keep at least one-third of his land under summer-fallow each year. The main object aimed at is to conserve moisture. The year that the land is fallow, the precipitation has a chance to percolate into the subsoil, none of it being used to support vegetation, and it is thus stored in an available place for the crop to draw upon during the periods of dry weather the following season.

The use of intertilled crops as a substitute for summer-fallow is a subject that is being given most careful study. In localities where the annual rainfall is less scanty this is a most satisfactory practice, but at Lethbridge it has been found that grain crops in a dry season will not give as good returns when following an intertilled crop as when seeded on summer-fallow. In a season when the rainfall is a little more abundant, the grain yield will be equally as good with the one treatment as with the other.

The hay question is perhaps one of the most perplexing problems confronting the farmer on non-irrigated land, for, with a perennial crop, it is impossible to introduce a summer-fallow every third year to stimulate growth by the addition of soil moisture conserved thereby.

Dry Land Rotations

The necessity of having to introduce a summer-fallow makes the problem of determining suitable rotations on the dry land a difficult one. To gather information along this line a number of rotations were inaugurated in the spring of 1911 and an outline of them is herewith given:—

Rotation "B" (Two years' duration). First year, summer-fallow; second year, grain, wheat.

Rotation "C" (Three years' duration). First year, summer-fallow; second year, grain, wheat; third year, grain, wheat or coarse grains.

Rotation "T" (Ten years' duration). First year, summer-fallow; second year, wheat; third year, oats or barley; fourth year, summer-fallowed May, seeded to alfalfa late June, in rows 35 inches apart; fifth year, alfalfa for hay or seed; sixth year, alfalfa for hay or seed; seventh year, alfalfa for hay or seed; eighth year, sunmer-fallow; ninth year, hoed crops; tenth year, wheat—manure applied on stubble.

Rotation "M" (Six years' duration). First year, summer-fallow; second year, wheat; third year, coarse grain—manure on stubble in fall; fourth year, summer-fallow; fifth year, peas and oats for hay; sixth year, barley or oats.

Rotation "S" (Nine years' duration). First year, summer-fallow; second year, hoed crops; third year, wheat; fourth year, summer-fallow; fifth year, wheat; sixth year, coarse grain; seventh year, summer-fallow; eighth year, peas and oats for hay—seeded in fall to rye; ninth year, rye pasture.

ROTATIONS (IRRIGATED LAND)

Three rotations have been established on the irrigated farm and each has proved satisfactory. The problem of finding a satisfactory rotation for the irrigated land is much more simple than it is on the dry land, as almost any crop adapted to a temperate climate can be grown.

Alfalfa, is used as the base of each of the irrigation rotations, as this crop furnishes an abundance of excellent feed for live stock, returns organic matter and nitrogen to the soil, which results in increased yields of the crops following, and is valuable as a weed exterminator.

Rotation "U" (Ten years' duration).—First year, alfalfa; second year, alfalfa; third year, alfalfa; fourth year, alfalfa; fifth year, alfalfa; sixth year, alfalfa, manured previous fall; seventh year, hoed crop; eighth year, wheat; ninth year, oats; tenth year, barley. Seeded down to alfalfa.

Rotation "V" (Alfalfa continuously).—This field was seeded to alfalfa in 1909, for the purpose of observing the probable life of an alfalfa field under favourable conditions and for the production of hay from year to year.

Rotation "X" (Fifteen years' duration).—First ten years, alfalfa; eleventh year, barley; twelfth year, corn; thirteenth year, wheat; fourteenth year, oats; fifteenth year, peas.

The above is really a rotation within a rotation. Instead of breaking up one field of alfalfa each year and seeding one each year, the breaking is done once in five years when five fields are broken up and used for cereal and hoed crops and the fields that had been used for these crops are seeded down to alfalfa. The cereal and hoed crops are used as a five years' rotation.

Irrigation Experiments

(Ten projects)

Investigations are under way at the Station regarding the proper use of irrigation water. The purpose of the experiments is to obtain information regarding:—

(1) The stage of development of crops when the first and subsequent irrigations of the season should be applied.

(2) The moisture content of the soil when crops require irrigation.

(3) The number of irrigations necessary for different crops.

(4) The value of fall irrigation.

(5) The optimum depth of water per application for the soil on this Station.

(6) The desirability of cultivating hay and grain crops after irrigating.

(7) The correlating of data obtained, in an endeavour to find a way for relieving the peak load of water required in June and July.

The problem is attacked in two ways: (*a*) By keeping careful note of the irrigations required by the general field crops and measuring all water used on the farm. (*b*) By applying definite quantities of water on well-prepared plots at different stages of plant growth. Spring wheat, alfalfa, timothy, brome, mixed pasture grasses, sunflowers and potatoes are the crops included in the plot tests. Each of these crops receives water at one or more stages of growth; for example, wheat is irrigated when in the one-leaf, five-leaf, shot-blade, flowering milk, and soft dough stages. Two, three, four and five inches of water are applied per irrigation to the intertilled crops and four, six and eight inches to the grain, alfalfa and grasses.

Soil Moisture

As the purpose of irrigation is to increase the moisture content of the soil, careful soil moisture studies are carried on in connection with the irrigation experiments. Samples are secured and moisture determinations made of each separate foot of soil to a depth of six feet before and after each irrigation, and at other times as deemed necessary. This phase of the investigations is supplying some interesting data, which promise to be of considerable value, regarding the water-holding capacity of the soil, the amount of water that can be applied with safety, the demands made on the soil for water by various crops at different stages of their development, and kindred problems.

Forage Crops

(Twenty projects)

Variety tests are carried on with corn, sunflowers and roots on both the dry and irrigated land. Tests are made of the same varieties of roots from seed obtained from a number of seedsmen, to determine the purity of the seed supplied. A large number of varieties and strains of grasses and legumes are under test to find, if possible, a satisfactory perennial hay and pasture crop for the dry land and the varieties and mixtures best suited for irrigated pastures. As a hay crop for irrigated lands, alfalfa stands in a class by itself, so, at all times, careful study has been given this crop relative to the most hardy and productive strains. The question of seed production is receiving most careful attention.

Cereals

(Fourteen projects)

Tests of the standard varieties of the different grains are conducted each year on both the dry and irrigated lands. Whenever possible larger quantities of the better sorts are raised for seed distribution among farmers. While grain is almost the only crop grown on the dry farms of the district, the problem of securing suitable varieties has not been serious, as the season here, unlike some parts of the Northwest, is long enough for maturing almost any of the varieties commonly grown. Cereal investigations have therefore been principally the testing of a few of the better varieties. The major part of the work affecting grain farming has been along cultural lines, due to the difficulty of producing satisfactory crops with limited rainfall.

Poultry

(Twelve Projects)

One breed, the Barred Plymouth Rock, is kept at this Station. For a number of years, careful pedigree breeding has been carried on, with the result that a flock of excellent utility birds, with good egg records, has been developed. The average production of all pullets kept during the season of 1922-23 was 200 eggs per bird, a pen of fifty averaged 211·5 eggs and twenty birds entered in the Alberta egg laying contest averaged 229 eggs per bird. One bird laid 315 eggs in her laying year and 302 in the contest year.

It is the practice of the Station to supply hatching eggs and cockerels from this high-laying strain to farmers and others for the purpose of increasing the egg production of the poultry kept in the province. Hundreds of poultry keepers have received stock in this way, and almost invariably report an increase in the egg production of their flocks due to the blood of high producers, thus introduced.

In addition to the breeding work, proper methods of flock management suited to local climatic conditions are being worked out. One of the outstanding difficulties met with locally is the securing of satisfactory hatches in incubators. Several makes of incubator have been tested, but none has been found entirely satisfactory here, if operated according to the maker's instructions. Various methods of operating have been tested, and the proper application of moisture now gives promise of doing much to solve the problem.

Alberta Egg Laying Contest.—The Alberta egg laying contest was started at the Lethbridge Station November 1, 1919 and has been repeated each year since. That the interest in the contest is increasing and the quality of the birds sent in improving are shown by the number of entries received and the increased production. The number of pens entered for each of the first five years, not including Experimental Station pens, were 1st, 11; 2nd, 20; 3rd, 19; 4th, 22; 5th, 27; and the average production per bird for four years were 1st, 122; 2nd, 128; 3rd, 131; 4th, 168.

Bees

(Four Projects)

Bees have been kept at this Station for a number of years, the work undertaken having been principally to determine the possibilities of the industry in Southern Alberta and to find a suitable method for carrying the bees through the changeable, and often severe, weather of the winter. It has now been shown that bees can be relied upon to produce a large annual yield of excellent honey and that they can be successfully wintered outside in packing cases, thus avoiding the necessity of constructing expensive cellars or other elaborate winter quarters.

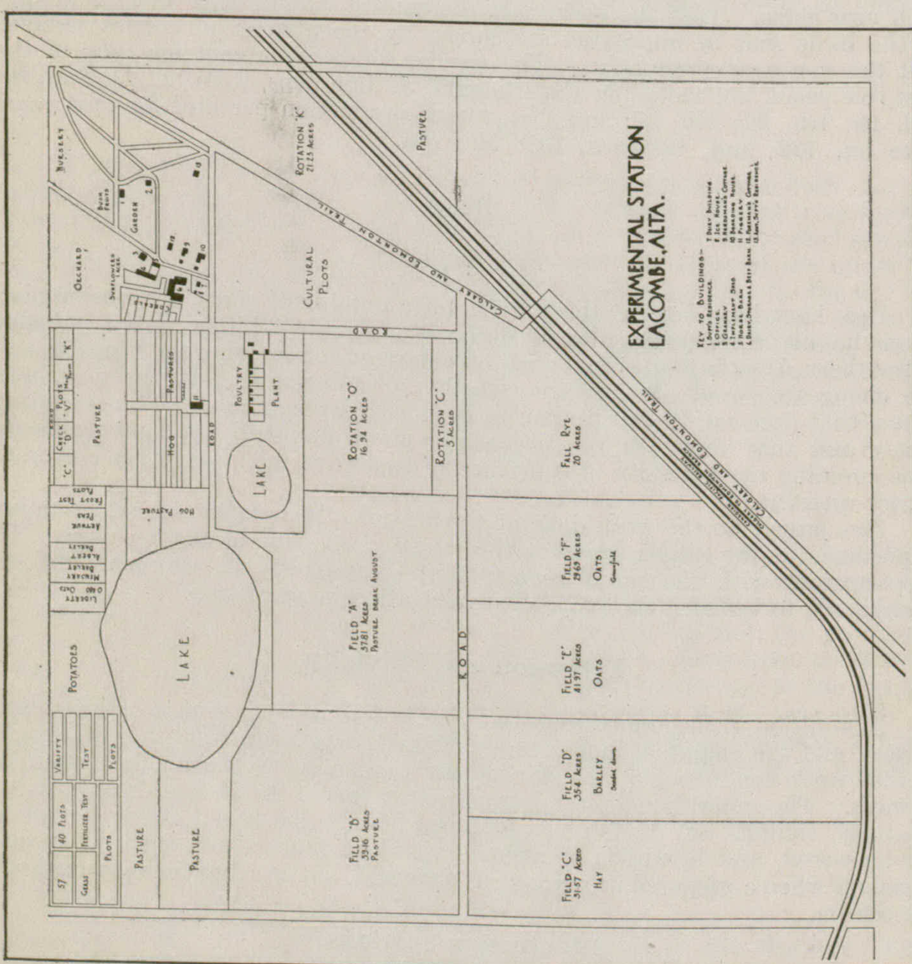
Due largely to the work done at the Station, the industry is fast assuming importance in the alfalfa areas of the irrigated sections of the province. To keep abreast with the rapid development of bee-keeping, arrangements are being made to broaden the scope of investigation in apiculture.

Extension and Publicity

In addition to the annual report of the Station, which is sent to all interested parties, and the issuing of bulletins and press articles, the results of all experimental work conducted at the Station are carried to the farmer in a number of ways. The superintendent and various members of the staff address farmers' meetings, exhibits are made at agricultural fairs, numerous letters of enquiry are answered, and hundreds of farmers visit the Station not only on special occasions when a prepared programme is arranged, but at other times throughout the season.

