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This volume includes Progress Reports of the following Experimental Stations of the Canada Department of Agriculture:

CANADA
DEPARTMENT OF AGRICULTURE
EXPERIMENTAL FARMS SERVICE

DOMINION EXPERIMENTAL STATION
STE. ANNE DE LA POCATIÈRE
QUE.

J. R. PELLETIER, B.S.A., M.A., M.Sc., SUPERINTENDENT

PROGRESS REPORT
1936 – 1945

SUPERINTENDENT'S RESIDENCE,
DOMINION EXPERIMENTAL STATION,
STE. ANNE DE LA POCATIÈRE, QUE.

Published by authority of the Rt. Hon. JAMES G. GARDINER, Minister of Agriculture, Ottawa, Canada.

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INTRODUCTION

This report follows the one published in 1938, which covered the years 1931-1936. It involves an analysis of experimental projects conducted during the 10-year period, 1936-1945, on the main agricultural problems of this district.

The experimental work covers different branches of the livestock industry, dairy cattle, swine, sheep, horses and poultry. Also, experiments are conducted in field husbandry, including pastures, cereals, forage crops, economic fibre plants, horticulture and apiculture. The experiments are carried on in relation to the major problems connected with mixed farming, which is the type followed throughout eastern Quebec and particularly in the Lower St. Lawrence Valley the area served by this Station.

In spite of six years of war (1939-1945), the major experimental undertakings have been continued. In fact some projects have been enlarged that were connected with extraordinary wartime needs for pedigree seeds, etc.

Since the publication of the last report, J. A. Ste-Marie, who was Superintendent, was transferred to the Lennoxville Station in 1937, and succeeded by J. R. Pelletier. In 1939, L. J. Boulet, was appointed Assistant in Cereal and Forage Crops. He resigned later and was succeeded in 1943 by J. R. Beaudry, who, in turn was in 1945 succeeded by F. M. Gauthier. At the time of closing the Experimental Farm at Cap-Rouge, in 1940, Paul Bertrand, who was Assistant in Horticulture there, was transferred to this Station, but left in 1944 for l'Assomption Station. He later was succeeded in 1945, by B. Forest. In May 1947, Dr. L. Dessureaux was appointed Assistant in Charge of the Plant Breeding Department.

METEOROLOGY

Climatic Records

The influence of climate on plant growth and crop yields is well recognized. Temperature, rainfall, evaporation, sunshine and wind velocity are all important factors influencing the behaviour and yield of farm crops. These climatic factors vary quite significantly between districts.

In the following three tables is given an analysis of data collected at this Station in regard to these different climatic factors.

TABLE 1.—CLIMATIC RECORDS FOR 33 YEARS (1913-45)

Month	Temperature in °F.			Precipitation in inches			Hours of sunshine hour	Wind velocity, Miles per hour	Evaporation Piche (evap)
	Highest	Lowest	Mean	Rain	Snow	Total			
January	50	−32	10·77	0·40	23·99	2·79	88·35	10·0	.....
February	46	−33	12·15	0·33	22·72	2·60	109·84	9·0	.....
March	61	−19	23·45	0·64	20·50	2·69	141·65	9·5	.....
April	82	3	36·40	1·78	8·88	2·66	170·20	7·0	.....
May	88	19	49·26	3·00	0·26	3·03	208·06	6·5	130·5
June	95	23	59·26	3·53	.....	3·53	210·18	4·5	140·9
July	94	30	64·98	3·69	.....	3·69	250·93	4·5	139·7
August	92	28	62·73	3·29	.....	3·29	226·77	4·0	123·3
September	89	18	54·18	3·71	.....	3·71	157·12	4·0	98·1
October	80	10	43·83	3·25	1·55	3·40	110·39	6·5	45·8
November	70	−10	30·66	1·71	9·78	2·69	72·86	6·0	.....
December	55	−27	15·88	0·59	18·15	2·40	69·11	7·0	.....
Annual	.....	.....	38·63	25·92	105·83	36·48	1,815·46	6·5	678·3

TABLE 2.—AVERAGE ANNUAL PRECIPITATION IN INCHES
FOR 33 YEARS (1913–45)

Year	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Total
1913	4·20	2·40	4·47	1·32	2·69	1·32	3·64	1·34	2·81	3·42	0·77	1·18	29·56
1914	2·15	1·30	1·33	1·09	3·28	0·99	0·64	1·04	2·34	3·61	1·99	0·89	20·58
1915	1·62	3·68	0·80	2·07	4·01	2·30	1·81	3·05	3·85	2·20	1·67	1·95	29·01
1916	2·42	2·63	1·60	0·94	3·47	5·18	1·89	0·75	3·07	5·66	2·43	4·32	34·36
1917	3·10	2·40	3·90	2·31	3·64	7·68	2·29	3·63	1·18	5·56	1·38	1·34	38·41
1918	2·80	3·40	0·82	1·25	4·24	5·13	6·73	1·01	6·60	0·60	1·22	0·80	34·60
1919	3·10	2·20	3·65	4·94	3·76	1·80	4·22	3·68	3·86	2·39	1·68	1·20	36·48
1920	0·90	2·70	3·02	6·07	1·16	1·07	4·47	1·87	5·89	3·69	1·05	3·85	35·74
1921	1·60	2·00	5·09	2·03	1·56	1·53	2·72	3·30	2·78	4·74	1·13	1·74	30·22
1922	1·25	1·70	1·70	1·92	2·19	6·17	1·48	2·12	0·65	2·62	2·11	1·81	25·72
1923	1·55	0·65	3·55	3·68	2·67	1·59	1·00	4·03	2·22	6·25	5·01	0·96	33·16
1924	3·72	2·50	1·25	6·35	4·39	2·91	5·77	4·57	4·41	1·24	2·67	1·40	41·18
1925	2·40	7·91	1·85	2·12	2·44	2·01	2·68	1·37	3·47	3·12	3·07	1·75	34·19
1926	1·80	1·93	3·63	3·03	3·94	1·93	4·38	2·11	3·27	2·71	3·81	2·80	35·34
1927	3·32	1·85	1·26	0·98	3·34	1·40	4·46	2·06	1·88	5·30	7·76	5·58	39·19
1928	4·25	1·50	0·85	2·51	5·49	3·86	3·21	2·96	1·52	2·67	2·41	1·07	32·30
1929	4·92	1·50	2·13	3·12	3·29	3·19	5·08	3·11	2·45	3·61	1·73	3·85	37·98
1930	2·63	0·55	3·20	1·19	2·94	3·68	5·78	4·88	4·32	1·01	3·45	1·40	35·03
1931	2·10	1·45	1·85	1·59	2·94	4·75	5·29	2·50	5·80	4·09	1·11	0·60	34·07
1932	1·87	2·90	4·35	2·14	1·30	3·45	4·46	5·83	5·03	2·76	2·67	1·08	37·84
1933	1·85	2·00	3·15	2·87	3·29	3·40	2·00	3·45	1·95	2·56	3·96	2·83	33·31
1934	2·04	2·12	2·50	4·04	1·85	4·87	2·94	3·77	2·19	1·93	4·00	2·65	34·90
1935	4·75	2·25	1·74	3·11	1·17	4·80	5·07	3·56	3·12	3·16	1·94	2·30	36·97
1936	4·90	1·95	1·14	3·75	5·48	3·24	3·39	2·46	3·33	3·06	3·43	2·68	38·81
1937	2·67	3·12	2·11	0·86	5·13	3·06	5·50	9·21	6·83	4·65	4·27	0·80	48·21
1938	4·47	3·45	2·36	3·27	2·47	3·19	6·01	6·09	6·59	1·75	1·31	6·11	47·07
1939	2·00	6·18	2·88	3·15	2·94	3·72	3·30	3·91	4·57	4·05	0·74	3·75	41·19
1940	3·50	2·00	4·74	3·56	3·46	6·54	2·10	3·21	3·07	2·47	5·74	3·18	43·47
1941	2·95	1·48	3·13	2·29	1·43	5·91	3·15	4·32	7·38	4·29	3·60	3·14	43·07
1942	2·92	6·40	6·29	2·04	1·99	7·09	2·18	1·47	3·85	3·34	3·12	3·95	44·64
1943	1·20	3·35	2·67	2·82	2·41	3·65	2·93	5·20	1·72	7·15	3·95	0·71	37·76
1944	0·70	2·05	2·50	1·34	1·48	2·52	5·53	3·55	3·91	3·64	1·14	3·30	31·66
1945	6·50	2·15	3·24	4·16	4·14	2·60	5·63	3·15	6·48	3·02	2·39	4·30	47·76
Mean	2·79	2·60	2·69	2·66	3·03	3·53	3·69	3·29	3·71	3·40	2·69	2·40	36·48

TABLE 3.—OCCURRENCE OF KILLING FROSTS DURING GROWING SEASON FOR 31 YEARS (1915–1945)

Year	Date of last spring frost	Date of first fall frost	Frost-free period (days)
1915	May 27	October 7	133
1916	" 1	" 1	154
1917	" 28	" 6	131
1918	" 2	" 8	159
1919	" 30	September 28	121
1920	April 30	October 6	159
1921	May 11	September 21	133
1922	" 14	" 21	140
1923	" 24	October 8	137
1924	" 26	September 25	122
1925	" 26	September 30	127
1926	" 22	" 30	131
1927	" 20	" 11	104
1928	" 14	" 15	124
1929	" 22	" 19	120
1930	" 18	October 3	138
1931	" 5	September 26	144
1932	" 10	" 29	142
1933	" 16	October 17	154
1934	" 20	" 4	137
1935	" 25	September 27	125
1936	" 21	" 25	127
1937	" 15	October 2	140
1938	" 17	September 7	113
1939	" 27	" 24	120
1940	" 11	" 30	141
1941	" 4	" 19	138
1942	April 27	" 24	150
1943	May 23	" 28	128
1944	June 4	" 27	115
1945	" 1	" 18	109
Mean	May 17	September 27	133

Extreme records obtained during the 31-year period

Date of the last spring frost.....June 4
Date of the first fall frost.....September 7
Number of days in the shortest frost-free period.....104 days
Number of days in the longest frost-free period.....159 days

TABLE 4.—DATES ON WHICH THE FARM OPERATIONS OCCURRED 18-YEAR PERIOD (1928-1945)

Operations	Dates of the year		
	The earliest	The latest	Average
Seeding of wheat	April 20	May 30	May 11
Seeding of oats	April 20	May 18	May 7
Cattle going to pasture	May 9	May 24	May 16
Seeding of corn	May 18	June 5	May 25
Cutting of timothy	July 3	August 7	July 17
First cutting of alfalfa	June 24	July 23	July 10
Second cutting of alfalfa	August 20	September 10	August 25
Harvesting wheat	" 17	" 12	" 27
Harvesting oats	" 13	" 11	" 23
Harvesting silage corn	September 14	" 26	September 20
Digging potatoes	" 21	October 4	" 30
Bringing in cattle	October 29	November 16	November 12
Date of freeze-up	November 6	December 8	" 22

From these tables covering a period of thirty-three years of records it is shown that the average annual temperature is 38·63°F., the annual average precipitation is 36·5 inches, total annual number of hours of sunshine is 1815 and that the average wind velocity is 6·5 miles per hour. In addition, it is shown that the highest evaporation occurred in June and July. Table 3 shows that the last spring frost occurred on June 4 while the earliest fall frost was on September 7; the shortest frost-free period was 104 days. The longest frost-free period recorded was 159 days, the average length was 133 days.