Illustration Stations

Illustration Station work in the province of Alberta was commenced in 1915, and there are at present twelve such in operation in that province, all under the general oversight of the Superintendent of the Lethbridge Experimental Station. Some valuable information has already been obtained on rotations, cultural practices, varieties, etc., most suitable for different styles of farming in the localities where these Stations are being conducted.


EXPERIMENTAL STATION
LACOMBE, ALTA.
KEY TO BUILDINGS—
1 SUPT'S RESIDENCE
2 OFFICE
3 GRANARY
4 IMPLEMENT SHED
5 HORSE BARN
6 DAIRY, SWINE & BEEF BARN
7 DAIRY BUILDING
8 ICE HOUSE
9 HERDSMAN'S COTTAGE
10 BOARDING HOUSE
11 PIGGERY
12 FOREMAN'S COTTAGE
13 ASST. SUPT'S RESIDENCE
CALGARY AND EDMONTON TRAIL
ROTATION 'K' 21.25 ACRES
PASTURE
CULTURAL PLOTS
NURSERY
ORCHARD
GARDEN
POULTRY PLANT
LAKE
ROTATION 'O' 16.94 ACRES
ROTATION 'C' 5 ACRES
FALL RYE 20 ACRES
HOG PASTURE
FIELD 'A' 37.81 ACRES PASTURE BREAK AUGUST
FIELD 'F' 29.63 ACRES OATS
FIELD 'E' 41.97 ACRES OATS
FIELD 'D' 35.4 ACRES BARLEY
FIELD 'B' 33.16 ACRES PASTURE
FIELD 'C' 31.57 ACRES HAY
ROAD
POTATOES
VARIETY TEST PLOTS
40 PLOTS FERTILIZER TEST PLOTS
57 GRASS PLOTS
PASTURE
CHECK PLOTS

THE EXPERIMENTAL STATION FOR CENTRAL ALBERTA

F. H. Reed, B.S.A., *Superintendent*

History and Description

The Dominion Experimental Station for Central Alberta was established at Lacombe in March, 1907. Lacombe is centrally located in one of the largest live stock and mixed farming areas of the West. It is easily accessible, being located 115 miles north of Calgary and 80 miles south of Edmonton, on the Calgary and Edmonton trail, and on the Canadian Pacific line between Calgary and Edmonton. The Canadian Pacific Railway also operates a line running east from Lacombe, and the Lacombe and Northwestern Railway line has opened up a large, new district to the west and north. The Canadian National Railway has a right of way into the town from its line five miles south. As the Calgary and Edmonton trail, and the two lines of railway pass through the farm just south of the town, an excellent view is afforded to travellers of the experimental plots and the buildings.

The altitude of the Canadian Pacific Railway station is 2,795 feet above sea-level and its situation is 52° 28′ N. latitude and 113° 44′ W. longitude. The Experimental Station is situated about one mile southwest of the railway station and just on the southwest corner of the town.

The topography of the district shows a series of broad, fertile valleys. These valleys become broader and shallower towards the east until the open prairie is reached; while, towards the west, the valleys become narrower and the land rougher as the foothills grade into the mountains. The same type of country extends, with slight variations, southward as far as Calgary, and northward throughout the entire Edmonton district, and is situated in, or constitutes, the park belt of Alberta.

The soil of the district varies from a sandy to a dark chocolate loam, varying in depth from one to four feet, and is underlaid by a deep subsoil which varies from a gravelly loam to a stiff clay. The 490 acres of land in the Experimental Station, while fairly uniform in character, varies in places from a rich black loam four feet in depth, with stiff clay subsoil, to a sandy loam one foot deep with sandy subsoil. The farm is quite representative of the district.

As climatic conditions are so important in crop production and for the health and comfort of both man and live stock, accurate records are made at the Experimental Station of the daily temperatures, precipitation, evaporation, sunshine and wind velocity. The climate of central Alberta is in almost every way ideal. The prevailing bright, warm sunshine, with very little of the high winds which are so trying in many districts, is most pleasing, and at the same time very suitable for the production of farm crops. While there is but little damp, cloudy weather and an average annual precipitation of only 17·03 inches during the last fifteen years, the fact that most of the rain falls during the growing season in June, July and early August renders it immeddiately available, and usually quite sufficient, for abundant plant growth. June, July and August are the wettest and also the warmest months of the year. This moisture and heat, combined with sunshine from three o'clock in the morning until nine o'clock at night, force a very rapid, strong growth. A short growing season, with late spring and early fall frosts and occasional dry years, presents many crop problems, but, where proper farming methods are used, a crop failure in the Lacombe district is unknown.

Cultural Plots—480 required. Experimental Station, Lacombe, Alta.

The winter weather of central Alberta is modified by the warm chinook winds that extend northward from the southern part of the province. These winds, while seldom warm enough to remove the snow, are a big factor in modifying the climate for a considerable distance east of the Rocky mountains. The thermometer seldom falls below $-20°$, and though, at times, the temperature is down to $-40°$ these severe cold spells are of short duration and are always accompanied by bright sunny days.

The Station farm comprises about 490 acres. All of this land is now devoted to experimental work of various kinds, and a second farm of 480 acres, four miles north of the Station, is leased and used for pasture and for the growing of hay, greenfeed and coarse grains for feeding the large numbers of pure-bred animals which are kept for the production and distribution of breeding stock, and for experimental work in breeding, housing and feeding.

Field Husbandry

When the Station was started in 1907, settlers were coming into the country in very large numbers, and these newcomers looked to the "Government Farm" as a reliable source of information. The object of the experimental work has been to assist farmers in solving the many problems of a new country as it developed from the homestead and ranching era into a purely grain farming stage and later into a highly developed type of mixed farming, with the keeping of large numbers of pure-bred live stock. As some of the land at the Station has been under cultivation for thirty-one years, it is particularly adapted for this purpose. The first work was to determine what varieties of wheat, oats and barley were best suited to the district. The next problem was to find methods of cultivation which would conserve moisture, retain soil fertility, control weeds, and produce paying crops. The third stage was to develop crop rotations which while retaining a cash grain crop, would provide for pasture and forage crops and the production of coarse grains for the feeding of beef cattle, dairy cows, sheep and hogs. In 1911, an extensive series of cultural experiments was started. These comprised tests of many methods of stubble treatment, summer-fallow treatment, depths of ploughing, applying manure, dates, rates and depths of seeding, methods of seeding down grasses and breaking sod, and the growing of roots and silage crops. The nine years' results now available from these experiments have provided very valuable information for both old and new settlers.

In 1921, a new series of cultural experiments was started, based on the results of the previous experiments and designed to cover some of the more recent problems of soil drifting, summer-fallow substitutes, growing of grain in group rows, etc. This work requires 18 acres, divided into 480 plots. In 1911, a series of four crop rotations was started. Two of these rotations were for grain growing exclusively, while the other two contained pasture and forage crops. In 1922, nine other rotations were added, covering a much wider range of problems such as the growing of sweet clovers, annual and biennial, the place of fall rye in farming, the growing of grain in intertilled rows, methods of growing and controlling alfalfa and Brome grass and the economical production of greenfeed, silage crops and roots. The thirteen rotations now under trial require 253 acres divided into 52 blocks or small fields. Accurate and complete records are made of every item of cost of production on all of these rotations, seed, rent of land, horse and manual labour, machinery depreciation, and loss in soil fertility as nearly as this may be obtained from check plots. In the 480 cultural plots and 52 rotation blocks, 45 distinct experiments in field husbandry are under way.

Cereals

In experimental work, negative results are often almost as valuable as positive ones. In cereal work, the object has been to decide what varieties of wheat, oats, barley and peas are best suited to central Albertan conditions of climate and soil. In doing this, it has been found that many varieties, which are heavy yielders in other districts, are entirely unsuited to central Alberta and, if used, mean crop failure. It has also been found that some of the older varieties are peculiarly adapted to these conditions. Perhaps the most valuable work in cereals has been the trying out and introducing of new varieties of grains produced by the Dominion Cerealist. Among these are Marquis, Ruby and Prelude wheats, a selection of Banner oats, Ottawa 49, and Bearer barley. A new cross-bred wheat called Producer, Ottawa 197, which will, in a few years, be available for distribution, has, over a five-year period, produced considerably heavier yields than Marquis, and requires approximately three days less to attain maturity. Garnet, Ottawa 652, is one of the most promising new varieties of wheat, and indications are that it may prove a serious rival of Ruby, Ottawa 623, for districts requiring a very early ripening variety. It matures in from two to four days less time than Ruby, and, over a four-year average, has produced 6 bushels more per acre. For districts where early fall frosts are not the limiting factor in barley production, Bearer, Ottawa 475, can be recommended as, with the exception of one rather unsuitable variety, it is the heaviest yielding sort under test. Since the Station was started in 1907, fifty-five varieties of spring wheat, sixty-five varieties of oats, seventy varieties of barley and twenty-five varieties of field peas have been grown on the variety plots. While a few of these have been found to be particularly adapted to the conditions of the district and have given outstanding yields, many varieties have proved quite unsuitable and have been discarded. In cereals there are now fifteen projects under way, including some work in plant breeding and the selection of new strains of varieties. The production of registered seed grain is also receiving special attention.

Forage Crops

As the Station is located in a prominent live stock district, the production of forage crops is an important line of work. There are now twenty-nine projects under way. These include the testing out of twenty-five strains of Western Rye grass, four of timothy, fifteen of red clover, five of White Dutch, five of sweet clover, and eight strains of alfalfa. These grasses and clovers are grown singly and in combination with brome, red top and other grasses, and are compared for hay production and as pastures. The production of ensilage crops is very important, and for this purpose eight varieties of sunflowers and fourteen varieties of corn are under test. These are grown in comparison with different varieties of oats for ensilage. Many varieties of swede turnips, field carrots, mangels and sugar beets are being tried. Wherever possible, home-grown seed is used in comparison with commercial seed, and, almost without exception, home-grown seed has given the better results. In all of this work it is found that while some strains and varieties are well adapted to central Alberta conditions, many are quite useless, and yet all of these strains and varieties are to some extent on the market. As the use of an early maturing variety of sunflowers which will yield a heavy tonnage is very important, selection work with some 130 strains has been commenced. The difference in the strains is, in most cases, quite marked.

Horticulture

When the Station was started, avenues and shelter belts of elm, ash and Manitoba maple were planted, and, around the gardens, hedges of laurel-leaved willow and caragana. On the main lawn, some seventy different kinds of ornamental trees and shrubs were set out in small clumps. In the sixteen intervening years these have grown well, and now, with the borders of perennial and annual flowers which have since been added, make the grounds a beautiful sight, well worthy of a visit.

The object of the experimental work in horticulture has been to ascertain what varieties of ornamental trees, flowers and shrubs, what varieties of garden vegetables, what bush fruits, and what tree fruits are best adapted to central Alberta, and to develop the most suitable cultural methods. It has been amply demonstrated that probably in no part of Canada can vegetables and bush fruits of higher quality be produced; and that every farmer can, with a little extra effort and care, have a good farm garden and an attractive farm home. All the common vegetables do well in this soil and climate. Red and black currants, gooseberries and raspberries give heavy yields of excellent fruit. Strawberries are grown with great success. The gooseberries and raspberries require to be covered with earth during the winter, and the strawberries should be covered with straw. Tests of varieties, methods of cultivation, and winter protection are being made. The arboretum contains the oldest and largest collection of trees and shrubs north of Calgary, and an effort is being made to test all of the annual and perennial flowers suitable to northern conditions. As the country becomes older, farmers and townspeople are building new and better houses, and making permanent homes. When laying out lawns and gardens, the information from the Experimental Station is of very great service to them.

The growing of tree fruits has, so far, not been a success, though several hundred trees of plums, crab-apples, standard apples and cross-bred apples have been planted at various times. A few trees of the standard and cross-bred apples have produced fruit, but, without exception, after bearing fruit the tree has died during the following winter. The crab-apples and plums have been more hardy, and at present there are a few crab-apple trees and several plum trees in the orchard which have borne fruit.

Horticulture is one of the important branches of the work at the Station, and forty-eight different projects or experiments are now under way.

Apiculture

During the last few years, the keeping of bees has been receiving a great deal of attention in many parts of Alberta. For this reason, the few colonies of bees which have been kept at the Station for several years have been given more attention and the numbers greatly increased. It has been found that the production of honey depends very much on the type of weather during the summer months. The nectar is collected very largely from wild flowers and the honey is of very high quality, but frequent showers are necessary to prolong the blooming period. The wintering of the bees is not difficult, as excellent results have been secured from colonies wintered in a room in the office basement, and from colonies wintered in the open in a box with about six inches of straw or shavings surrounding the hive. During 1923, the thirteen colonies carried over the previous winter produced an increase of ten colonies and gave an average yield of 93 pounds of extracted honey, per colony. Twenty-three colonies have been put into winter quarters. Experiments are under way in control of swarming, methods of wintering, and size of frames.

Poultry

Poultry is rapidly receiving more attention as a profitable branch of farm operations in central Alberta. The plant at the Station consists of eight buildings exclusive of colony houses. White Wyandottes, Barred Rocks and Single Combed Rhode Island Reds are the three breeds kept. There are also small flocks of African geese and Pekin ducks. Practically all the young males are sold to farmers in the surrounding district. In addition to breed comparisons, experiments are conducted in methods of incubation and rearing, costs of rearing chicks and producing eggs, kinds of feeds and methods of feeding, and in breeding of pedigreed stock. Good pen and individual egg records have repeatedly demonstrated that excellent winter egg production can be secured in this climate, using only home-grown feeds. Artificial heat is found detrimental rather than beneficial, and all that is required is well built frame houses, free from drafts, but well ventilated through cotton fronts.

Live Stock

It has become an established fact that the keeping of live stock is a necessary branch of successful and permanent farming in central Alberta. With an abundant supply of water available in lakes, sloughs and streams, with good pastures and shelter in woods and tree bluffs, and with an abundance of rough feed, oat straw, wild and cultivated hay, corn, sunflowers and roots always available, it was early recognized that the Lacombe district was peculiarly adapted for mixed farming and the production of live stock. For these reasons, experiments in animal husbandry are one of the largest and most important branches of the work at the Experimental Station. Unfortunately, space will permit of only a very brief outline of the numbers of animals kept, and the experiments completed or under way.

The first work with live stock on this Station was the feeding of beef steers. These were fed in comparison, in groups kept in stables, in corrals, and sheltered in bluffs or woods. Home-grown feeds were used, prairie hay, green feed, oat straw, low-grade wheat, barley and oats. It was found that good profits could be made in steer feeding, and that the largest profits were secured from the steers fed in corrals.

Dairy Cattle.—In 1911, two pure-bred Jersey cows were purchased, but it was not until 1912, when herds of 17 pure-bred Holsteins, and twenty pure-bred Aberdeen Angus cattle were bought, and dairy and beef barns were erected, that breeding work with cattle commenced at the Station. In addition, a grading-up experiment was commenced, using pure-bred dairy bulls on grade cows. From this foundation, herds have been developed by careful breeding and selection until the dairy herd is now known as one of the most uniformly good herds of Holsteins in the West. The cows combine size, breed type, quality of milk producing ability in a marked degree. All pure-berd milking cows are entered in the R.O.P. and R.O.M. tests, and many very creditable records have been made. While one mature foundation cow, May Echo Lady, has produced 21,885 pounds of milk in 365 days, the best records have recently been made by the younger cows bred at the Station. The champion two-year-old milk record for the Prairie Provinces is held, at time of writing, by L.E.S. Nina Alcartra with a 365-day R.O.P. record of 18,184·8 pounds of milk and 676 pounds of butter. Her stable mate, L.E.S. Johanna Alcartra, is the champion two-year-old butter producer of the Prairie Provinces with an R.O.P. record of 17,718 pounds of milk and 780 pounds of butter in 375 days. Several other almost equally good records have recently been made, and the average production of the thirteen pure-bred Holstein cows completing their lactation periods during 1922 was 15,667 pounds of milk and 625 pounds of butter. Six grade Holsteins averaged 8,416 pounds of milk and 364 pounds of butter. Nine different lines of experimental work are under way, including the comparison of different kinds of hay, green feed and silages for milk production; the comparison of home-grown oats and barley fed alone and in combination with molasses and oilcake meal for milk production; methods of feeding and costs of rearing dairy heifers; methods of feeding cows for record milk and butter production. In all experimental feeding, accurate records are kept of feed costs.

As large numbers of animals are necessary for reliable experimental work, the herds have been developed until there is now a total of 151 head, about equally divided between the two breeds. So far, very few breeding females have been sold, but annually a number of good young bulls of both breeds are disposed of to breeders in Alberta and British Columbia.

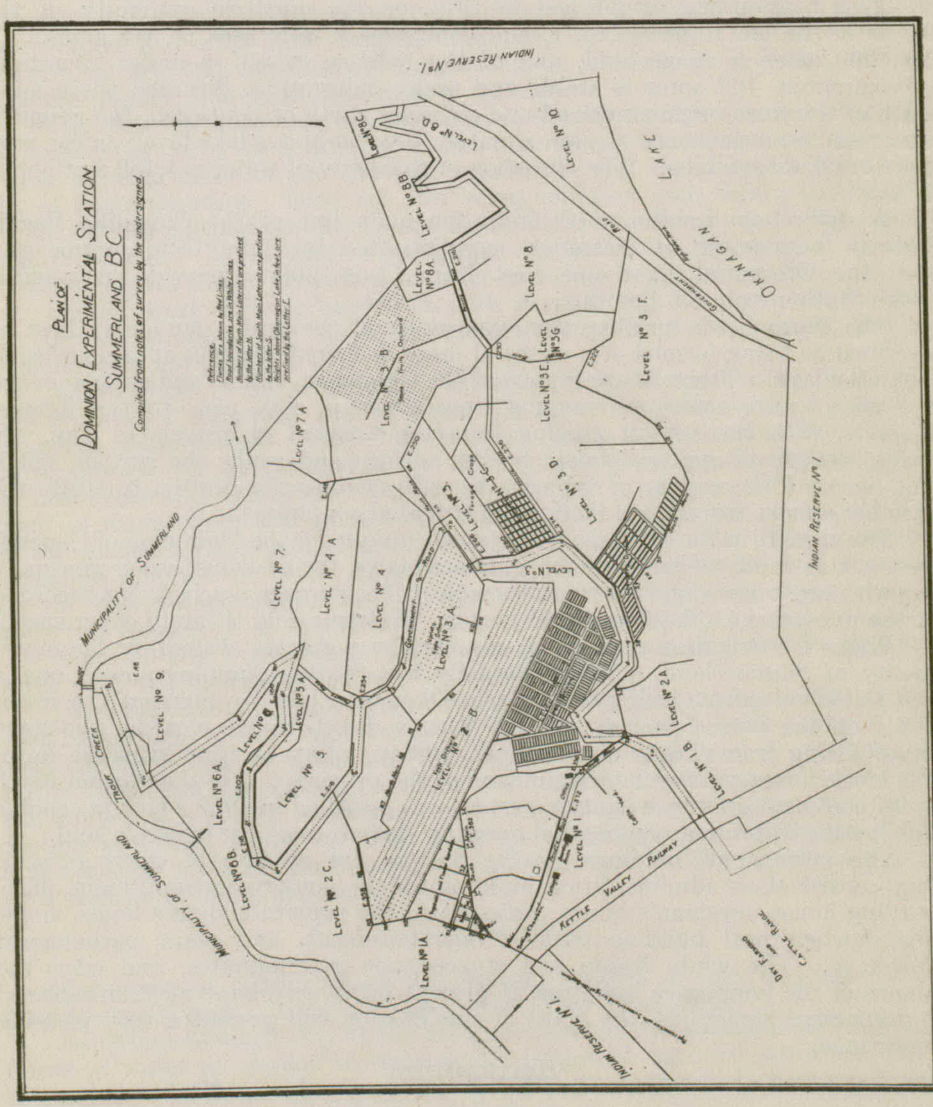
Owing to lack of suitable stabling for such a large herd, not as much experimental work has been possible with the Aberdeen Angus as with the Holsteins. However, data have been compiled on the costs of maintaining and developing the herd, and eight experiments are now under way, including methods and costs of wintering yearling heifers and nursing cows; cost of raising bulls to one year of age and heifers to two years of age; the comparison of various feeds for beef production; the economy of feeding yearling steers for beef and the cost of fitting a show herd.

Dairy Manufacturing.—About half of each day's milk, roughly 500 pounds, is made into cheese, and the whey is fed to the pigs. Only Cheddar cheese is made, put up in small cheese of about ten pounds each. For this there is a very keen demand. The remainder of the milk is separated and the cream sold to the local creamery. The skim milk is necessary for the dairy calves. The making of cream cheese has been tried, but a market cannot be found.

Swine.—Hog raising has, during the last few years, been for many farmers the most profitable branch of their operations. One reason has been that very little capital is required to start in the business and the increase in numbers is very rapid. Hogs were first kept at the Lacombe Station in 1912, when four Yorkshire sows were sent from Ottawa, and one Berkshire sow was purchased locally. In 1915, although a large number of market hogs had meantime been sold, the breeding stock had increased to sixty head. In 1915, a large piggery was built containing ten farrowing pens, feed room, weigh scales and water supply, with storage room overhead for feed and bedding. The work with swine was rapidly increased, and, in 1917, 675 hogs were used in experimental work, in addition to eighty head of breeding stock. Three breeds, Yorkshires, Berkshires and Duroc-Jerseys, have been kept, and every effort has been made to secure the best boars available and to establish good strains of the breeds, the object being to secure the best possible type of each for the breed comparison experiments, and to have for sale only breeding animals of superior merit. In the breed comparison tests, it has been found that the Yorkshire is superior in prolificacy, in hardiness, in the time required to reach market size and weight, in economy of pork production, and in the number of "select bacon" hogs produced. As the Duroc-Jersey has not given satisfactory results in the comparative breed tests, and as it has been found impossible to produce any "select bacon" hogs from this breed, they have been discarded this fall (1923). Tamworths may be substituted if satisfactory foundation stock can be secured. Some work with cross-bred hogs is also being carried on. In addition to the numerous breed comparisons, some of the other experiments under way are: Methods of feeding for bacon production; the self feeder vs. hand feeding; pasture vs. indoor feeding with and without minerals; tankage vs. oilcake meal for weaned pigs, different kinds of hog pastures; methods of wintering brood sows; a comparison of fall vs. spring litters. There is always a wide demand for breeding swine from the Station, and annually, large numbers of young boars and gilts are sold to all parts of Alberta and British Columbia.

Sheep.—Sheep cost the least in feed and care, and usually give the largest net returns of any animal on the farm. The keeping of sheep was commenced at the Lacombe Station in October, 1913, when twenty range ewes were purchased and mated to a pure-bred Shropshire ram. This grading-up experiment was continued until 1917, when some 400 range ewes were added, and an experiment was started with the object of testing the relative merits of different pure breeds of sheep for grading up the average range flock. Shropshire, Oxford, Hampshire, Leicester, Cheviot and Corriedale rams are being used. These six crosses have been kept distinctly separate for breeding purposes, and pure-bred rams of good type have been used continually. All of the original ewes have been disposed of, and the flock now consists of first, second and third cross sheep of the six breeds, together with the pure-bred rams, in all 871 head. Careful notes and records have been made as to the comparison of the six breeds for the production of wool and mutton, prolificacy, hardiness of the lambs, and their growth while on summer range and in winter feed lots. Numerous feeding experiments are under way to test the relative values of the different roughages and grains for the fattening of wethers and lambs. Wethers have frequently been shown in the fat classes and later in the carcass competitions at the winter fairs, thus testing their suitability for market requirements.

Horses.—Only grade work horses were kept at the Station until 1912 when, with the addition of 320 acres of land, ten mares were added for work and breeding purposes. Of these, two were pure-bred Percherons, and four were pure-bred Clydesdales. The Percheron mares were shipped to the Station at Scott, in the fall of 1920. Several foals have been raised from the Clydesdale mares, but with only fair results, owing largely to the lack of good sires. In 1921, two pure-bred Clydesdale mares of good type and breeding were purchased. The first foals from these mares were lost from various causes, but an outstanding filly was this year raised from the best mare. On May 16, 1923, the two Shire stallions and three Shire mares, presented to the Dominion Government by the English Shire Horse Society, arrived at the Station. One of these mares was accompanied by a ten-days-old filly foal, and one of the mares later foaled, but both mare and foal were, unfortunately, lost. The two Shire mares and seven Clydesdale mares have been bred to the Shire stallions. There are now at the Station twenty horses; five pure-bred Shires, eight pure-bred Clydesdales, three pure-bred Hackneys and four grade Clydesdales. Experimental work has so far been limited to the costs of wintering work horses in stables and outside, the costs of keeping work horses for a year, and the costs of rearing young horses. It is now planned to do some experimental breeding work.