Table 4 shows that in an average year grains were seeded around May 10, haying was started around July 10, grain was harvested at the end of August and the land could be ploughed in the fall until November 22.

ANIMAL HUSBANDRY

DAIRY CATTLE

The Ayrshire Herd

During the period 1936-1945, as in the past, the dairy herd was composed exclusively of purebred Ayrshires, varying in number from 39 to 73. It has been the object of the staff in charge of breeding work to improve the type and health of the animals, as well as to increase the production of milk and fat. During the last few years, the Station has more rigorously followed practices of selection on stock raised from better sires and adopted more appropriate breeding methods. R.O.P. tests every year for all cows, blood test for contagious abortion, the tuberculosis-free accredited test, the different tests for mastitis control, artificial insemination, the type classification of cows and line or inbreeding are a few of the activities of the last ten years.

Splendid lot of Ayrshire heifers.

The most important work done in the herd during the last ten years was to improve the type by inbreeding or line breeding with stock raised from sires imported from the Strathglass Farm (Port Chester, N.Y.). This Station has promoted the Strathglass strains while other Canadian agricultural institutions have been developing the Penshurst strains.

The Ayrshire herd has brought favourable comment throughout the district, where young breeding bulls have been placed in leading purebred herds. Furthermore, the herd was used for numerous demonstrations. Nevertheless, the main purpose was to use it for securing experimental data on the economy and technology of operating a large purebred Ayrshire herd under conditions prevailing in this district. The results of the most significant studies carried on during the last ten years are mentioned in this report.

Type Classification

In 1943, the herd underwent type classification for the first time and was again reclassified at the end of 1945. Five cows were rated "excellent", ten were "very good" and eight were "good plus". The herd obtained an average score of 87·06 per cent and placed second among herds of 15 to 25 cows throughout Canada.

Results of R.O.P. Control

During the last ten years, 159 official production records were listed in the Canadian R.O.P., 104 in the 305-day division and 55 in the 365-day division. The average of 104 production records in the 305-day division was 9,003 lb. of milk with 4·47 per cent fat, that is 402 lb. of fat. The average of 55 production records in the 365-day division was 10,456 lb. of milk with 4·44 per cent fat, that is 464 lb. of fat.

During the twenty-one years since the R.O.P. work was started at this Station, a total of 331 production records were listed, 219 in the 305-day division with an average of 9,148 lb. of milk at 4·31 per cent fat and 112 in the 365-day division with an average of 10,487 lb. of milk at 4·35 per cent fat. If one compares the official production records of the last ten years with those listed in the last twenty-one years it will be noted at once that the fat percentage has increased considerably in latter years. On the other hand, a very slight decrease in milk has been noticed.

Meritorious Production Records

During the last ten years, several meritorious production records were noted. In 1936, the cow "Ste. Anne Viola de Reflection" –166590– had the highest fat record in Canada in the 2-year-old class 365-day division with a production record of 564 lb. of fat and 11,434 lb. of milk.

In 1938, the cow "Ste. Anne Reinette de Supreme" –139752– made a record of 18,020 lb. of milk with 4·23 per cent of fat and 762 lb. of fat.

Fifteen cows obtained a certificate of meritorious production from the Canadian Ayrshire Association, eight were in the 50,000 lb. and up class, three in the 75,000 lb. and up, and four in the 100,000 lb. and up class. Among the four cows with a meritorious certificate in the 100,000 lb. and up class, should be mentioned "Ste-Anne Fadette 2e" –87702– with a lifetime production of 126,197 lb. of milk, and her daughter "Ste Anne Fadette de Supreme" –113478– with a lifetime production of 100,314 lb. of milk. It was the first time in Canada among Ayrshires that a meritorious production certificate was accorded to both mother and daughter, in the 100,000 lb. and up class.

The Production Record of the Herd

During the 1936-45 period, the herd was made up of an annual average of eighteen cows. The annual production per cow, for an average of ten years, and based on a hundred and eighty-three lactation periods, was 9,255 lb. of milk with 4·42 per cent fat and 409 lb. of butterfat. For the eleven years previous to 1936, the annual average production of cows, based on 216 lactation periods, was 9,120 lb. of milk with 4·29 per cent fat and 391 lb. of butterfat. On an average of twenty-one years, that is to say from 1925-45 inclusive, the annual average production per cow, based on 399 lactation periods, was 9,182 lb. of milk with 4·35 per cent fat and 399 lb. of butterfat.

Feed Consumed per 100 lb. of Milk

In connection with the production record of the herd, mentioned in the preceding paragraph, there was consumed on an average of 100 lb. of milk produced during the last ten years, 30 lb. of meal, 41 lb. of hay, 28 lb. of roots and 58 lb. of silage, besides 1·54 pasture days. On an average for twenty-one years, 1925-1945, there was consumed to produce 100 lb. of milk the following quantities of feed: 29 lb. of meal, 35 lb. of hay, 41 lb. of roots, 59 lb. of silage, and 4 lb. of green feed, besides 1·41 pasture days. All these data on the feed consumed per 100 lb. of milk, include the feeds given to cows during their dry period as well as during their milking period; they include also what heifers consumed during the sixty days or so before their first calving.

Milch cows grazing on an improved highly productive pasture.

Feed Cost per 100 lb. of Milk and One Pound of Fat

For the ten-year period, as well as during the last twenty-one years, the feed cost of milk and fat was established each year for all the cows in the herd. In order to do so, all feeds consumed by the milch cows were listed and calculation made on the basis of consumption per 100 lb. of milk produced. Feeds grown on the farm such as hay, silage, roots, green feed and pasture were charged according to the cost prices established on this Station, while meal was charged according to the commercial price each month of the year. On an average of the last ten years, the feed cost for milk production was 82·8 cents a 100 lb. and that of fat was 18·7 cents a lb., based on the average butterfat content of 4·42 per cent. For an average of twenty-one years, comprising the period 1925-1945, the feed cost of milk was 84·9 cents the 100 lb. and that of butterfat was 19·5 cents a lb. calculating the milk with 4·35 per cent of fat as established.

Feed Cost of Milk and Fat per Month, 14-Year Average—(1932-45)

From 1932 to 1945, all data were listed and summaries made in order to determine the cost price of feed to produce 100 lb. of milk and 1 lb. of fat. These costs were calculated separately for each month of the year with all cows in the herd, including the dry period and the milking period, even the feed used by heifers 60 days before their first calving was included. Calvings took place regularly during the year except during the period between May 15 and August 15. The value of a pound of butterfat was listed according to the commercial price for each month of the year, including premiums.

The results of this project are shown in Table 5, representing an average of 14 years and including the milk per cow, the percentage of fat, the feed cost of

TABLE 5.—FEED COST OF MILK AND FAT PER MONTH, 14-YEAR AVERAGE (1932-1945)

Month	Milk per cow	Percent of fat	Feed cost		Value		Profit		Feed consumed per 100 lb. of milk				
			Per 100 lb. of milk	Per lb. of fat	Per 100 lb. of milk	Per lb. of fat	Per 100 lb. of milk	Per lb. of fat	Meal	Silage	Hay	Roots	Pasture
	lb.	%	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	$ cts.	lb.	lb.	lb.	lb.	days
January	603	4·38	1 06	0 24	1 45	0 33	0 39	0 09	35·3	77·2	75·2	105·9	.....
February	570	4·43	1 03	0 23	1 55	0 35	0 52	0 12	34·8	51·1	78·2	123·6	.....
March	628	4·39	0 98	0 22	1 54	0 35	0 56	0 13	34·2	53·4	72·3	100·3	.....
April	749	4·34	0 87	0 20	1 51	0 35	0 64	0 15	32·2	96·5	58·7	27·4	.....
May	906	4·37	0 76	0 17	1 41	0 32	0 65	0 15	30·2	87·1	46·9	0·9	0·3
June	911	4·41	0 49	0 11	1 42	0 32	0 93	0 21	18·4	10·3	2·0	.....	3·1
July	812	4·24	0 59	0 13	1 41	0 33	0 82	0 20	21·9	23·9	0·3	.....	3·7
August	723	4·26	0 70	0 16	1 44	0 34	0 74	0 18	25·8	36·4	3·3	.....	4·1
September	649	4·38	0 76	0 17	1 54	0 35	0 78	0 18	27·5	43·5	1·9	0·05	4·2
October	639	4·39	0 92	0 21	1 54	0 35	0 62	0 14	33·5	53·2	45·4	57·6	1·5
November	556	4·38	1 13	0 26	1 55	0 35	0 42	0 09	38·1	134·5	79·3	53·6	0·02
December	549	4·43	1 18	0 26	1 62	0 36	0 44	0 10	39·2	153·1	82·0	40·8	.....
Whole year	8,295	4·36	0 84	0 19	1 49	0 34	0 65	0 15	30·2	65·2	42·0	37·5	1·5

100 lb. of milk and of 1 lb. of fat, the value of 100 lb. of milk and of 1 lb. of fat, and the feed consumed to produce 100 lb. of milk, for each month of the year and for the whole year.

Feed cost naturally is much lower during the summer months when the cows are on pasture than during the winter months when cows are fed in the stable. On the other hand, a pound of fat brings a higher price in the winter than in the summer. But, all factors considered, profits are still higher when the cows are on pasture than when they are fed in the stable during the winter, provided that pastures are in a good producing condition. Profit per 100 lb. of milk or 1 lb. of butterfat, as appearing in the Table 5, are based on the value of the fat production, and do not take account of the value of skim-milk, calves and manure.

Feed Cost of Rearing Heifers

In order to establish the cost of feed in raising heifers a 10-year record was kept of feeds consumed by all individuals raised and kept on the Station up to a year old or to first calving. Certain feeds, such as hay, roots, silage and pasture were charged at the cost price on the farm, while meal and whole milk were charged according to commercial prices. Skim-milk was always charged at the rate of 20 cents per 100 lb.

Cost of Feeding Heifers from Birth up to a Year Old.

In ten years, one hundred and three heifers were included in this experiment and they consumed on the average per head, from birth to a year old, 822 lb. of whole milk, 1,862 lb. of skim-milk, 1,291 lb. of hay, 92 lb. of silage, 676 lb. of ordinary meals, 85 lb. of calf meal and 774 lb. of roots, besides 35 days on pasture. The average cost of their feed was $37.34 per head and their average weight at a year old was 578 lb. In eighteen years, the cost of feed for raising heifers to a year old was based on 181 head. They consumed on the average per head, 641 lb. of whole milk, 1,794 lb. of skim-milk, 799 lb. of ordinary meal, 48 lb. of calf meal, 1,301 lb. of hay, 664 lb. of roots and 401 lb. of silage, besides spending 38 days on pasture. The average cost of feed per head was $35.41 for heifers, who weighed an average of 601 lb. at a year old.

Cost of Feed for Raising Heifers from Birth to First Calving.

During the ten-year period under review, this experimental work was based on sixty-two heifers raised and kept to first calving. They consumed on an average per head, 863 lb. of whole milk, 1,712 lb. of skim-milk, 1,265 lb. of meal, 4,193 lb. of hay, 3,200 lb. of silage and 2,307 lb. of roots, besides spending 293 days on pasture. Feed costs were, on an average per head, $72.05 for heifers weighing 1,067 lb. at two years and 220 days of age when they gave their first calf.

For nineteen years, the feed of 127 heifers was listed to establish the cost of raising them. Average feed consumption per head was 628 lb. of whole milk, 1,818 lb. of skim-milk, 1,325 lb. of meal, 4,401 lb. of hay, 3,772 lb. of silage and 3,532 lb. of roots, besides pasture for 281 days. Feed cost averaged $74.31 per head for heifers which gave their first calf at two years and 228 days of age and then weighed 1,057 lb.

Feeding Experiments with Silage

Corn and Sunflower Silage compared with Molassed, Oat and Pea Silage. (See Experiment 1, Tables 6A and 6B).

An experiment was undertaken in the winter of 1938-39 to determine if molassed oat and pea silage (about 80 per cent oats and 20 per cent peas) could replace efficiently corn and sunflower silage (about 50 per cent corn and 50 per

cent sunflower), when served to milch cows as succulent feed, besides their regular ration of hay and meal. The economy of milk production, the gain or loss in weight of cows and the succulence of silages were the principal factors being studied in this project.

When cows received molassed oat and pea silage as a succulent feed, the production of milk, corrected to 4 per cent fat, was 7 per cent higher than when they received the corn and sunflower silage. But the cost price of feed for 100 lb. of milk, corrected to 4 per cent fat, was 18·6 per cent higher when milk was produced with molassed oat and pea silage, due to the fact that the production cost of fodder per ton is higher for oat and pea silage than with the corn and sunflower silage.

It was noted that the cows preferred the corn and sunflower silage to the molassed, oat and pea silage. The latter gave off a bad odour.

Regarding the gain or loss in weight of cows, the data listed show a daily gain of 1 lb. per cow, when the molassed, oat and pea silage was fed. On the other hand, a daily loss of 0·4 lb. per cow was noted when the corn and sunflower silage was used.

(For supplementary information, see tables 6A and 6B—Experiment I.)

Molassed Oat and Pea Silage compared with Swede Turnips (See Experiment 2, Tables 6A and 6B).

This project was carried on during the winter of 1938-39 in order to determine if molassed oat and pea silage (about 80 per cent oats and 20 per cent peas) could replace swede turnips in feeding milch cows, when served as a succulent feed, besides the daily hay and meal ration. Economy of milk production, gain or loss in weight of cows and succulence are the three principal factors studied.

When the cows received swede turnips, milk production, corrected to 4 per cent fat, was 5½ per cent higher than when they received the molassed oat and pea silage. With the latter, the cost of feed per 100 lb. of milk, corrected to 4 per cent fat, was 22·4 per cent higher than with swede turnips, attributable to the fact that the production cost per ton of succulent feed is much higher in the case of the oat and pea silage than in the case of swede turnips. It was noted also that the cows much preferred swede turnips to the oat and pea silage.

Concerning the gain or loss in weight of cows, the data indicate a daily gain of 0·7 lb. per cow, when fed oat and pea silage and a daily gain of 0·1 lb. per cow when swede turnips were fed.

(For supplementary information, see Tables 6A and 6B, Experiment 2.).

Molassed Oat and Pea Silage compared with Pure Corn Silage (See Tables 6A and 6B, Experiment 3.)

This experiment was carried on during the winters of 1939-40 and 1940-41 in order to determine if molassed oat and pea silage (about 80 per cent oats and 20 per cent peas) could replace pure corn silage as a succulent feed for milch cows, besides their regular ration of hay and meal. The flavour of silages, economy of milk production and the gain or loss in weight of cows are three principal factors which were studied in this experiment.

When cows received molassed oat and pea silage, milk production, corrected to 4 per cent fat, was 2·6 per cent higher than when they received pure corn silage. But, the total cost of feed per 100 lb. of milk, corrected to 4 per cent fat, was 12·1 per cent higher with the molassed oat and pea silage than with the pure corn silage, resulting from the fact that the production cost per ton of fodder is higher in the case of the oat and pea silage than with the pure corn silage.

Regarding the gain or loss in weight of cows, the data listed show a daily gain of 0·7 lb. per cow, when they received oat and pea silage and a daily loss of 1·5 lb. per cow when fed corn silage.

With regard to flavour, it was noted that cows much preferred the pure corn silage to the molassed oat and pea silage. The latter gave off a bad odour. (For supplementary information, see Tables 6A and 6B, Experiment 3).

Molassed Oat and Pea Silage compared with Non-Molassed Oat and Pea Silage (See Tables 6A and 6B, Experiment 4.)

This experiment was carried on during the winter of 1939-40 and 1940-41 to determine if non-molassed oat and pea silage (about 80 per cent oats and 20 per cent peas) could replace molassed oat and pea silage of the same composition, when used as succulent feed for milch cows, besides their regular ration of hay and meal. Economy of milk production, flavour of silages and gain or loss in weight of cows were the principal factors studied in this experiment.

When cows received molassed oat and pea silage as succulent feed, the milk production, corrected to 4 per cent fat, was 1·3 per cent higher than when they received non-molassed oat and pea silage. With molassed silage the feed cost per 100 lb. of milk, corrected to 4 per cent, was 3·8 per cent higher than with non-molassed silage.

As to the gain or loss in weight of cows, the listed data show a daily gain of 0·7 lb. per cow, when the non-molassed silage was served and a daily loss of 0·2 lb. per cow when molassed silage was served.

These two silages were noted for comparable flavour, while both give off a bad odour.

(For supplementary information, see Tables 6A and 6B, Experiment 4.).

General Comments Concerning the Feeding Value of Oat and Pea Silages Based on the Four Preceding Experiments.

From the four preceding experiments, the molassed and non-molassed oat and pea silages, although less palatable, and having an unpleasant odour, which sometimes taints the milk, seem to have approximately the same feeding value as succulent feed for milk production as pure corn silage, sunflower and corn silage and swede turnips. The former, however, are costlier, rendering the cost of feed per 100 lb. of milk much higher. Besides being favourable weight producers, the dry matter and protein contents of these silages are much higher. (See experiments 1, 2, 3, 4, Tables 6A and 6B).

Molassed Red Clover Silage Compared with Pure Corn Silage (See Tables 6A and 6B, Experiment 5.)

An experiment was undertaken during the winter of 1941-42 to determine if molassed red clover silage could replace pure corn silage, as a succulent feed for milch cows, along with regular rations of hay and meal. Economy of milk production, flavour of silages and the gain or loss in weight of cows were the main factors studied in this experiment.

When the cows received pure corn silage, milk production, corrected to 4 per cent fat, was 3·4 per cent higher than when they received molassed red clover silage. The cost price of feed per 100 lb. milk, corrected to 4 per cent fat, was 4 per cent higher in the case of the molassed red clover silage than in the case of the corn silage.

As regards the gain or loss in weight of cows, the data listed show a daily gain of 0·3 lb. per cow, when they received corn silage and a daily gain of 0·9 lb. per cow, when they received the molassed red clover silage.

In comparing the two silages with regard to flavour, it was noted that cows ate the molassed red clover silage less readily than the corn silage, even though the clover silage was well preserved in the silo and had a normal odour.

(For supplementary information, see Tables 6A and 6B, Experiment 5.)

Molassed Alfalfa and Clover Silage Compared with pure Corn Silage (See Tables 6A and 6B, Experiment 6).

An experiment was undertaken during the winter of 1942-43 in order to determine if molassed alfalfa and clover silage (about 50 per cent alfalfa and 50 per cent red and alsike clover) could replace pure corn silage. Economy of milk production, flavour of the silages and gain or loss in weight of cows were the principal factors studied in this experiment.

When cows received molassed alfalfa and clover silage, milk production, corrected to 4 per cent fat, was 0·6 per cent higher than when they received corn silage. Cost of feed per 100 lb. of milk, corrected to 4 per cent fat, was 3·1 per cent higher in the case of the corn silage than with the molassed alfalfa and clover silage.

Regarding gain or loss in weight of cows, the data show a daily gain of 0.8 lb. per cow when they received molassed alfalfa and clover silage, and a daily gain of 0·3 lb. per cow when they received the corn silage.

When comparing the flavour of the two silages, it was noted that cows showed a preference for pure corn silage, even though the leguminous silage was normal as regards preservation and odour.

(For supplementary information, see Tables 6A and 6B, Experiment 6.)

General Comments Concerning the Feeding Value of Leguminous Silages Based on the Two Preceding Experiments and Other Preliminary Trials

From the experiments carried on to date at this Station, it appears that leguminous silages (mixed alfalfa and clover or pure alfalfa or pure clover) molassed or non-molassed, are as suitable and as economical, if not more so, for milk production, than pure corn silage. However, they are a little less appreciated by the animals than the corn silage. With regard to preservation in the silo, alfalfa or a mixture of alfalfa and clover, proved more difficult to keep than corn, since they require either a partial drying on the field after being cut, or an appropriate preservative, or both. Should the preservation in leguminous silages be faulty, they will be found detrimental to the quality of the milk produced.

By comparison with corn silage, legumic silage appeared to produce more gain in weight, probably because of the higher contents of protein and dry matter in the latter silage as shown in Tables 6A and 6B, experiments 5 and 6.