Plan of
Dominion Experimental Station
Summerland B.C.
Compiled from notes of survey by the undersigned
Municipality of Summerland
Municipality of Summerland and Trout Creek
Indian Reserve No 1.
Indian Reserve No 1
Okanagan Lake
Kettle Valley Railway
Government Road
Dry Farming and Cattle Range
Level No 1
Level No 1A
Level No 1B
Level No 2A
Level No 2B
Level No 2C
Level No 3
Level No 3A
Level No 3B
Level No 3D
Level No 3E
Level No 3F
Level No 3G
Level No 4
Level No 4A
Level No 5
Level No 5A
Level No 6A
Level No 6B
Level No 7
Level No 7A
Level No 8
Level No 8A
Level No 8B
Level No 8C
Level No 8D
Level No 9
Level No 10

THE EXPERIMENTAL STATION FOR THE OKANAGAN VALLEY AND THE DRY BELT OF BRITISH COLUMBIA

W. T. Hunter, B.S.A., *Superintendent*

This Station was established in 1914, on the northern extremity of the Penticton Indian Reserve No. 1, and comprises a total area of 545 acres. Of this, 260 acres is range land, and of the balance, which is under irrigation, approximately 160 acres is arable and under cultivation. Situated three miles south of the town of Summerland and six miles north of Penticton, the irrigated farm rises to an elevation of approximately 400 feet above lake level, on the west shore of Okanagan lake. The elevation of this body of water is 1,130 feet above the sea.

A daily boat service south from the main line of the Canadian Pacific Railway, connecting at Sicamous, supplemented by daily train service east from the Crowsnest Pass and west from Coast points, provide easy access to the Station from all directions.

The Farm has a southeastern exposure and the arable land may best be described as being formed of a series of large and small benches at various levels above the lake. The soils are typical of the Okanagan Valley, and are comprised of a wide variety of types, ranging from a heavy, silty clay to the lightest of sands, with the subsoil ranging from the coarsest of gravels to clay. In places, the gravel appears almost at the surface and again the surface soil is very deep. This variety of type in the soils enables the Station to study the action of almost any class of land under irrigated conditions.

The climate in the southern Okanagan is unique for the Dominion of Canada, inasmuch as the total hours of sunshine are many, the growing season unusually long with cool nights, and the rainfall sparse. The average precipitation recorded for the five years 1917-22 was 9.64 inches. Extreme cold is rarely experienced.

Water for irrigation purposes is supplied by a gravity system by the municipality of Summerland, supplemented by two Station pumping plants, one, a semi-Deisel oil outfit, lifting water from Okanagan lake to augment the water supply on the lower benches, and the other a direct-driven, electric, two-stage pump, lifting from Trout creek to the highest point on the irrigated farm. This creek forms the northern boundary of the property. On the Station itself, a very complete gravity irrigation system was installed in 1915 which is capable of delivering water in any measured quantity desired to all the irrigable land.

The permanent buildings on the Station are modern in every respect. They consist of an administration building for the poultry division, main office, boarding house, foreman's house, assistant to the superintendent's house, horse barn, horticultural building with storage basement, and plant pathological laboratory. The white frame and stucco type predominates, and when the balance of the temporary buildings at present being used have all been replaced by permanent structures, the plant of this Station will present a very pleasing appearance.

Horticulture

Tree Fruits.—Situated in the heart of British Columbia's tree fruit area, the Summerland Station has devoted special attention to experimental work in this branch of horticulture. In 1916, a twelve-acre apple orchard was set out. Ten varieties of apples which were grown commercially in the Dry Belt of British Columbia, were used in the planting, and the trees were so arranged that each acre is a duplicate of the next. The orchard is divided into six blocks, each two acres in area, and each of these blocks is under a different system of cultivation.

The object of this experiment is to determine the most economical method of developing a young orchard and of maintaining it after it reaches bearing age. The effect of clean cultivation, alfalfa and vetch cover crops and various intercrops, on growth and vigour of trees, yield of fruit, texture and condition of soil, water requirements, and cost of operation is being recorded. This orchard is also serving for tests of systems of pruning and methods of thinning.

In addition to the cultural blocks, there are five acres of orchard devoted to the testing of apple varieties. This orchard is planted to two trees each of the more important varieties grown in the district, and two trees each of a number of seedlings and cross-bred varieties originated at Ottawa. The object of this experiment is to test varieties, old and new, under Okanagan conditions, for yield, keeping quality, hardiness, and disease resistance.

The recent construction of a packing house with storage basement has made it possible to carry on a number of experiments in the storage of apples. A study is being made of the effect of ventilation and humidity on the storage life of apple varieties. Data are also being collected with regard to the effect which various cultural conditions and methods of handling have on the keeping quality of fruit. An attempt is being made to determine the stage of maturity at which apples should be picked in order to ensure long storage life.

Similar work is being carried on with stone fruits, five acres being utilized in cultural, pruning and thinning experiments with plums, prunes, peaches, cherries and apricots.

Vegetables.—The work with vegetables includes the testing of varieties and methods of planting, the selection of improved strains and the study of irrigation requirements. An effort is being made to determine the varieties most suited to the district and also to develop new varieties or strains adapted to local needs and conditions. Particular attention is being paid to the improvement of cantaloupes and tomatoes, both of which are grown on a large scale in the southern Okanagan country. In order to ascertain the most economical irrigation practice for truck crops, information is being sought with regard to the most advantageous amount of irrigation water to apply per season, time to apply it, frequency of application, and amount to apply at each irrigation. It is expected that a greenhouse will be provided in the near future, so that more work with tender vegetables can be undertaken.

Ornamental Grounds.—The situation of the Summerland Station lends itself admirably to landscape work. While the Station is still young, a good start has been made in laying out the grounds. A large number of ornamental shrubs have been found to thrive under our climatic conditions, while the perennial border is a source of inspiration to the many visitors who frequent the Station grounds. Bulbs are used to good advantage in providing a display in the spring, while, in the summer and autumn months, the gardens are bright with annuals of many and varied hues.

Agronomy

Agronomy as conducted at this Station consists of four divisions: Field Husbandry, Forage, Cereal and Economic Fibre Production.

Experiments under way at the Station in systematic rotations and measurements of water as applied to crops under irrigation were probably the first to be conducted in the southern interior of British Columbia. In field husbandry, a seven-year rotation is under test as follows:—

First year, hoed crop; second year, spring wheat, followed by five years in alfalfa. The essential object of this rotation is to improve the soil, which is naturally deficient in nitrogen and humus. Alfalfa, being an excellent soil improver and a very productive crop under irrigation, is satisfactorily fulfilling the object in view. Advantage is taken of the hoed crop year to make comparative tests, for drought resistance and yield, of different varieties for corn and sunflowers for ensilage and stock feeding.

With forage crops very close attention is being given to the selecting and testing for hardiness, drought resistance, purity of type and yield in both green and dry matter, of grasses, clover, alfalfas, sunflowers, corn, sorghum, mangels, carrots, sugar beets and soy beans. Pioneer work in seed production is being conducted. .The object of this project is the production of pure foundation seed of standard, high-yielding varieties. This service has already been of great value to the seed growing industry of British Columbia.

With cereals, the work so far has been confined to testing varieties of wheat, oats, barley, and beans. Results of this work are on record from 1916 to 1923 inclusive.

In economic fibre production, several experiments have been conducted in growing hemp for seed. The object is to produce seed in the Dominion, thus avoiding payment of the existing high rate of duty. Tests to date, however, would seem to indicate that our growing season is too short for economic hemp seed production.