TABLE 6A.—FEEDING EXPERIMENTS WITH SILAGES

(Procedure, production, gain or loss in weight)

Principal items of comparison		Experiment 1		Experiment 2		Experiment 3		Experiment 4		Experiment 5		Experiment 6	
		Silage of corn and sunflower	Molassed silage oats and peas	Molassed silage oats and peas	Swede turnips	Silage of corn	Molassed silage of oats and peas	Molassed silage of oats and peas	Non-molassed silage of oats and peas	Silage of corn	Molassed silage of red clover	Molassed silage of alfalfa and red clover	Silage of corn
Procedure													
No. of winters the experiment was underway	No.	1	1	1	1	2	2	2	2	1	1	1	1
No. of days each experiment lasted each winter:													
Preparatory Period	Days	14	14	14	14	14	14	14	14	14	14	14	14
Experimental Periods	"	14	14	14	14	14	14	14	14	14	14	30	30
No. of cows in experiment each winter	No.	6	6	6	6	6 and 5	6 and 5	6	6	6	6	4	4
Production													
Lb. of milk corrected to 4% fat, by cow by day	Lb.	22·14	23·70	32·03	33·90	29·67	30·44	30·33	29·94	35·57	34·35	24·97	24·83
Percentage of fat in milk produced	%	3·68	3·90	4·24	4·41	4·22	4·24	4·34	4·44	4·42	4·30	4·39	4·44
Difference in milk production corrected to 4% fat, surplus in percentage	%	.....	7%	.....	5·5%	.....	2·6%	1·3%	.....	3·4%	.....	0·6%	.....
Gain or loss in weight													
Gain or loss in weight per cow per day—(−=loss; +=gain)	Lb.	−0·4	+1·0	+0·7	+0·1	−1·5	+0·7	−0·2	+0·7	+0·3	+0·9	+0·8	+0·3
Difference between gain and loss in weight per cow per day, surplus in lb	Lb.	.....	1·4	0·6	.....	.....	2·2	.....	0·9	.....	0·6	0·5	.....

IMPORTANT—These six experiments cannot be compared with each other.

TABLE 6B.—FEEDING EXPERIMENTS WITH SILAGES

(Feeds consumed, price of feeds, analysis of feeds and feed cost of milk)

Principal items of comparison		Experiment 1		Experiment 2		Experiment 3		Experiment 4		Experiment 5		Experiment 6	
		Silage of corn and sunflower	Molassed silage oats and peas	Molassed silage oats and peas	Swede turnips	Silage of corn	Molassed silage of oats and peas	Molassed silage of oats and peas	Non-molassed silage of oats and peas	Silage of corn	Molassed silage of red clover	Molassed silage of alfalfa and red clover	Silage of corn
Feed consumed													
Feeds consumed by 100 lb. of milk corrected to 4% fat:—													
Hay	Lb.	105·0	96·0	66·5	68·8	69·2	62·3	58·4	58·4	70·3	72·8	69·1	70·5
Meal	Lb.	38·7	36·3	32·1	32·2	33·2	32·6	31·6	31·2	19·0	19·3	21·8	21·5
Silage	Lb.	197·0	178·0	130·1	.....	140·3	128·3	130·8	130·8	110·6	115·6	139·2	188·3
Swede turnips	Lb.	.....	.....	.....	122·3	.....	.....	.....	.....	.....	.....	.....	.....
Price of feeds													
Hay (price per ton)	$	6·20	6·20	6·20	6·20	5·60	5·60	5·60	5·60	5·60	5·20	5·20	5·20
Meal (price per 100 lb.)	$	1·35	1·35	1·35	1·35	1·56	1·56	1·56	1·56	1·65	1·65	1·77	1·77
Silage or roots (price per ton)	$	2·90	6·19	6·19	3·27	3·94	6·68	5·87	5·33	4·48	4·79	5·19	4·22
Analysis of feeds													
Hay (protein)	%	11·62	11·20	12·44	13·49	8·61	10·33	10·63	9·55	14·80	13·18	14·93	14·93
Meal (protein)	%	15·88	15·34	15·81	14·86	16·54	16·40	15·93	16·24	15·20	16·36	13·18	12·01
Silage or roots:													
(protein)	%	2·19	3·02	3·15	1·06	1·59	2·95	2·84	2·54	1·45	3·91	4·73	1·40
(dry matter)	%	18·36	28·34	29·36	11·98	20·09	29·21	28·30	27·12	19·29	27·94	29·88	18·75
Feed cost of Milk													
Feed cost of 100 lb. of milk corrected to 4% fat	$	1·13	1·34	1·04	0·85	0·99	11·1	1·04	1·00	0·75	0·78	0·93	0·96
Difference in feed cost of 100 lb. of milk, surplus in	%	.....	18·6%	22·4%	.....	.....	12·1%	3·8%	.....	.....	4%	.....	3·1%

IMPORTANT—These six experiments cannot be compared with each other.

SWINE

During the 1936-45 period, as in previous years, a considerable herd of purebred Yorkshire swine has been maintained. Besides being distributed as breeding stock, these animals were used for experiments on feeding methods and to contribute in a breeding program under Advanced Registry policy, for the development of the most advantageous strains of bacon hogs. The number of breeding sows varied from ten to twenty-five, most of which were qualified in Advanced Registry for several generations.

Advanced Registry for Swine

From 1930-1945, fifty-three sows qualified in the Advanced Registry with an average score of 47·9 points for production, 110·6 points for maturity index and 81·3 points for slaughter test.

During the 1936-45 period, thirty sows qualified in the Advanced Registry with an average score of 47·5 points for production, 110·7 points for maturity index and 80·6 points for slaughter test. In 1936, the sow, Deschambault Evergreen 98M —174083, qualified with the highest score in Canada, that is, 45 points for production, 115 points for maturity index and 92 points for slaughter test.

In 1939, the scoring scale for pig carcasses, as originally adopted by the federal Production Service, was modified. Thirty-three of the Station's sows qualified in the original Advanced Registry scoring scale, while twenty have qualified since the carcass score was changed in 1939.

Table 7 gives in detail for each group of sows, the average score obtained by the carcasses and compares it with the perfect score. Among the fifty-three sows which have qualified in Advanced Registry since 1930, thirty-eight of them had their progeny developed at home, while the pigs from the remaining sows were sent to the Feeding Station for feeding and carcass test. For the fifteen groups of four pigs each, which were developed at the Feeding Station, the meal consumption averaged 356 lb. per 100 lb. of gain in live weight or 459 lb. of meal per 100 lb. of gain in carcass weight.

Experimental Data Established with Swine

Feed Cost for Maintenance of Brood Sows

During the period under review, the average annual feed consumption of brood sows, established with 108 individuals, was 2,230 lb. of meal, 343 lb. of skim-milk, 144 lb. of alfalfa hay, 8 lb. of alfalfa meal and 313 lb. of cooked potatoes. The average annual cost of feed per sow was $40.89 for the ten years covered by this report and $37.86 for the average of the last twenty-one years.

Feed Cost for Raising Suckling Pigs

The cost of feed, for raising suckling pigs up to weaning time which takes place at six or seven weeks was $3.64 per head for the average of the ten years under review and $3.53 for the average of the last twenty-three years, established with 165 litters or 1,388 piglets. These figures are based on the annual feed cost for maintenance of sows, the number of pigs weaned per sow annually and on the cost of feed consumption of piglets before weaning.

The feed cost for raising suckling pigs, based on the feed cost of the sow during suckling period only and on the feed consumed by young pigs before

TABLE 7.—ADVANCED REGISTRY (AVERAGE SCORE OF CARCASSES)—1930-38 AND 1939-45

		Length	Back fat			Balance			Belly	Loin	Total points
			Thickness		Uniformity	Ham	Middle	Shoulder			
From 1930 to 1938 with 33 sows	Perfect score	24	12		12	9	9	25	.....	.....	100
	Average score obtained	22·8	9·8		8·9	8·4	7·1	6·4	18·8	.....	81·6
			Max.	Min.	Diff.						
From 1939 to 1945 with 20 sows	Perfect score	20	6	6	8	7	7	7	20	20	101
	Average score obtained	18·0	5·6	5·4	6·9	5·6	4·6	4·0	15·3	16·2	80·7

For fifteen groups of four pigs developed at the Feeding Station, from seventy days old to market weight.....
(a) The average consumption of meal per 100 lb. of gain in live weight—356 lb.
(b) The average consumption of meal per 100 lb. of gain in weight of carcass—459 lb.

weaning, was also determined. This figure, established with 103 litters or 849 piglets, was $1.21 per piglet for an average of the last six years covered by this report and a $1.19 for an average of twelve years.

Feed Cost for Maintenance of Breeding Boars

The annual consumption of breeding boars was determined in order to establish the feed cost entailed for maintenance of such animals. Underway periodically since 1935, the results of this project are based on fourteen individuals. On the average, the feed consumed annually per boar was 2,548 lb. of meal and 173 lb. of alfalfa hay. The average feed cost per boar was $43.09.

Mortality in Suckling Pigs

In order to establish mortality percentage in suckling pigs, from birth to weaning at six weeks old, data were collected on the number of piglets born and the number of piglets that died at different ages before weaning.

Results are listed in Table 8 for an average of the last eight years covered by this report, including 1945. It will be noted that of the 1,434 pigs born, 21·5 per cent died before reaching the age of six weeks, for a mortality rate of 18·3 per cent in the first week, 2·2 per cent in second and third weeks and 1·0 per cent after three weeks up to weaning time.

Feeding Experiments

Self-Feeding in Comparison with Hand-Feeding

An experiment was conducted for three years to determine if dry self-feeding could replace wet hand-feeding for fattening bacon hogs for market. The main factors studied in this experiment were the meal consumption per 100 lb. of gain in live weight, the feed cost per 100 lb. of gain and the quality of carcasses.

On the average for three years, with 25 hogs in each case, the meal consumption per 100 lb. of gain was 379 lb. for self-fed pigs and 345 lb. for hand-fed pigs. The feed cost per 100 lb. of gain was $6.67 for self-fed pigs and $6.08 for hand-fed pigs. The carcass score under the Advanced Registry policy was 75 per cent for self-fed pigs and 78 per cent for the others. With self-feeding, it took an additional 34 lb. of meal at an extra cost of 59 cents to secure 100 lb. of gain in live weight, while the carcass score was 3 per cent lower.

Barley Compared with Oats and Corn for Pigs

For more than twenty-five years, provincial agriculturalists have been recommending the production of barley on a larger scale for the fattening of hogs. Despite the promotion work done, barley growing in Quebec has remained stationary, according to provincial statistics.

With the idea of convincing swine raisers to plant more barley and less oats, the results of an experiment undertaken in 1937 in Eastern Canada by two experimental farms and two agricultural colleges under the direction of the National Barley Committee are included in this report. This experiment, in which this Station participated, aimed at comparing barley, oats and corn for feeding bacon hogs.

In this project, five rations were tried:—barley (No. 3 C.W.), oats (No. 3 C.W.), yellow corn (No. 2), an equal mixture of oats and barley and an equal mixture of oats and corn. The grains were ground and fed without milk. All rations were balanced with a protein supplement of the same composition, at the rate of 15 per cent during the growth period and 10 per cent during the fattening period, the latter being from 100 or 110 lb. to market weight. During the growth period 15 c.c. of cod liver oil, Napco XX, were fed to each hog daily.

TABLE 8.—MORTALITY IN SUCKLING PIGS—1938-45

Years	No. of litters	Piglets born	Piglets living at 7 days	Piglets living at 21 days	Piglets living at six weeks	Mortality percentage			Living percentage		
						From birth to 7 days	7 days to 21 days	21 days to 6 weeks	At 7 days	At 21 days	At 6 weeks
	No.	No.	No.	No.	No.	%	%	%	%	%	%
1938	16	173	135	133	132	22·0	1·2	0·6	78·0	76·8	76·2
1939	18	199	157	150	148	21·1	3·5	1·0	78·9	75·3	74·4
1940	20	213	169	167	166	20·7	0·9	0·5	79·3	78·4	77·9
1941	16	184	158	156	155	14·1	1·1	0·5	85·8	84·7	84·2
1942	14	178	143	141	138	19·7	1·1	1·7	80·3	79·2	77·5
1943	16	149	118	114	110	20·8	2·7	2·7	79·2	76·5	73·8
1944	19	204	181	166	163	16·2	2·5	1·5	83·8	81·4	79·9
1945	14	134	116	113	113	13·4	2·3	.....	96·6	84·3	84·3
Total	133	1,474	1,171	1,149	1,125	18·3	2·2	1·0	81·7	79·5	78·5
Mortality	.....	.....	253	31	15	.....	21·5	.....	.....	.....	.....

The hogs were kept inside during the whole experiment. Five groups of five hogs each, at four different institutions, served to test each ration and pigs were under the test from an average age of 70 days to average weight of 205 lb. The slaughter test of all hogs was made under Advanced Registry control. For each group of pigs, the number of days in the experiment, the meal consumed, the increase in weight and the carcass score were noted. The results obtained are listed in following summary:

Items	Barley	Oats	Corn	Oats and barley	Oats and corn
Feed consumed by 100 lb. of gain in live weight (lb.)	369	398	380	385	385
Feed consumed by 100 lb. of gain in weight of carcass (lb.)	482	540	483	522	510
Gain in live weight per hog per day (lb.)	1·54	1·24	1·47	1·40	1·43
Score of carcass on 100 points	75·2	71·4	67·9	73·6	72·8

The above figures indicate clearly that barley is superior to oats for feeding bacon hogs. Its superiority is shown, both in the economy of feed consumed and in the quality of hog carcass. In fact, the hogs fed on barley in comparison with those fed on oats consumed 29 lb. less meal to make 100 lb. gain in live weight or 8 per cent; and 58 lb. less meal to make 100 lb. gain in carcass weight, or 12 per cent. As to the average carcass score, those produced with barley obtained 3·8 per cent more points than those produced with oats.

In taking as a measure of comparison the quantity of meal consumed per 100 lb. of gain in carcass weight, the five rations used in this project are classed by their results in the following order: barley, corn, oats with corn, oats with barley and lastly oats. On the other hand, if one takes, as measure of comparison, the score obtained on the quality of carcass, the five rations are classed as follows: barley, oats with barley, oats with corn, oats and lastly the corn.

In considering the quantity of meal consumed per 100 lb. of gain, the fact of having added 50 per cent of oats to the ration, diminished somewhat the value of the barley and increased somewhat that of the corn. On the other hand, as far as quality of carcass is concerned 50 per cent of oats considerably increased the efficacy of corn, only slightly changing that of the barley.

Value of Potatoes for Fattening Hogs

Since considerable quantities of non-marketable potatoes are often available in Eastern Canada and since it was the general practice of farmers to feed these potatoes to their hogs, this Station, over a 6-year period, conducted a series of experiments on the use of non-marketable potatoes for fattening hogs for market.

One of the experiments undertaken aimed to learn the quantity of meal replaced by a bushel of cooked potatoes mixed with meal in the form of mash. Potatoes were fed in two definite proportions: two pounds of potatoes for each pound of meal, and four pounds of potatoes for each pound of meal. The meal mixture employed was made up, for the first fattening period, of two parts ground oats, one part ground barley, one part shorts and 3 per cent soluble minerals; for the second fattening period, beginning around 100 lb., one part of ground oats, two parts ground barley, two parts shorts, two parts ground peas and 3 per cent soluble minerals. Skim-milk was served in a limited quantity. The hogs started the experiment around an average weight of 43 lb. and weighed, on the average, 168 lb. at the end of the experiment.

After five years of experimental work, it was found that a bushel of cooked potatoes replaced 28·5 lb. of meal, when served in the proportion of two pounds per pound of meal, and 22·3 lb. when served in the proportion of four pounds

per pound of meal. The twenty-five hogs, fattened with the proportion of two pounds of potatoes per pound of meal, made an average daily gain of 1·22 lb. and consumed per 100 lb. of gain in live weight, 222 lb. of meal, 247 lb. of skim-milk and 356 lb. of potatoes.

The twenty-five hogs which received four pounds of potatoes per pound of meal, made an average daily gain of 1·16 lb. and consumed per 100 lb. of gain in live weight, 185 lb. of meal, 277 lb. of skim-milk and 561 lb. of potatoes.

The twenty-five hogs which served as a check in the project and were fattened without potatoes, made an average daily gain of 1·12 lb. and consumed 378 lb. of meal and 228 lb. of skim-milk to make 100 lb. of gain in live weight.

Another experiment was tried during the winter of 1938-39 to ascertain if raw potatoes, cut up by a root slicer and mixed with meal in the same porportions as cooked potatoes, had as much value for fattening hogs as cooked potatoes. Potatoes were mixed with meal in the proportion of two pounds per pound of meal for the first fattening period and in the proportion of four pounds per pound of meal in the second fattening period, beginning around 100 lb. weight. This trial was carried on without skim-milk; but, on the other hand, 15 per cent protein supplement was added to the meal mixture during the first fattening period.

Although this experiment was carried on only for one year, the results definitely showed that raw potatoes cut up and mixed with meal in the above specified proportions and without skim-milk, were of very little value in fattening hogs. In fact, a bushel of raw potatoes so fed replaced only two pounds of meal. The average daily gain per hog was only 0·56 lb. and with the raw potato diet it was impossible to fatten hogs up to market weight. On the other hand, cooked potatoes, which were used as a comparison in this test, showed very good results, in spite of being fed without skim-milk. They replaced, per bushel, 16 lb. of meal and the five hogs which were used made an average daily gain of 1·32 lb.

From these two experiments, it was concluded that cull potatoes can be used very advantageously for fattening hogs, provided, however, that they are cooked and mixed with meal in the form of mash of ordinary consistency, with or without skim-milk. They can be used advantageously at the rate of four pounds of potatoes to each pound of meal. Their money value per bushel is evidently variable according to the price of meal and according to the proportion in which potatoes are mixed with the meal.

SHEEP

Raising Leicester Sheep

A flock of purebred Leicester sheep of superior strains is kept on this Station, in order to propagate good breeding stock in the lower St. Lawrence district where the sheep population is made up, for the most part, of the Leicester breed and also to amass some experimental data for the benefit of sheep breeders. Such data include cost of maintenance of ewes, cost of raising lambs, the best date for lambing and best age for first lambing.

Feed Cost for Maintenance of Ewes

The purpose of this project is to determine the annual feed cost for maintenance of a breeding ewe. It ended in 1939 after running eighteen years. The data amassed showed that the annual feed cost for maintenance of an adult was $6.10.

Feed Cost for Raising Lambs

The object of this experimental project is to determine the feed costs of raising lambs to weaning age which is about five months and for raising eight-month-old ewe lambs and eighteen-month-old ewes. In order to do so, a record was kept of the cost of feed consumed by mothers and lambs, less the revenue from the wool.

This project which ended in 1939, after being under way for fourteen years, showed that the feed cost of raising eight-month-old ewe lambs was $4.14 and $7.86 for eighteen-month-old ewes. For the average of the three years 1936-39, the feed cost of raising lambs to weaning time was $4.09 for lambs weighing 81 lb. at that age.

The Best Date for Lambing

The object of this project is to determine whether it is more advantageous with the Leicester breed and local climate, to have lambing early or late in the spring. In order to secure information on this matter, a comparison was made of the results obtained with lambs born before March 15 and with those born after March 15. The data obtained show the weight at birth, rapidity of development, percentage of mortality and the percentage of lambs suitable for breeding in the fall.

Ending in 1939, after six years of research, it was noted that lambing prior to March 15, gave better results, seeing that lambs were heavier in the fall while the percentage of those classed as good for breeding was much higher. Table 9 gives a good idea of the results obtained with this project.

Table 9.—LAMBING BEFORE AND AFTER MARCH 15

Items	Lambs born before March 15	Lambs born after March 15
Weight of lambs at birth (lb.)	9·7	9·6
Weight of lambs when put on pasture (lb.)	49·0	35·0
Weight of lambs at midsummer (lb.)	76·0	65·0
Weight of lambs in autumn (lb.)	98·0	89·0
Percentage of lambs classed good for breeding in autumn %	82·0	64·0

The Best Age for First Lambing

The purpose of this experiment was to determine the merits of first lambing ewes at one or two years of age. The factors studied in this project were the number of lambs born and raised by ewes, the development of lambs, the percentage of lambs suitable for breeding, and the weight of the adult ewes. After several years of experimentation, it appears that lambing at one year is not advantageous, except, perhaps, when the ewe lambs are sufficiently developed at mating time, weighing at least 100 lb.

Crossings Leicester × Cheviot

Cross-breeding Leicester rams with Cheviot ewes and Cheviot rams with Leicester ewes was undertaken in the fall of 1942. Up to the time of writing, the work accomplished consisted of the formation of a flock of cross-bred ewes (Leicester × Cheviot and Cheviot × Leicester) in order to make a second crossing with a black-faced breed and provide information on the value of such crossings. The aim of this project is to determine what influence the crossings will have in comparison with purebred breeding, on size, vigour, hardiness and prolificity, as well as on rapidity of development of market lambs and carcass quality. These facts will enable the Station to know what breed of rams would be the best to place at the head of cross-bred flocks in the lower St. Lawrence district.

This cross-breeding work is still in its initial stage, and the number of individuals raised is still insufficient to permit conclusions to be drawn. Nevertheless, results at the time of writing have shown certain tendencies which must be confirmed by further researches in this field. Apparently carcass quality with cross-bred lambs was better than that of purebred Leicesters. It appears also that the crossing of the Cheviot ram with the Leicester ewe results in a high percentage of twins, and since the Leicester ewes are good milkers, proper development of the lambs should be the natural outcome.

However, with regard to the crossing of the Leicester ram with the Cheviot ewe, this appears to be undesirable due to the fact that it has proved to be less prolific. Also, with the latter cross, troubles at lambing were noted on many occasions because the Cheviot ewe, naturally of smaller size than the Leicester had difficulty giving birth to extraordinarily large lambs weighing up to 14 and 15 lb., when the normal weight of the purebred Cheviot lamb at birth is much less.