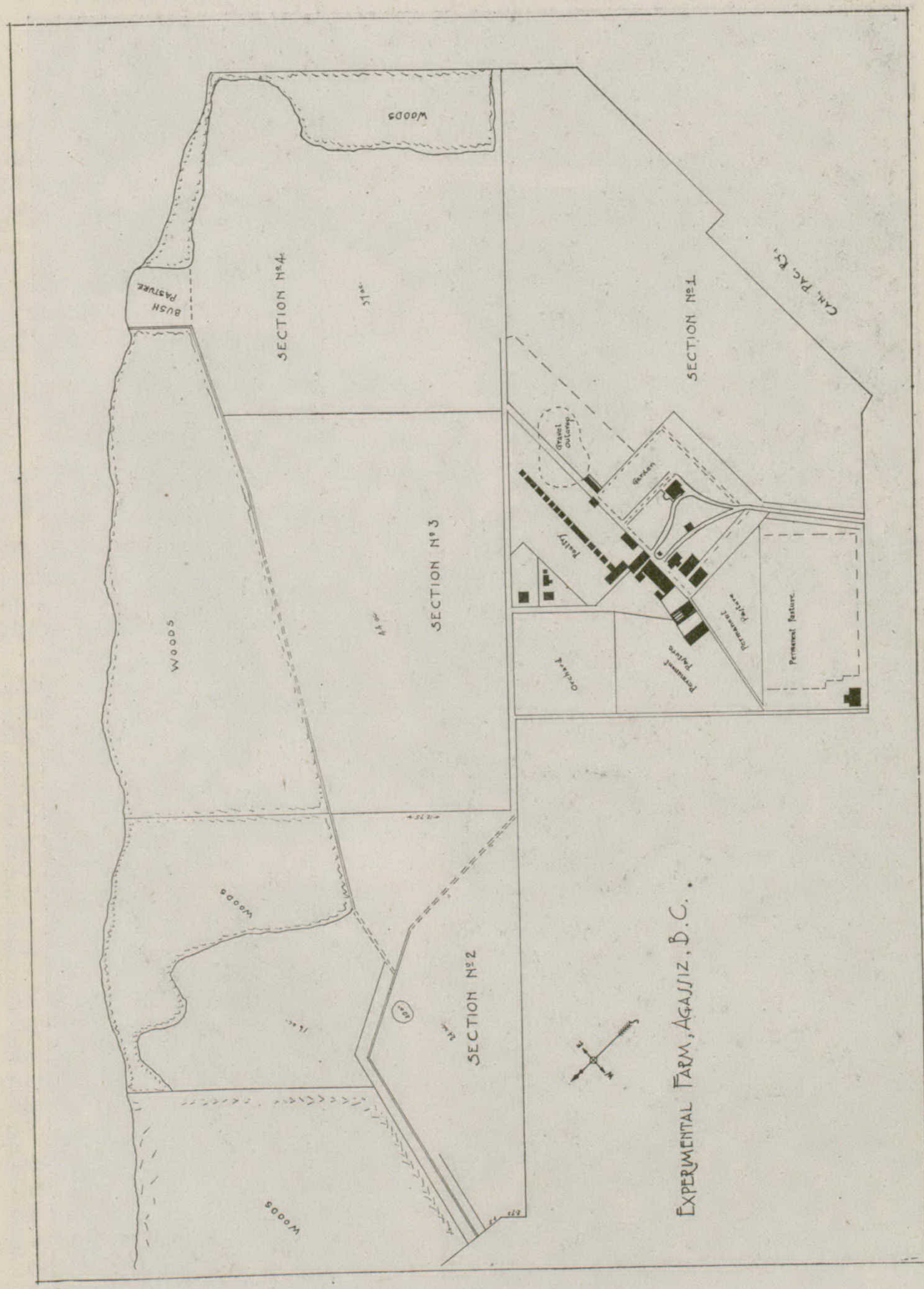
Live Stock

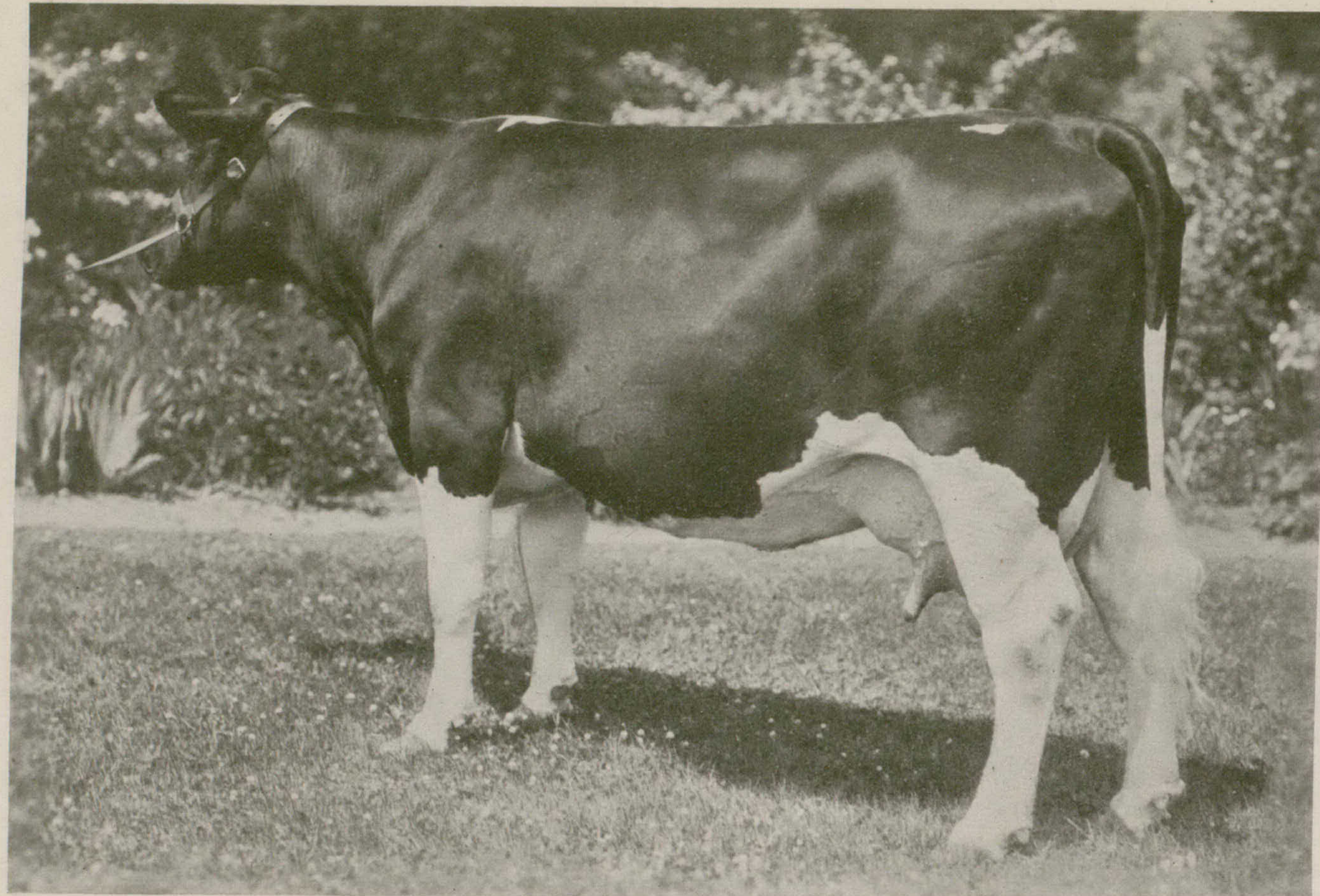
Live stock has not been developed as yet to any great extent at this Station, due chiefly to lack of range and pasture lands and other accommodation. A herd of high grade Berkshire swine and a flock of Cheviot sheep comprise the pure-breds at present on the farm. It will be possible to give the live stock work more consideration in the near future.

The poultry division has however, already made a very enviable reputation with the high producing quality of its stock, which consists exclusively of White Wyandottes.

Extension development has occupied a prominent place in the work of the staff at the Summerland Station. Illustration Stations have been established at different points in Armstrong, Salmon Arm, Kamloops, and in central British Columbia. These are administered under the Division of Illustration Stations, through the Summerland Station. The supervisor of these has rendered invaluable service in extending the work of this Station to those outlying districts.

The Summerland Experimental Station may be said to have performed its greatest good in extension work with the fruit growers of the Okanagan Valley proper. A great deal of effort has been expended during the past few years towards assisting the fruit growers of this district in their local problems, and in promoting sound agricultural practices in general. Work of inestimable value to them has been performed. The greatest emphasis has been placed on soil building programmes and the available time of the staff has been, to a great extent, devoted to individual supervision of this problem. Series after series of meetings have been held in recent years, and as a result the fruit growers of the district hold the Station in very high regard. From this, it can be inferred that the work has been of value to the Okanagan district.


EXPERIMENTAL FARM, AGASSIZ, B.C.
SECTION No 1
SECTION No 2
SECTION No 3
SECTION No 4
CAN. PAC. Ry.
WOODS
WOODS
WOODS
WOODS
BUSH PASTURE
Garden
Gravel outcrop
Poultry
Orchard
Permanent Pasture
Permanent Pasture
Permanent Pasture



Agassiz Segis May Echo, World's Champion Butter Producer from January to June, 1923. Production in 365 days, 30,886 lbs. milk, 1,681·25 lbs. of butter.
—Experimental Farm, Agassiz, B.C.

THE EXPERIMENTAL FARM FOR BRITISH COLUMBIA

W. H. Hicks, B.S.A., *Superintendent*

The Farm at Agassiz was purchased by the Dominion Government in 1888 and possession was obtained in September, 1889. It is situated at the station of the same name on the main line of the Canadian Pacific Railway, 70 miles east of Vancouver. The Farm lies under the shadow of Mount Cheam, about two miles from the Fraser river and five miles from Harrison lake.

The property consists of some 1,400 acres, 300 of which have been, or can be, brought under cultivation. The remainder is mountain or "bench" land, which was purchased to preserve the fine growth of timber trees on it and also to test the possibility of setting out orchards on the mountain slopes, where the situation made it otherwise impossible to make use of the land.

The soil is a loam of varying quality, underlaid with gravel. Near the mountain it is more peaty in nature, but fertile when cleared and drained. Of the 300 acres of bottom land, 250 have been cleared so far.

Water for the stock and domestic use is supplied from a concrete and stone reservoir on the mountain side, from which it is piped to the various farm buildings.

Although work along all the main lines of agriculture has been carried on here since the establishment of the Farm, a specialty was made of the testing of varieties of fruits, and of forest, nut and ornamental trees. This work was carried on for twenty-two years, and a very complete collection of data gathered as to the suitability of varieties for this part of British Columbia.

With the development of agriculture in other parts of the province from time to time, it was found that many sections were much better suited for fruit-growing, both from their climatic and soil conditions, than was the Agassiz district, where the winter weather is very changeable, ice-storms occasionally causing great damage by breaking down the trees, and severe frosts, occurring when the soil is saturated with moisture, leading to extensive winter-killing. The weather is frequently cold and wet at blossoming time, and lack of sunshine prevents good colouring of the fruit The results obtained from the orchards on the mountain slopes were much more favourable than from those on the bottom land, due partly to better drainage and, perhaps, to the higher altitude as well, but owing to the difficulty in reaching these areas this work was discontinued.

The results at Agassiz with forest and nut trees have been fairly successful. A considerable area is devoted to the growing of shrubs, hedges and flowers, and on the lawns almost every variety that will grow in this climate may be found. In the flower garden, roses, bulbs, perennials and from eighty to one hundred varieties of annuals give bloom from the latter part of March to November 15 and in some seasons, later.

In 1911, it was decided to make a change in the character of the experimental work most extensively to be pursued at the Agassiz Farm. As indicated above, the horticultural possibilities of the district had been thoroughly explored and its drawbacks as compared with newly opened and more favourable districts were evident. While, therefore, horticultural work at the Agassiz Farm has been continued, in the above year it was decided to go more especially into dairy farming, a line of work in which little had heretofore been done experimentally, but which had become one of the chief agricultural industries of the district.

Animal Husbandry

Cattle.—During the period from the establishment of the Farm until 1911, little work was attempted with dairy cattle while in the last few years of that period a good herd of Shorthorns had been collected. At that time it was decided to go more extensively into dairy farming and since then till the present day dairying has been the most important branch of the Farm work. In December, 1911, 28 head of grade Holstein females were imported from the Province of Ontario, accompanied by a pure-bred bull, in the effort to form a grade herd of high-producing cows by the use of pure-bred sires, and to demonstrate what could be done in turning out first-class dairy products at a profit. Feeding experiments of many kinds were also carried on, the results of which have been of value and interest to dairy farmers, the more important ones probably being comparisons of corn, clover, peas and oats and sunflower silages. It is interesting to note that milk production in the grade herd was increased 29.72 per cent and butter fat production 25.09 per cent in two generations, by the use of good sires.

After ten years' work with the grade cattle they were disposed of to make room for the rapidly increasing pure bred herd which was started in June, 1912, by the purchase of three foundation cows and added to in October, 1915, by two two-year old heifers and two heifer calves, in December, 1920, by a yearling heifer and in December, 1922, by another yearling heifer. These nine females cost less than $2,000, and with their progeny now total at the present seventy-six head. This herd is one of the best of its size in Canada, not only from the standpoint of type but also of production. They have competed at Class A Exhibitions in British Columbia and have always won a championship where shown, as well as many first prizes. Yearly testing under R.O.P. rules has been carried on extensively. Nine records of over 18,000 pounds of milk in a year and five of over 20,000 pounds have been made, besides many creditable records by two-year old heifers.

The famous past world's record butter producer, Agassiz Segis May Echo, was born and developed on this Farm. She produced ,in 365 days, 30,886 pounds of milk and 1,681·25 pounds of butter. This was the world's record from January to June, 1923.

Testing for tuberculosis has been regularly and carefully done, without locating any re-actors during the past nine years. When the Federal Accredited Herd schemes were inaugurated, the Agassiz herd was entered and was one of the first to qualify.

The milk from the cows is removed to a modern-equipped farm dairy where a portion of it is separated, the skim-milk going to the calves, pigs and poultry, while considerable of it is used for experimental work in cheesemaking. Cream, Pont l'Eveque, Cheshire, Wensleydale and Stilton cheese have each been made in varying quantities and of excellent quality. The Stilton especially is of prime quality, being considered equal to that imported from England.

The change from chiefly horticultural work to dairying, in 1911, necessitated the erection of several buildings. A new dairy barn was built, in which an attempt was made to combine cheapness and utility with sanitary conditions, light and air. The stable was made to hold forty-two cows and has concrete floors and iron fittings throughout. It is 86 feet by 39 feet with 9-foot ceiling and has a feed and mixing room 22 feet by 25 feet to which three silos are joined. The latter are of wooden staves, are 18, 16 and 14 feet in diameter and 30 and 36 feet high, with a total capacity of approximately 600 tons.

The original stone wall stable to which the new barn was joined was remodelled, first with four box stalls for cows and an equal number of calf pens and later, when the horses were provided with a new barn, six other box-stalls were provided for cows and three calf pens were added.

Horses—Previous to October, 1917, horses were maintained solely for working purposes. At that time an imported Clydesdale mare Melita was purchased and, later, four Canadian-bred fillies were secured. These have formed the basis of a good Clydesdale stud, numbering at the present time twenty-three head, nineteen of which are pure-bred. They provide the horse power for farming and a few of the best mares raise foals each year. One of the choicest mares is Melita Pride, bred on the Farm and sired by Pride of Dumburle. This filly was Grand Champion at Portland, U.S.A. in 1922 and at the Provincial Exhibition New Westminster, B.C., in 1923.

Sheep.—For a number of years, a fair-sized flock of Dorset Horned sheep has been maintained on the Experimental Farm. The flock is a good one, of excellent type and very prolific. They are noted for their fecundity and frequently produce triplets, which they raise well. A specialty is made of raising lambs out of season and selling to the Easter market. This has proved a profitable branch of the sheep business in this province, particularly during prosperous times. Of late years, a few of the best individuals from the flock have been shown at the largest Coast fairs and have always carried off more prizes than any other two flocks. The senior flock ram has been a Grand Champion eight times and never defeated. Some excellent work in improving grade flocks with good rams has been accomplished and valuable data in connection with feeding experiments are available.