HORSES

During the ten years under review, as in earlier years, Percheron horses were raised on the Station. In the fall of 1940, when the St. Joachim stud was closed, eight Canadian horses (seven mares and a stallion) representing the best lines of the breed were transferred to this Station, with the idea of carrying on their breeding simultaneously with that of the Percheron horses. Also, a few crossings between the French coach and the Canadian horses were made. The Percheron and Canadian horse stud, besides serving for research as to the best breeding, feeding and stabling methods, also served to establish certain experimental data.

Experimental Data Established with the Percheron Breed

Feed Cost of Percheron Foals (Male or Female) from Weaning to One-Year Old.

This project has been under way for fourteen years, including the last ten years of the period under review. The results to date are based on fifty-two foals. From weaning, up to one year of age, a foal consumed on the average, 2,276 lb. of hay, 1,391 lb. of oats and 323 lb. of bran, besides being on pasture for fourteen days. The average feed cost was $31.96.

Canadian mares and colts grazing on improved pasture.

Feed Cost of Percheron Foals (Male or Female) from Weaning up to Two and a Half Years of Age.

This experiment has been under way for twenty-one years, including the last ten years covered by this report. The aim was to determine the feed cost of Percheron foals, from weaning up to two and a half years of age, that is to say, up to the time when they are first broken in for work. The results compiled are based on fifty-one foals. They consumed, on the average per head, 6,022 lb. of hay, 3,677 lb. of oats and 781 lb. of bran, besides being on pasture for 265 days. The average feed costs per foal was $106.69.

Annual Feed Cost of Percheron Brood Mares Kept Exclusively for Breeding and Wintered Outside.

For five years, records have been kept of feed consumed and established annual feed cost for maintenance of Percheron brood mares, kept exclusively for

breeding and wintered outside. The results of this experimental project at time of writing are based on seventeen mares. They had an average annual consumption of 4,568 lb. of hay, 1,468 lb. of oats and 84 lb. of bran, besides spending 134 days on pasture. The average upkeep cost, for feed only, was $54.37 per mare.

Weight and Measurements of Percheron Foals (Male and Female)

For fifteen years, including the last ten years under review, information was gathered concerning the weight and measurements at different ages of all Percheron foals raised on this Station. These data were compiled separately for males and females and are summarized in Tables 10 and 11. The figures in brackets show the number of individuals in each case.

TABLE 10.—WEIGHT AND MEASUREMENTS OF PERCHERON FOALS (MALES)

Age of foals	Weight	Height		Size of cannon		Girth measurement
		At withers	At rump	Front	Rear	
	lb.	hands	hands	in.	in.	in.
At birth	159(27)					
At 6 months	761(27)	13·4(27)	13·7(25)	7·3(4)	8·3(4)	59·8(4)
At one year	1,038(25)	14·6(25)	14·9(23)	8·1(4)	9·1(3)	66·5(4)
At two years	1,526(17)	15·8(17)	16·1(16)	9·3(6)	10·2(5)	78·2(6)

A hand = 4 inches.
The figures in brackets indicate the number of individuals

TABLE 11.—WEIGHT AND MEASUREMENTS OF PERCHERON FOALS (FEMALES)

Age of foals	Weight	Height		Size of cannon		Girth measurement
		At withers	At rump	Front	Rear	
	lbs.	hands	hands	in.	in.	in.
At birth	155(32)					
At 6 months	727(31)	13·3(31)	13·7(29)	7·7(16)	8·3(16)	59·0(16)
At one year	999(28)	14·5(28)	15·0(26)	8·3(12)	9·2(11)	66·3(12)
At two years	1,435(23)	15·6(23)	16·0(21)	9·1(9)	9·9(9)	76·8(9)

A hand = 4 inches
The figures in brackets indicate the number of individuals.

Cost of Horse Labour for the Percheron Breed

This project was undertaken to determine how much feed Percheron horses consume, while working regularly all years as well as the feed cost of horse labour with this breed. The results established up to the time of writing are based on 171 horses. The annual consumption per horse was over a 24-year period, 5,933 lb. of hay, 5,469 lb. of oats and 487 lb. of bran. The average annual cost of feed was $119.69 per animal. The number of work hours per horse per year was 2,047 and the feed cost of a work hour was 5·8 cents per horse.

EXPERIMENTAL DATA ESTABLISHED WITH THE CANADIAN BREED

Cost of Feed of Canadian Foals (Males or Females) from Weaning to One-Year Old.

In order to determine the feed cost of raising Canadian colts from weaning to one-year old, records covering the last four years of the period under review

were kept of the feed consumed by all the colts raised on this Station. The results of this project at time of writing are based on ten foals. They consumed on the average per head, 2,521 lb. of hay, 859 lb. of oats and 116 lb. of bran. The average feed cost was $26.53 per head.

Annual Feed Cost of Canadian Brood Mares, Kept Exclusively for Breeding and Wintered Outside.

For five years, records were kept of the feed consumed by Canadian brood mares used exclusively for breeding and wintered outside, in order to establish the feed cost of their annual maintenance. The results of this experimental project at time of writing are based on twenty-four mares. They consumed annually on the average, 3,774 lb. of hay, 1,201 lb. of oats and 48 lb. of bran, besides being on pasture for 136 days. The annual average feed cost was $45.61 per mare.

Annual Feed Cost of Canadian Stallions, Kept Exclusively for Breeding and Wintered Outside.

For the last five years of the period under review, records were kept of the feed consumed by Canadian stallions used exclusively for breeding and wintered outside, in order to establish the annual feed cost for maintenance. The results on this project at time of writing are based on five stallions. They show an average annual consumption of 6,659 lb. of hay, 2,435 lb. of oats and 23 lb. of bran. The average annual feed cost was $65.36 per stallion.

Weight and Measurements of Canadian Foals (Males and Females)

For four years, some data have been compiled concerning the weight and measurements at different ages of Canadian foals raised at this Station. These records were compiled separately for males and females and are summarized in Tables 12 and 13. The figures in brackets show the number of individuals in each case.

TABLE 12.—WEIGHT AND MEASUREMENTS OF CANADIAN FOALS (MALES)

Age of foals	Weight	Height		Size of cannon		Girth measurement
		At withers	At rump	Front	Rear	
	lb.	hands	hands	in.	in.	in.
At birth	120 (9)	.....	.....	.....	.....	.....
At 6 months	536(6)	12·6(6)	13·0(6)	6·5(6)	7·3(6)	53·8(6)
At one year	701(6)	13·4(6)	14·0(6)	7·2(6)	7·9(6)	60·2(6)
At two years	1,043(3)	14·4(3)	14·8(3)	7·7(3)	8·4(3)	70·7(3)

A hand = 4 inches
The figures in brackets indicate the number of individuals.

TABLE 13.—WEIGHT AND MEASUREMENTS OF CANADIAN FOALS (FEMALES)

Age of foals	Weight	Height		Size of cannon		Girth measurement
		At withers	At rump	Front	Rear	
	lb.	hands	hands	ins.	ins.	ins.
At birth	132(5)	.....	.....	.....	.....	.....
At six months	570(5)	12·9(5)	13·2(5)	7·1(5)	7·5(5)	56·4(5)
At one year	765(3)	13·8(3)	14·3(3)	7·4(3)	8·0(3)	61·3(3)

A hand = 4 inches
The figures in brackets indicate the number of individuals.

Weight and Measurements of cross-bred foals (geldings) (French coach × Canadian)

During the past five years, two cross-bred geldings (French coach stallion on Canadian mare) were raised and kept at this Station until the age of two years. Table 14 summarizes information concerning their weight and measurements at different ages.

TABLE 14.—WEIGHT AND MEASUREMENTS OF CROSS-BRED FOALS (GELDINGS)
(French Coach × Canadian)

Age of foals	Weight	Height		Size of cannon		Girth measurement
		At withers	At rump	Front	Rear	
	lb.	hands	hands	ins.	ins.	ins.
At birth	119(2)	.....	.....	.....	.....	.....
At six months	515(2)	12·6(2)	13·0(2)	6·8(2)	7·4(2)	55·0(2)
At one year	685(2)	13·1(2)	13·5(2)	7·4(2)	7·9(2)	60·0(2)
At two years	995(2)	14·5(2)	14·8(2)	7·9(2)	8·3(2)	68·0(2)

A hand=4 inches
The figures in brackets indicate the number of individuals.

POULTRY

In the period under review, the flock consisted of a yearly average of 2,300 pedigree birds, composed as follows: 1,800 chicks, 400 R.O.P. hens and 100 R.O.P. males of the Barred Plymouth Rock breed. The incubation period lasted from February 25 to May 10, when 56,055 chicks were taken from the incubators. All hens were trap-nested during their first and subsequent years. Each mating was proved by its offspring. The results obtained by each family are recorded along with such economic characters as hatching capacity, family viability, fast-feathering, rate of growth, conformation of birds, absence of winter pause, production and weight of eggs, quality of eggs and structure of shell.

As shown in Table 15, the pullets kept under R.O.P. control during the nine years (1936-45) were certified in the proportion of 65·1 per cent with an average production of 243·1 eggs, weighing an average 25·9 ounces a dozen. Mortality was 6·6 per cent.

Fourteen experimental projects were active during these ten years.

TABLE 15.—COMPARISON OF R.O.P. FOR THE 9-YEARS, 1936-1945 (official records)

Years	Number of pullets	Number of certified pullets	Per cent certified	Average production of certified hens		Per cent mortality
				Eggs	Weight of eggs	
			%		oz.	%
1936-37	105	44	41·9	228·3	25·5	10·4
1937-38	82	47	57·3	231·9	25·9	2·4
1938-39	272	120	52·4	240·4	25·7	3·9
1939-40	250	163	65·2	248·1	26·0	4·0
1940-41	200	127	63·5	244·4	25·9	6·5
1941-42	200	131	65·5	240·6	26·0	6·5
1942-43	200	142	71·0	261·3	25·8	3·5
1943-44	200	127	63·5	262·7	26·0	15·5
1944-45	209	189	90·4	230·5	26·4	7·1
Average (9-yr.)	186	121	65·1	243·1	25·9	6·6

PROGENY TEST

During the last few years of the period under review, all sires used for individual matings were submitted to a severe selection, being classed according to their offspring. To be useful, proof of the offspring must be based on family records. One must have families of at least five sisters and the incubation season must be of five or six weeks. Table 16 gives results for the years 1938-45 inclusive, and shows clearly that a considerable variation exists in the capacity of males to transmit to their offspring an intensive production of quality eggs. Due to the progeny test, the best matings are known. These best strains are multiplied to form laying flocks of economic production. This is the best means of lowering the production cost of eggs.

TABLE 16.—PROGENY TEST

Year	Number of males	Daughters					Production of daughters from sire who transmitted highest average production by hen		Production of daughters from sire who transmitted lowest average production by hen	
		Start	Finish	Per cent mortality	Egg production	Weight of eggs				
				%		(gm.)	Eggs	Weight	Eggs	Weight
1938	6	116	110	3·1	207·4	60·6	221	60·4	195	62·4
1939	6	220	207	5·9	218·6	60·7	251	61·3	195	62·0
1940	7	194	173	10·8	232·8	60·2	244	59·4	221	59·9
1941	5	197	181	8·1	231·0	60·6	249	61·2	211	61·5
1942	6	195	189	3·1	228·0	61·6	250	61·8	214	61·3
1943	5	193	163	15·5	227·0	62·8	234	61·1	218	62·5
1944	7	209	194	7·2	230·0	63·0	238	64·0	218	63·0
1945	5	220	190	13·6	235·0	62·0	262	66·0	229	62·0

POULTRY IMPROVEMENT IN THE DISTRICT

In connection with this project and with a view to aiding the development and improvement of poultry in general, 31,925 hatching eggs, 43,003 chicks of R.O.P. stock, 3,566 R.O.P. cockerels, 3,953 R.O.P. pullets and 311 of R.O.P. certified hens were sold in the district during 1936-45. All were of Barred Plymouth Rock breed.

Table 17 gives number of hatching eggs and breeding birds sold each year.

TABLE 17.—HATCHING EGGS AND BREEDING BIRDS SOLD

Year	Eggs	R.O.P. chicks	R.O.P. cockerels	R.O.P. pullets	Certified R.O.P. hens
1936	4,336	285	141	204	.....
1937	3,810	.....	227	273	.....
1938	597	1,900	220	271	.....
1939	2,954	2,753	229	352	.....
1940	1,434	4,296	294	419	.....
1941	615	5,315	254	276	25
1942	181	9,135	187	486	34
1943	3,770	9,452	585	546	110
1944	7,738	5,985	782	601	84
1945	6,490	3,882	674	525	58
Total	31,925	43,003	3,566	3,953	311

FEED COSTS OF PRODUCING EGGS

In order to establish the net cost of producing eggs, a group of pullets was kept under supervision for a whole laying year in order to arrive at an annual and monthly feed cost.

The data collected on this project appear in Table 18 for 1945 and eight preceding years. It will be noted that 100·5 pullets composed this group in 1945, and that they laid a yearly average of 219·5 eggs for a net feed cost of 13·35 cents a dozen, while price of a dozen eggs was 35·71 cents. The feed cost per pullet was $2.44 and the value of eggs was $6.53. This represents a margin of profit over feed cost of $4.09 per pullet, or of 22·36 cents per dozen eggs.

The average egg production of the last nine years under review, established on an average number of 89·6 pullets per year, was 217·4 eggs. The feed cost was $2.20 per pullet or 11·74 cents per dozen eggs. The value of eggs was $5.57 per pullet or 30·67 cents per dozen. The profit over feed cost was $3.36 per pullet or 18·96 cents per dozen eggs. The cost of a dozen eggs is closely related to the number of eggs produced by the laying flock. The total amount of feed required for a flock whose average production is 150 eggs per hen, is obviously very little less than that of a flock averaging 217 eggs per hen, since approximately 25 per cent of feed consumed is employed for the production of eggs, and 75 per cent for maintenance of the body.

TABLE 18.—FEED COSTS OF PRODUCING EGGS

For period of 28 days from Oct. 3 1944 to Oct. 2 1945	Number of pullets	Eggs laid		Feed cost		Value of eggs		Profit over feed cost	
		Number	Dozen	Total	Per doz.	Total	Per doz.	Total	Per doz.
				$ cts.	cts.	$ cts.	cts.	$ cts.	cts.
1st.....29 days	104	2,004	167·0	19 53	11·69	58 45	35	38 92	23·31
2nd.....28 "	104	1,845	153·8	19 50	12·68	61 52	40	42 02	27·32
3rd..... " "	104	1,678	139·8	19 03	13·61	55 92	40	36 89	26·39
4th..... " "	103·9	1,510	125·8	18 58	14·77	37 74	30	19 16	15·23
5th..... " "	103	1,540	128·3	18 81	14·66	38 49	30	19 68	15·34
6th..... " "	102	1,864	155·3	21 25	13·68	46 59	30	25 34	16·32
7th..... " "	101·6	2,053	171·1	19 43	11·35	51 33	30	31 90	18·65
8th..... " "	98·6	1,841	153·4	18 60	12·12	53 69	35	35 09	22·88
9th..... " "	97·1	1,837	153·1	19 31	12·62	53 59	35	34 28	22·38
10th..... " "	97	1,758	146·5	19 08	13·02	51 28	35	32 20	21·98
11th..... " "	97	1,671	139·3	17 20	12·35	55 72	40	38 52	27·65
12th..... " "	97	1,262	105·2	18 54	17·63	47 34	45	28 80	27·37
13th..... " "	97	1,196	99·7	16 56	16·60	44 87	45	28 31	28·40
Total.....	100·5	22,059	1,838·3	245 42	13·35	656·53	35·71	411·11	22·36
Average per pullet....	1	219·5	.....	2·44	13·35	6·53	35·71	4·09	22·36
Average of 9 last years established with 89·6 pullets a year.....	1	217·4	.....	2·20	11·74	5·57	30·67	3·36	18·96

RELATION BETWEEN ANNUAL PRODUCTION AND DATE FIRST EGG IS LAID

This project was undertaken with a view to learning the best age at which pullets should begin to lay, in order to give the highest annual production while taking into account both the size of eggs and maintenance of live weight of birds. Records were kept of the weight of eggs and weight of birds for four groups of pullets which started to lay at different ages; 150 days and less, from 160 to 170 days, from 180 to 200 days and after 210 days.

Table 19 records all the data collected on the project for years 1939-45 inclusive. During this period the 93 pullets which started to lay at the age of 150 days and less, laid 235·9 eggs weighing 59·8 grams per dozen. The 456 pullets which started to lay between 160 and 170 days, had an average production of 229·1 eggs weighing 61·3 grams a dozen. The 222 pullets which started to lay between the age of 180 and 200 days, laid 231·5 eggs weighing 61·9 grams a dozen. Finally, the 115 pullets which started laying after age of 210 days, gave an average annual production of 206·6 eggs weighing 62·5 grams a dozen. This experiment shows that the pullets which are late in starting to lay produce the least eggs. Also, their per dozen production is less economical.

TABLE 19.—PROJECT P.163—RELATION BETWEEN ANNUAL PRODUCTION AND DATE FIRST EGG IS LAID

Year	First egg laid at age of 150 days or less				First egg laid at age of 160–170 days				First egg laid at age of 180–200 days				First egg laid after age of 210 days			
	Number of pullets	Average weight of body per pullet	Annual production—Average egg production by pullet	Average weight of eggs	Number of pullets	Average weight of body per pullet	Annual production—Average egg production by pullet	Average weight of eggs	Number of pullets	Average weight of body per pullet	Annual production—Average egg production by pullet	Average weight of eggs	Number of pullets	Average weight of body per pullet	Annual production—Average egg production by pullet	Average weight of eggs
	No.	Lb.	Eggs	Gm.	No.	Lb.	Eggs	Gm.	No.	Lb.	Eggs	Gm.	No.	Lb.	Eggs	Gm.
1939–45	93	6·1	235·9	59·8	456	6·2	229·1	61·3	222	6·3	231·5	61·9	115	6·2	206·6	62·5

Pullets vs. Hens for Egg Production

The purpose of this project is to compare first year production with second year production of the same birds.

As shown in Table 20, with a total number of 475 R.O.P. hens during nine years, the number of eggs laid per bird during the first laying year, was 247·6 and 151·8 for the second. This experiment reveals that the best layers can produce economically for two consecutive years.

Table 20.—PULLETS VS. HENS FOR EGG PRODUCTION

Year	No. of birds	Pullets	Hens	Difference
		No. of eggs laid in first laying year	No. of eggs laid in second laying year	
In 9 years—1937–45	475	247·6	151·8	95·8

Best Date for Incubation

This experiment aims to determine the influence of date of incubation on fertility of eggs, the percentage of hatching and percentage of chicks alive at three weeks. With this idea in mind, the results obtained with incubation in March were compared with those of April. With regard to fertility, hatchability and livability, the results were better in March than April. Table 21 gives the average results for the 17-year period previous to 1946.

Table 21.—BEST DATE FOR INCUBATION

Month	Total eggs set	Number fertile eggs	Per cent fertile	Number of chicks	Per cent fertile eggs hatched	Per cent total eggs hatched	No. of chicks alive at three weeks	Per cent chicks hatched alive at three weeks
17-year average—								
March	1,167·2	965·5	82·6	734	76·1	62·8	703	95·6
April	1,115·5	899·0	80·6	622	68·9	55·7	583	93·6

Incubation Costs

This project is carried on with a view to determining the incubation costs of a one-day-old chick, taking into consideration all costs incurred except labour. In 1945, this experiment was undertaken with an electric Jamesway incubator having a capacity of 5,880 eggs, in which 8,004 eggs were incubated and 5,598 chicks hatched. Total expense, excluding labour, was $402.31 as shown in Table 22, or 7·1 cents per chick. The average cost price per chick for six years is 6·1 cents.

TABLE 22.—INCUBATION COSTS

Interest on incubator ($745 at 5%)	$37.25
Depreciation of incubator ($745 at 8%)	59.60
Upkeep of incubator	10.00
Interest on incubation room ($500 at 5%)	25.00
Depreciation on incubation room ($500 at 4%)	20.00
Upkeep on incubation room	3.00
Electricity for incubator (1,928 watts)—75 days	38.56
Coal for heating incubator room (800 lb. at $17)	6.80
Electricity for candling and light	2.00
Incubation eggs (8,004 eggs at 30c. a dozen)	200.00
Total expenses except labour	402.31
Number of chicks	5,598
Mean cost per chick in 1945	7·1c.
Mean cost per chick—Average of six years	6·1c.

RELATION OF WINTER PRODUCTION TO FERTILITY, HATCHABILITY AND LIVABILITY

This project seeks to determine if the quantity of eggs laid during the winter influences the fertility of eggs, hatching percentage and the percentage of living chicks at three weeks.

The results of incubation obtained for six years with eggs produced by hens which laid 30 eggs or less from November 1 to March 20 are compared with those obtained with eggs produced by hens which laid 50 eggs or more during the same period. These results are recorded in Table 23.

TABLE 23.—RELATION OF WINTER PRODUCTION TO FERTILITY, HATCHABILITY AND LIVABILITY

Year	Winter laying (Nov. 1 to March 20)	Total eggs set	Per cent fertile eggs	Number of chicks	Per cent fertile eggs hatched	Per cent chicks hatched alive at 3 weeks
6-year average	30 eggs or less	3,534	89·6	2,671	85·2	98·7
1940-45	50 eggs or more	3,327	83·2	2,394	83·7	98·4

TIME TAKEN FOR TRAP-NESTING

This project, studied for nine years, serves to establish the time required to trap nest. The time required to control 100 hens of different production rates—25, 50 and 80 per cent was established. Results are listed in Table 24.