Swine.—At first, the swine on the Farm were kept chiefly for supplying pure-bred stock to people in the out-lying districts of the province rather than for experimental feeding purposes. The demand for young stock has been usually greater than the supply. As the by-products of the dairy herd increased, hog raising was entered into more extensively and some very valuable and interesting data were secured. This is particularly true regarding the value of rice meal and other rice products for swine feeding. Only one breed is kept at the present time i.e., the Yorkshire, as this breed is well suited to conditions in this province and is quite popular. A modern piggery was built in 1915. It is equipped with ten pens, feed cooker, scales and storage space for feed and bedding. This building is used for the sows only at farrowing time and for fattening market pigs. The breeding stock is housed in portable cabins placed in the bush, where the sows get plenty of exercise and not too much feed.

Poultry

About two acres of land, part of which is well shaded by a nut plantation, forms the area devoted to the poultry plant. The poultry department, as it is today, differs considerably from the plant in its early history, when it contained only three houses. These were what is known as the "Ottawa Cotton Front" the "Woods" and the "Tolman", all of the same size, viz., 20 by 14 feet. Originally, no less than six breeds were represented, but with development of various lines of work it was found advisable to reduce the number of breeds to two, one being the Barred Plymouth Rock, a worthy representative of the general purpose type and familiarly known as the "farmers' favourite". The other breed, representing the purely egg-laying type, is the Single Comb White Leghorn, which is unexcelled as the premier bird of the British Columbia commercial poultryman.

Considerable experimental work is being carried on from year to year in feeding, range vs. confinement, various styles of housing, in fertility and hatchability, while pedigree breeding is carried out in such detail that every bird retained for breeding purposes is pedigreed. In the hatching season, settings of eggs are sold, the demand always being greatly in excess of the supply and for breeding purposes the demand for cockerels is always considerably more than can be met.

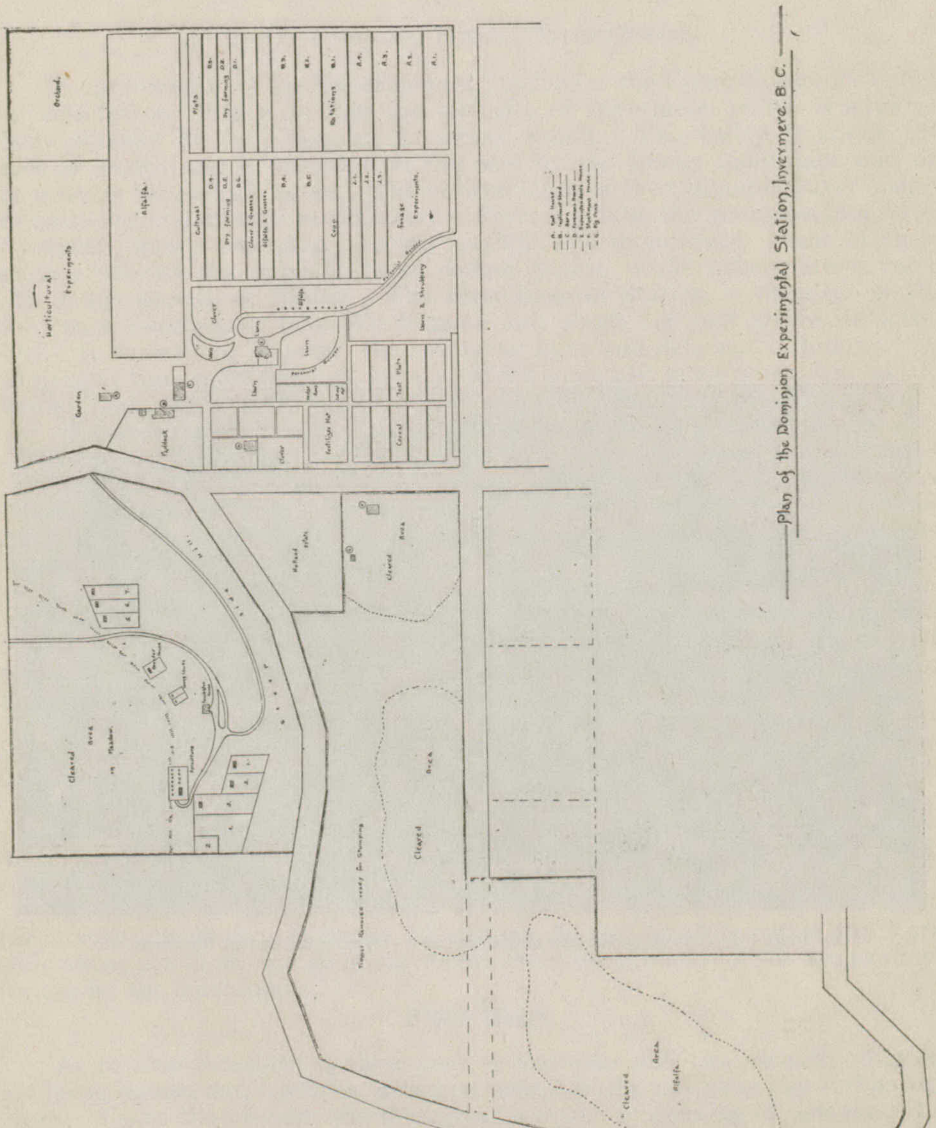
With the inception, three years ago, of an Egg Laying Contest at the Farm, the poultry work took another leap forward. The contest is conducted as one of a chain of contests carried on throughout the Dominion by the Experimental Farms Branch and open, in each province, to poultrymen within that province. Besides the value of any advertisement each contestant may receive, these contests are the only channel leading to registration whereby, after qualifying in such a contest by laying 200 eggs or over, these eggs weighing 24 ounces to the dozen, and conforming to the required standard of the breed concerned, a bird can be registered in the Canadian National Poultry Record Association. This scheme of registration of poultry has been recently inaugurated throughout Canada and is the first of its kind in existence. In the three contests to date, the Farm pens have taken high honours. In the 1920-21 contest, the Farm Barred Rock pen stood sixth out of twenty-six pens with the White Leghorn pen seventh; in the 1921-22 contest, comprising twenty-nine pens, the Farm won with a Barred Rock pen, the average of this pen being 260 eggs per bird, while the White Leghorn pen stood second; in the 1922-23 contest, composed of thirty-six pens, the Farm Barred Rock pen finished first with the White Leghorn pen fifth. These results are in themselves sufficient evidence of the fact that the poultry department has developed into one of great importance on the Farm, particularly as the Farm birds have been brought in this way into close and successful competition with the birds of the foremost poultry breeders of British Columbia where the poultry industry is in the front rank.

Bees

A few colonies of Italian bees are always kept. They prove a profitable sideline, as they winter successfully outdoors and, in most seasons, produce a fair crop of honey.

Field Husbandry

The aim of the field work is the supply of suitable feeds for dairy cattle as well as for hogs, sheep, chickens and horses. The Farm is divided into four fields which are worked as a four-year rotation consisting of: first year, hoed crop; second year, grain seeded down; third year, hay; fourth year, pasture. Other sections are devoted to the growing of cereal varieties, forage crops, varieties of grasses, clovers, roots, corn and sunflowers. Flax for fibre can also be grown successfully, but as yet, no market is available in British Columbia for this product. Some valuable data have also been secured on the value of commercial fertilizers in determining the most profitable combination and quality of a mixture as measured by its influence, in relation to cost, throughout a three-year rotation.



Plan of the Dominion Experimental Station, Invermere, B.C.

Cambridge Russett Potatoes, just prior to blooming, 1922—Experimental Station, Invermere, B.c.

THE EXPERIMENTAL STATION FOR THE UPPER COLUMBIA VALLEY

R. G. Newton, B.S.A., *Superintendent*

The present site of the Experimental Station for the Upper Columbia Valley was selected in 1910, adjoining the townsite of Invermere, which is situated about midway of the Columbia-Kootenay Valley. The valley is about 190 miles in length and is bounded on the east by the Rocky mountains and on the west by the Selkirk range. The bottom lands of the Columbia River Valley are quite flat and alluvial in character. From the flats, the land rises in a series of benches, finally emerging into the foothills and mountains. Some of these benches present the appearance of rolling prairie, while others are covered with a fine growth of timber. The Experimental Station is situated on the first bench overlooking lake Windermere and about 150 feet above its water level. It consists of 70 acres, the soil being light and deficient in humus. At the present time there has just been acquired some 240 acres across the lake at Windermere. This additional area is needed for increased work in forage crops, field husbandry and live stock. Clearing commenced at Invermere in 1911 and the first crops were harvested in 1912. When the Station was started, fruit growing was the main feature, but it has been fairly well demonstrated that tree fruits are not a commercial proposition in this district; however, the growing of the hardier varieties for home consumption should be encouraged on all the farms and ranches.

The average annual precipitation as recorded at the Station during the past nine years is 11·98 inches, varying from 14·47 in 1915 to 9·17 in 1922. Of this, a little more than half falls between April and September, so that irrigation is absolutely necessary if crops are to be assured. Irrigation water is supplied to the Station, by the local irrigation company, between May 1 and September 30. We are confident that if later applications of irrigation water were made there would not be so much winter killing of the clovers throughout the district. Irrigation would certainly improve all sections of the valley where dry-land farming exists at the present time.

The following numbers of projects are being carried on at the Station:—Animal husbandry, 3; forage crops, 8; field husbandry, 4; cereals, 5; horticulture, 64; poultry, 10; apiary, 6.

On account of the present small acreage, very little work has been undertaken with live stock. However, Clydesdale horses, Ayrshire cattle and Yorkshire swine are kept, and good representative sires of these breeds are available for use by the community.

Field Work

As to crop rotations, a three-year, a four-year and two six-year rotations are being carried out, featuring potatoes, peas, cereals, and some hay and pasture crops. Up to the present, the three-year rotation (consisting of oats seeded to clover; clover; potatoes) has shown the greatest returns per acre. Clover, alfalfa, and mixtures of clover and grasses are being tried as hay crops. Clover winter-kills badly, especially when going into winter with insufficient root moisture. Alfalfa is strongly recommended for long rotations or as a permanent crop. Two crops of alfalfa are harvested each season, running from 4 to 5 tons per acre. Three cuttings for hay could be made, but better results are obtained by pasturing, or ensiling the last cutting. For a short rotation, clover and grasses have out-yielded alfalfa and grasses over a three-year period, the grasses standing in the following order: meadow fescue, Western Rye, orchard grass, timothy and tall oat. Several select strains of Western Rye grass are being tested alongside of commercial seed and are showing up as decidedly superior to the latter. Variety tests with the following forage crops are being conducted: corn, sunflowers, swedes, mangels, sugar beets and carrots. Various cultural and fertilizer experiments are being conducted with grains and potatoes. Variety tests with wheat, oats, barley and peas are being carried on. Field peas are, possibly, the most outstanding crop in this line, Prussian Blue averaging 58 bushels per acre for the past five years. The average yield of the other leading cereals over a six-year period is as follows: Marquis wheat, 36 bushels; Huron wheat, 36 bushels; Banner oats, 73 bushels; Gold barley, 49 bushels per acre.

Horticulture

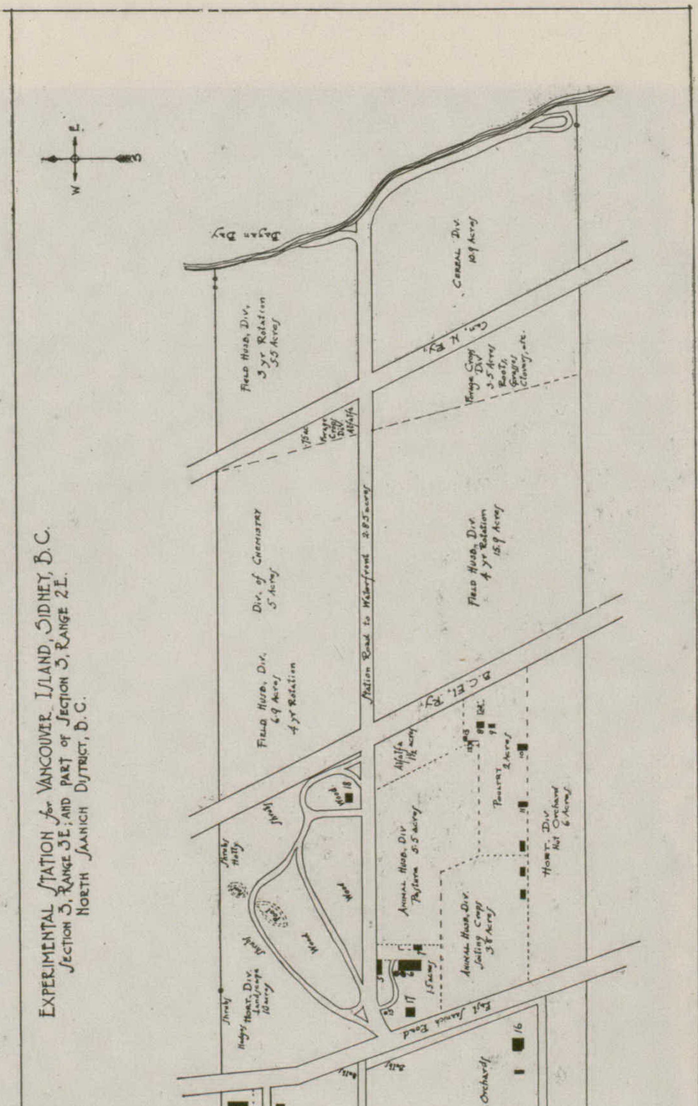
As previously mentioned, the Station was primarily started to test out the district as a fruit-growing section, but that apples had not proved a commercial proposition. Hardy varieties such as Wealthy, Yellow Transparent, Rupert, Dudley, Okabena, Pinto and Charlamoff, may be grown for home consumption. Crabs, currants, raspberries and strawberries do very well, but, on account of our late season, they reach the market at the end of the season and are, therefore, at a discount. Variety tests of fruits, vegetables and flowers are carried on, and during the past eight years data have been collected on these. On account of our short season without frost, usually from the middle of June until the 1st September, special cultural methods have to be adopted in forcing to maturity such fruit as tomatoes, cucumbers, melons and squash. Potatoes and peas are the most outstanding vegetables, on account of their large yields. Forty-five varieties and strains of potatoes are being tested and a great many cultural experiments are under way. Last season, in the variety tests of potatoes the yields ran from 14 to over 50 tons to the acre. A stock, or strain, of Lincoln peas that has been developed on the Station was sent out to the other Farms and Stations throughout the Dominion, and about 75 per cent reported that it had stood first in their variety test. A number of seedling selections at the present time promise to outyield this variety considerably, and are of equal quality.

Poultry

In the poultry section, White Leghorns and White Wyandottes have been experimented with at the Station. Pedigree trap-nesting is carried on, a superior strain of high producers being the object in view. Various poultry houses have been tried, the one giving the best satisfaction is the farmers' hen-house with a capacity for 100 birds. Hatching, feeding and fattening trials are carried on and data collected. The most outstanding achievement from the poultry is the record of "Lady Dot", E.3, which produced 325 eggs in her pullet year and 224 in her second year. In her second year, thirteen sons and thirteen daughters were raised from this bird. The males were distributed, as far as possible, to other Farms and Stations. A small flock of Bronze turkeys is kept, and no difficulty or trouble has been experienced with black-head, the dreaded turkey disease.

Bees

The apiary for demonstration and experimental work has shown very good results for the past seven years, the average production per colony for that period being 90. pounds of extracted honey. Experiments in swarm control, feeding and wintering are being carried on. The Kootenay hive case has been used with good results up to last winter, which was very severe and during which losses occurred. The honey is put up in 5-pound containers and finds a ready market. The district is one of the few sections of the Province that are free from foul-brood.



EXPERIMENTAL STATION for VANCOUVER ISLAND, SIDNEY, B.C.
SECTION 3, RANGE 3E; AND PART OF SECTION 3, RANGE 2E.
NORTH SAANICH DISTRICT, B.C.
W
E
S
Division of Horticulture 46 acres.
" An. Husbandry 10.8 "
" Poultry 2 "
" Forage Crops 4.25 "
" Chemistry 5 "
" Cereals 10.9 "
" Field Husb. 25.3 "
Railroads 6.3 "
Public Roads 2.1 "
Beach Road 2.85 "
KEY.
1. Well.
2. Office.
3. Old Barn.
4. Horticultural Barn.
5. Implement Shed
6. Dairy Barn
7. Bull Pen
8. Poultry Adm. Bldg.
9. Brooder House
10. Laying House
11. Laying House
12. Fattening Shed
13. Bee House
14. Bee Yard
15. Weigh Scale.
16. Supt's House
17. Office.
18. Cottage
19. Pump House.
ARBORETUM
HORT. DIV.
Orchard
Nursery
Vegetables
Small fruit
HORT. DIV.
Total 30 acres
Orchards
Orchards
HORT. DIV.
East Saanich Road
HORT. DIV.
Landscape
10 acres
Shrubs
Hedges
Wood
Wood
Wood
Shrubs
Holly
ANIMAL HUSB. DIV.
Pasture 5.5 acres
ANIMAL HUSB. DIV.
Soiling Crops
3.8 Acres
Alfalfa
Poultry
2 Acres
HORT. DIV.
Nut Orchard
6 Acres
B. C. El. Ry.
FIELD HUSB. DIV.
6.9 Acres
4 yr Rotation
DIV. of CHEMISTRY
5 Acres
Station Road to Waterfront 2.85 acres
FIELD HUSB. DIV.
4 yr Rotation
15.9 Acres
Forage Crops
Div.
Alfalfa
Forage Crops
Div.
3.5 Acres
Roots,
Grasses
Clovers, etc.
Can. N. Ry.
FIELD HUSB. DIV.
3 yr Rotation
5.5 Acres
CEREAL DIV.
10.9 Acres
Bazan Bay

Oats—Fall-sown—Experimental Station, Sidney, B.C.

THE EXPERIMENTAL STATION FOR VANCOUVER ISLAND

E. M. Straight, B.S.A., *Superintendent*

Establishment.—The Experimental Station for Vancouver and adjacent islands was established in the North Saanich district, near Sidney, in 1912. The land when purchased was in bush and heavy timber, but, except for the park area, the Farm is now cleared and in a high state of cultivation. The clearing of land on Vancouver island constitutes a problem of considerable magnitude, for the rocks, like the trees, are large. When these giant trees are removed, the area levelled and made fit for the plough, a very considerable portion has to be tile drained, adding greatly to the labour and consequent cost. The total area of the Farm, since the purchase of the Victoria and Sidney right of way, is about 130 acres.

Situation.—The Station is delightfully situated on the strait of Georgia, about 15 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 British Columbia Electric with a station on the property. These, with several bus lines, make transportation to and from Victoria easy, but from the northern part of the island the whole peninsula is difficult of access. The proposed ferry to be inaugurated next year connecting Patricia and Mill Bays will make Vancouver island a unit as nothing else would.

Soil.—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, without apparent cause, from a black prairie soil to muck, to hardpan, to brick clay or to sand. This variation makes it difficult to obtain uniform and sufficiently large areas to conduct exact experimental work, yet it broadens the scope of an investigation for the project may be repeated on various types of soil.

Buildings.—The buildings consist of superintendent's house, foreman's cottage, gardener's cottage, dairy barn, horse barn, implement shed, root house, horticultural building, office, and numerous laying sheds and colony houses in connection with the poultry plant. During 1923, a continuous poultry contest house of sufficient size to accommodate thirty-four pens of pullets was constructed.

Though practically all phases of farm work are represented at the Station, particular stress is laid on horticulture, apiculture, and poultry husbandry. Cereal husbandry, forage crop work, field husbandry and live stock all receive their share of attention, but the major part of the work is given to the more intensive side of agricultural production—that in which the farmers on Vancouver island are chiefly concerned.

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 specimen trees of 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 vs. clean cultivation, and clean cultivation vs. cover crop, are standard projects.

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 expansion in this line is hoped for.

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 enquiries 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.

Vegetables.—Variety tests with vegetables, together with all standard cultural methods, have been, and are, under trial. Many theories concerning vegetables have been exploded and the truth concerning their growth demonstrated over a period of many years.

Flowers.—One of the most attractive features of the Farm is the display of flowers, consisting of annuals, perennials and shrubbery. The collection is large and quite complete. Much of the world has been drawn on in getting the collection together. The mildness of the climate has permitted the use of many semi-tropical plants not found in other parts of Canada. Roses are in bloom from spring until December, while a constant succession of flowers is to be had from the time the crocus pushes through the frosty earth until the end of the year.

Apiculture

The possibilities of apiculture are receiving close attention. 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 still under investigation. The island is being mapped from the beekeeper's standpoint as rapidly as time will permit, and the various systems of wintering, prevention of swarming, etc., are under test. During the past season eight projects were either in the process of being investigated or completed.

Poultry Investigations

Poultry work at the Station, in keeping with the importance of the industry on Vancouver island, is an outstanding feature of the work, which is not only comprehensive but exact. White Wyandottes are kept exclusively. The work being done 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 investigations 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 obtaining future layers, breeders, or market birds, are distinct problems and must be considered as such. The project now under study 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 the electric, 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 feed cost of raising young chicks, which has been found to amount to 9·5 cents per chick up to eight weeks old.

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

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 average 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.

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 factors 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 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; and from

5 to $5\frac{1}{2}$ pounds, 208·8; $5\frac{1}{2}$ to 6 pounds, 197; over 6 pounds, 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 always 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 better 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 from the two pens (confinement vs. 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 cheaper than beef scrap.

Cereals

Perhaps no more interesting line of work has been undertaken than that with the common grains. During the growing season the moisture content of the soils of this district is never sufficient for best results, while the winter rains are excessive. This moisture factor suggests the line of procedure, if grains can be found of sufficient hardiness to withstand the Vancouver island winter. The whole of America has been combed to secure such seed. For the last two years we have been able to report wheats, barleys and oats quite hardy under our conditions, while the yield when fall sown is often double that of the same variety when sown in the spring. The winter moisture is utilized, while the crop is harvested the next year during the driest time. During 1923, eight main projects in the cereal department were being investigated.

Forage Crops

Forage crops receive as much attention as the limited area will permit. Here all the forage crops such as roots, corn, sunflowers, etc., are grown and the behaviour of each noted. At present sixteen projects are being carried on.

Animal Husbandry

A small herd of dairy cattle (Jerseys) is kept at the Farm. Among these "Plashes Model Jessie" has just completed her R.O.P. with a production of 16,018·9 pounds of milk. Other cows have done nearly as well. The cost of milk production and breeding problems are being studied.

Field Husbandry

The work in field husbandry has been confined to the regular rotations running over three, four and five years, but varying somewhat to suit the peculiar conditions of the Pacific coast. The cost of production of the various crops is obtained as well as the relative profit or loss between the different rotations. The most profitable line of procedure is thus arrived at.

General

The effect of fertilizers, singly and in combination, is being noted and the sugar content of beets, ensilage mixtures, etc., receive attention.

In the botanical division, the weeds of the district and plant diseases have been studied in general, while a few problems such as "control of moss on lawns" and "rose mildew" have received special attention.

Illustration Stations

A commencement has been made in the endeavour to demonstrate some of the results obtained on the Sidney Experimental Station by establishing two Illustration Stations on the island. It is hoped to increase the number of these in the near future.

THE EXPERIMENTAL SUBSTATIONS

For ascertaining the agricultural possibilities of a remote district, where the establishment of a regularly equipped experimental station is not warranted, for a time at least, the "substation" fills a most useful purpose. Its location and operation are simple and inexpensive. A farmer of the district is found possessing a good practical knowledge of agriculture and a willingness to undertake the work and from him a varying area of his farm is rented, he to conduct experiments according to instructions and report results in return for a payment for services as agreed upon.

The above is the typical arrangement made although, when expansion of work warrants, larger areas may be rented and the operator's full time employed thereon; or on the other hand, when the amount of work desired is very small, the operator is paid a small sum yearly, simply to test seeds sent him, no rental being paid.

Experimental Substation, Fort Vermilion, Alta.

The oldest substation of the Experimental Farms system is that of Fort Vermilion on the Peace river, some 350 miles north of Edmonton, in 58° 24′ north latitude, 116° west longitude and at an elevation of 950 feet above sea-level. Work here commenced in 1908 on an area of 5 acres rented from Mr. Robert Jones, a farmer of the district, who has since conducted the experimental work. This work has grown until 25 acres are now devoted to experiments in cereals, forage crops, horticulture, field husbandry, etc., Mr. Jones' full time now being taken up by the Department of Agriculture.

Excellent results have been obtained from the experimental work conducted at this point. In no season has there been a crop failure; in fact Mr. Jones states that a "crop failure is unknown". The growing season is, of course, short, but in summer the "day" i.e. from sunrise to sunset is some 18 hours long and growth is extremely rapid.

In horticulture all the hardier sorts of vegetable, such as beets, carrots, onions, lettuce, radish, parsnips, spinach, potatoes, and turnips, and also more tender kinds such as beans and corn, grow readily in the open. Others such as cabbage, cauliflower and tomatoes are started under glass, as is done in other parts of Canada.

Small fruits, such as strawberries, currants and raspberries do well; gooseberries, plums and apples have not yet succeeded and work is being continued to secure forms of these hardy enough to resist winter-killing.

Flowers bloom profusely and the hardier varieties of ornamental trees and shrubs have done well.

The success with cereals has been outstanding. Early maturing varieties must, of course, be used and the yields of these are never as high as are obtained from varieties having a longer season, yet the six-year average of five varieties of wheat has run from 58 bushels 40 pounds per acre to 41 bushels 50 pounds with a weight per bushel from 64.9 to 62.7 pounds. Three varieties of oats tested for the same period, gave yields of from 88 bushels 33 pounds to 63 bushels 2 pounds per acre; four varieties of barley from 60 bushels 40 pounds to 51 bushels 42 pounds and two varieties of peas on a seven-years' average, yielded 35 bushels 52 pounds and 34 bushels 20 pounds respectively.

With forage crops, the work, although not very extensive, has been sound, and productive of valuable results. Roots such as swede and garden turnips, mangels, sugar beets and carrots have given good returns. Indian corn for ensilage is not a sure crop, the shortness of the growing season preventing its reaching a stage to make good ensilage. Sunflowers for ensilage, however, tested in 1921 and 1922, gave very promising results, both as to quality and yield.

With grasses and clovers, alfalfa, sainfoin, red clover and alsike, brome grass, timothy, western rye grass, meadow fescue and several annual grasses, such as canary grass and millet, have been tested. Yields of all these have been most satisfactory. Some difficulty was at first experienced with alfalfa, owing to winter-killing, but by the use of hardier varieties and strains, this has been largely overcome.

NOTE.—For further details of experiments at Fort Vermilion, weather records, etc., the reader is referred to Experimental Farms Bulletin No. 6, New Series, Results of Experiments at Fort Vermilion, Alta., which may be obtained free on addressing the Publications Branch, Department of Agriculture, Ottawa.

Harvesting Variety Plots of cereals at Beaverlodge, 1923

Experimental Substation, Beaverlodge, Alta.

Work here was undertaken in 1914, by Mr. W. D. Albright, who volunteered to do some experimental work upon his farm, without remuneration. It has since gradually expanded until now over forty acres are devoted to experiments in cereals, forage crops and horticulture. Some work with live stock is also undertaken. An experimental silo has proved the feasibility of ensilage practice in the district. Mr. Albright's time is now fully taken up with the work.

The substation is located some 28 miles west of the town of Grande Prairie and 25 miles east of the boundary of British Columbia. Its altitude is 2,500 feet above sea-level.

Temperatures and precipitation records have been accurately kept since the latter part of 1915 and an evaporimeter, a soil thermograph, and a sunshine recorder were installed in 1922. A study of these records indicates that while, in the average year, temperatures are rather low and the rainfall only moderate and somewhat irregular, yet restricted evaporation and the absence of scorching heat waves permit of the most effective use by crops of the soil moisture available.

The work at the Beaverlodge Station covers a very wide field, although, of course, in no particular line has it yet been possible to carry on a very large amount of detailed research and experiment owing to limitations of staff, equipment, and land. The problems connected with forage crops are perhaps among the most pressing in this district, both as a source of fodder to permit of successful live stock husbandry, and also as preserving soil fertility. The experimental work going on includes:—

Forage Crops

(1) *Nurse Crop Experiments.*—This includes comparison of effects of seeding down with and without nurse crops; comparison of the various cereals as nurse crops, and at varying rates of sowing. It has so far been found that the seeding of hay crops alone without a nurse crop has given the heaviest yield, though possibly it is not the most profitable practice.

(2) *Pasturing Test in Seeding Down.*

(3) *Grass and Clover Mixture Experiments.*—This is to compare various mixtures of grasses and legumes for hay production. It has been found so far that the combination of alfalfa and Western rye has given the best yields.

(4) *Thickness of Seeding Tests with Grasses.*—In order to secure the best rate of seeding for timothy, Western rye, and Red top for general farm practice, five pounds per acre of timothy seed is recommended; Western rye should be sown more thickly, but the best rate is not yet decided.

(5) *Inoculation Tests with Legumes.*—The necessity of this has been very clearly indicated by the experiments carried on.

(6) *Legume Root Penetration of Hard Sub-Soils.*—The extent and effect of root penetration on hard sub-soils is most surprising, as shown by the results obtained.

(7) *Cultural Experiments with Alfalfa.*—It has been found that when not inoculated, alfalfa has given the very best results if seeded thinly in inter-cultivated rows, but when inoculated, the larger yields have generally been obtained from broadcast seeding, except in extremely dry seasons.

(8) *Variety Tests with Alfalfa.*

(9) *Grasses and Clovers for Seed Production.*—All the common grasses and clovers have regularly demonstrated their ability to mature good seed in ample quantities in this district, with the exception of alfalfa previous to 1922. During the last two years, however, alfalfa has ripened good crops of seed.

(10) *Variety Tests of Sunflowers and Corn.*—Sunflowers have proven a productive crop for ensilage, but earlier varieties are desired. Several of these originated in the Cereal Division are now under further test. With corn for ensilage, the average temperature is too low to make it a safe crop.

(11) *Variety Tests of Field Roots.*—These are an irregular crop under ordinary cultural conditions.

(12) *Variety Tests with Clovers and Grasses.*—A considerable number of plots are devoted to this work, including tests of some of the best strains of rye grass selected at Ottawa.

(13) *Miscellaneous Forage Crops.*—Millets and Sudan grass have proven too tender. Rape is but a moderate success in broadcast formation but does well in drills. Oats on well-prepared land often yield three to four tons of cured forage per acre. Combinations of oats with peas and vetches have scarcely been so productive.

Cereals

The work with cereals includes varieties of all the most likely kinds of spring wheat, oats, barley, rye, and peas, and also with a few kinds of winter rye, winter wheat, and other winter annuals. With the spring grains, very early sorts are not desirable owing to adverse conditions early in the season; on the other hand, late varieties are too subject to frost before maturity, so that the medium early sorts are best suited to the Grande Prairie district. Plot yields at the Substation have run as high as 136 bushels per acre of Victory oats and 68 bushels per acre of Huron wheat. Some of the most promising varieties and strains of spring wheat grown in 1923 were Ruby, Garnet, and Early Triumph. Among oats, the standard old variety, Banner, ranks high. Other good kinds are Ligowo, Gold Rain, Abundance, and Victory. The Liberty hulless oat does well, giving a yield equivalent to about 107 bushels of ordinary oats. Tests of varieties of some 15 barleys and 11 sorts of peas are also under way. Spring rye, flax and buckwheat all yielded well in 1923. Three kinds of winter rye, six of winter wheat, also winter barley, emner, oats and hairy vetches have been seeded this year. In the past as high as 57 bushels of winter rye per acre have been harvested.

The work with field husbandry comprises thickness of seeding tests, date of seeding experiments and cultural work.

The investigational work on soils and fertilizers is very carefully conducted and is already yielding most valuable results. Data so far obtained would seem to indicate that, owing to climatic conditions, soluble nitrogen probably takes rank second to moisture as a direct limiting factor in crop production.

The possibilities of horticulture in the Grande Prairie district are being well demonstrated; currants, strawberries, and raspberries are regularly raised with fair success for local use, and all the usual garden vegetables are successfully grown. Potatoes have given yields ranging from 100 to 460 pounds per acre according to conditions of the season. It has been found that sprouting in trays and early planting have proven sound practices in backward years. Nearly 300 plots of potatoes were grown experimentally in 1923, comprising tests of varieties and strains and also the comparison of various cultural methods. With trees, shrubs and flowers, a very fine collection and display is to be found on the Station, indicating to the farmer the possibility and desirability of the beautification of the surroundings of the farm home.

A commencement in beekeeping was successfully made in 1923.

With live stock, some experimental work with cattle and hogs has confirmed the experience of pioneer farmers in the district that the climate is well adapted to live stock husbandry. In 1922, a carload of cattle were fattened, in a cheap pole and straw shed, with homegrown feeds, and after a 440-mile trip to Edmonton, the cattle topped the market by an easy margin.

In 1922, some 88 hogs were fed experimentally to compare breeds and feeds and also to obtain data as to the requirements of the bacon hog industry. Some very valuable information was obtained in this work, which will be continued.

Swede Creek, Dawson, Y.T.

Arrangements were made in 1917 for some experimental work to be conducted on an area of 20 acres on the farm of Mr. Jas. Farr. Soil improvement was found to be necessary, and this work necessarily slow, and further hampered by transportation difficulties and high cost of fertilizers, has prevented other tests and experiments so far taking so wide a range, or producing such clear-cut results, as have been obtained on some other Substations.

Progress, however, has been made. Good crops have been harvested each year of wheat, oats, and barley. Root crops have so far given only fair yields, owing to soil and climatic conditions. Some difficulty is, naturally, being experienced with winter-killing of clover and considerable reseeding has been found necessary, but on those plots which survived, average yields have been obtained. Wheat, oats and barley have done well. In 1922 part of the wheat crop (of the Prelude variety) was ground into whole wheat flour and proved far superior to the imported article as obtained locally. In 1923, the same variety gave a crop weighing 64 pounds to the bushel.

The hardier vegetables have done fairly well in most cases. With these, as indeed with all other crops, the variation from season to season has so far been most marked, owing to scanty rainfall, late opening of spring, or early fall frosts, in some years. The land, moreover, has not yet reached a condition where best possible results can be expected.

Salmon Arm, B.C.

A limited amount of experimental work, principally with fruits, is being conducted, on his farm, by Thos. A. Sharpe, formerly Superintendent of the Experimental Farm at Agassiz, B.C. Work here was commenced in 1911, and considerable progress has been made in the testing and originating of varieties of fruits suited to the conditions of the Salmon Arm district.

Forts Smith, Resolution and Providence

Work here began in 1911. These forts are Hudsons' Bay Company posts, Fort Smith being located on Slave river, about half-way between lake Athabaska and Great Slave lake. Fort Resolution is on the south shore of Great Slave lake and Fort Providence is a short distance northwest of the western end of that lake, on the Mackenzie river. A mission for the Indians is located at each fort and the fathers in charge have done the experimental work for the department.

Conditions of transportation, soil and climate and limited facilities for the performance of cultural operations and the accurate observation of results have limited the work to the testing of varieties of cereals, forage crops, vegetables and ornamentals, etc. In some years a fair measure of success has been obtained; in others, late spring and early fall frosts, dry or too wet seasons, insect and bird damage, have seriously affected results. Valuable data are being gathered however, as to the agricultural possibilities of this region.

Betsiamites Saguenay County, Quebec

Some experimental work here was arranged for in 1921. Settlement along the north shore of the lower St. Lawrence river is scattered and the region is never likely to be one of great agricultural importance. However, until the present, the settlers have been importing most of the necessaries of life, and it was with the view of ascertaining how far they might become self-supporting as to agricultural produce that experimental work was commenced. It may also be found possible to grow feeds locally which will permit of new lines of industry and additional sources of income.

Substations Now Discontinued

From time to time during the history of the Experimental Farms, substation work has been conducted at points other than those mentioned above, but for one reason or another has been discontinued. Some of these points were:

KAMLOOPS, B.C.—In a district having a very scanty rainfall. Some study of "dry-farming" methods was here made. Extension of such work on the regular Experimental Farms on the prairies made further work at Kamloops unnecessary.

GROUARD, ALTA.—Some testing of varieties of cereals, forage and garden crops, was conducted here for a number of years by the fathers of the mission. Changes among these, however, left no one to continue the work.

ATHABASKA LANDING, ALTA.—Work was discontinued here owing to the operator being no longer in a position to carry on experiments.

ABITIBI DISTRICT, NORTHERN QUEBEC.—Work here some years ago was unsuccessful, chiefly owing to the operator's inability to perform the necessary seeding and cultural operations in good time. At present, the regular Experimental Station at La Ferme in northern Quebec fills all requirements.