TABLE 24.—TIME TAKEN FOR TRAP-NESTING

Years	Time required per day to control 100 hens		
	With a production percentage of 25 per cent	With a production percentage of 50 per cent	With a production percentage of 80 per cent
9-year average	26·2 minutes	34·7 minutes	49·7 minutes

Table 24 records that over a 9-year period 26·2, 34·7 and 49·7 minutes were required to control 100 hens per day on trap nests at the respective production percentages of 25, 50 and 80 per cent.

Breeding for Egg Size

In order to improve the size of eggs, a project has been under way for more than eighteen years. Only male birds whose dams laid eggs above normal size are used for breeding. Table 25 gives results of the experiment from 1927 to 1945 inclusive.

Table 25.—BREEDING FOR EGG SIZE

Years	Number of pullets controlled	Number of pullets laying eggs of 24 oz. or more to the dozen	Percentage of pullets whose eggs weigh 24 oz. or more to the dozen
			%
1927	116	30	25·8
1933	121	77	63·6
1938	113	98	86·7
1941	174	157	90·2
1942	187	176	94·1
1943	193	174	90·1
1944	170	157	92·3
1945	194	186	95·8

Brooding Costs and Rate of Growth in Rearing

The aim of this experiment is to determine *(a)* the feed consumed, the feed and fuel costs to raise Barred Plymouth Rock pullets to age of production; *(b)* the rate of growth. This project takes into account the quantity and cost of feed consumed and fuel used, as well as weight of pullets during six periods of four weeks each starting at hatching.

On average of fourteen years, Table 26 shows that a pullet consumed 16·03 lb. of mash, 10·63 lb. of scratch grain, 11·05 lb. of skim-milk, 0·46 lb. of grit and 0·42 lb. of oyster shell. The cost of feed was 51·0 cents, fuel 0·69 cents and the total cost was 52·26 cents.

Table 26.—BROODING COSTS AND RATE OF GROWTH IN REARING

Period of 24 weeks	Feed consumed per pullet					Brooding cost per pullet			Increase in weight per pullet
	Mash	Grain	Milk	Grit	Oyster shell	Feed	Fuel	Total	
	Lb.	Lb.	Lb.	Lb.	Lb.	cts.	cts.	cts.	Lb.
Total per pullet for 24 weeks	16·03	10·63	11·05	0·46	0·42	51·0	0·69	52·26	5·18
Average of 14 years	.....	.....	[1]	[3]	[4]	.....	[2]	.....	.....

[1] 2-year average [2] 8-year average. [3] 6-year average. [4] 5-year average.

Note:—For the development of a Barred Plymouth Rock cockerel the cost of feed is about 20 per cent more than that of a pullet.

Home-mixed Mash vs. Standard Commercial Mash

The goal of this experiment is to determine from an incubation as well as an egg production point of view, the value of commercial rations in comparison with those prepared at the Station. Accordingly, two groups of pullets having practically the same laying capacity were compared. Fed for a whole year, one group received balanced commercial feeds; the other mixed feeds prepared at

this Station. In both cases, a count was kept of feed consumed, cost of feed, number of eggs laid, price of eggs, net price per dozen, profit over cost price of feed, percentage of fertility of eggs and hatching percentage.

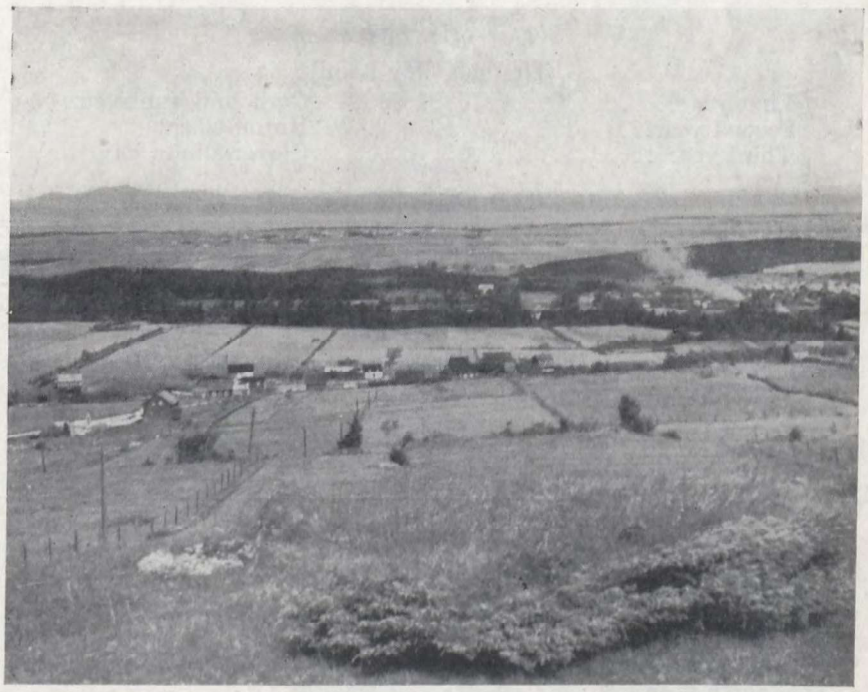
Table 27 gives egg production, profit over cost price of feed, fertility of eggs and hatching percentage averaged over an 8-year period.

TABLE 27.—HOME MIXED MASH VS. STANDARD COMMERCIAL MASH

Items	Standard commercial mash	Home-mixed mash
	8-year average	8-year average
Number of birds in group	69·4	69·4
Total seasonal feed cost	$ 178 28	$ 151 45
Number of eggs laid	14,979	15,330
Value of eggs	$ 405 35	$ 416 14
Cost price per dozen	14·18c.	11·77c.
Profit over total cost of feed	$227 13	$264 68
Total eggs set	352	347·2
Percentage of fertility	84·3	87·6
Percentage fertile eggs hatched	74·3	82·6
Percentage total eggs hatched	63·2	70·3

FIELD HUSBANDRY

The field crops produced on this Station include clover-alfalfa hay, timothy-alfalfa hay, green fodder hay, clover-timothy hay for silage, corn for silage, rutabagas, mangels, horse carrots, potatoes, wheat, peas, barley, oats. In addition, a certain area is used for permanent pasture during the summer. The area of the Station comprises 315 acres of arable land, sixty per cent being compact clay which is difficult to work but very fertile, while forty per cent is sandy or gravelly and fertility varies from poor to medium. These two soil types are fairly representative of soil in this district.



Countryside view of the lower St. Lawrence valley, typical of the dominant topography.

Proper soil drainage, good cultural practices, weed control, rotations and rational use of farm manure and chemical fertilizers have been responsible for the good yields obtained with most field crops on this Station.

In addition to producing the necessary crops for feeding livestock, this Station is conducting numerous experiments with various problems in field husbandry such as the production costs of crops, rotations, soil drainage, weed control, improvement of pastures and meadows, cultural practices, preparation of soil for grain, and the value of farm manure and chemical fertilizers for different crops and various types of soil. The object of these experiments is to obtain from the land the maximum yield and to ascertain the crops which may be grown on a large scale in the district, taking into consideration both the soil and climatic conditions.

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Rotation of Crops

Since 1924, different rotations on heavy soil have been compared. With the exception of one that was started in 1924 and continued up to 1945, these can be divided into two groups. The first group comprises the rotations started in 1924 and discontinued in 1936, the second, the rotations started in 1937 and still being carried on.

ROTATIONS OF FIRST GROUP (1924-36)

For thirteen years, five rotations were compared in order to determine which would be best for the dairy industry in the district. The description of these different rotations, as well as their yields and the cost of crop production for an average of thirteen years, is given in following tables.

Three-year rotation

(Drained Clay Land)

First year.....Corn and sunflower
Second year.....Huron wheat
Third year.....Clover-alfalfa hay

TABLE 28.—YIELD AND COST PRICE OF CROPS

Rotation year	Crops	Average yield per acre for 13 years	Average cost per ton or bushel for 13 years
		tons	$ cts.
1st	Corn	12.70	4 01
"	Sunflower	17.99 bushels	2 71
2nd	Huron Wheat	33.3 tons	0 90
3rd	Clover and Alfalfa	3.07	7 32

Four-year rotation

(Drained Clay Land)

First year.....Swedes, sunflower and corn
Second year.....Wheat
Third year.....Clover
Fourth year.....Timothy

TABLE 29.—YIELD AND COST PRICE OF CROPS

Rotation year	Crops	Average yield per acre for 13 years	Average cost per ton or bushel for 13 years
		tons	$ cts.
	Swedes	18.73	3 19
1st	Corn	12.65	3 88
	Sunflower	16.93 bushels	3 00
2nd	Wheat	29.0 tons	1 01
3rd	Clover	2.81	7 51
4th	Timothy	2.91	6 11

Four-year rotation

(Undrained Clay Soil)

First year.....Swede turnips, corn, sunflower
Second year.....Wheat
Third year.....Clover Hay.
Fourth year.....Timothy Hay

TABLE 30.—YIELD AND COST PRICE OF CROPS

Rotation year	Crops	Average yield per acre for 13 years	Average cost per ton or bushel for 13 years
		tons	$ cts.
1st	Swede Turnips	15.59	3 89
	Corn	11.64	4 27
	Sunflower	15.25	3 28
		bushels	
2nd	Wheat	23.3	1 42
		tons	
3rd	Clover	2.94	7 41
4th	Timothy	2.86	6 38

Five-year rotation

(Undrained Clay Soil)

First year.....Swede turnips
Second year.....Wheat
Third year.....Clover
Fourth year.....Timothy
Fifth year.....Pea and oat hay

TABLE 31.—YIELD AND COST PRICE OF CROPS

Rotation year	Crops	Average yield per acre for 13 years	Average cost per ton or bushel for 13 years
		tons	$ cts.
1st	Swede turnips	16.54	3 73
		bushels	
2nd	Wheat	22.9	1 35
		tons	
3rd	Clover	2.89	7 73
4th	Timothy	2.70	7 29
5th	Pea and oat hay	3.14	9 07

Four-year rotation

(Partially Drained Clay Land)

First year.....Sunflower and corn mixed
Second year.....One part oats and one part wheat
Third year.....Mixed clover and alfalfa hay
Fourth year.....Mixed timothy and alfalfa and aftermath grazed at times.

TABLE 32.—YIELD AND COST PRICE OF CROPS

Rotation year	Crops	Average yield per acre for 13 years	Average cost per ton or bushel for 13 years
		tons	$ cts.
1st	Sunflower and corn	16.41	3 07
		bushels	
2nd	Oats	78.5	0 36
	Wheat	39.6	0 68
		tons	
3rd	Clover and alfalfa hay[1]	4.87	5 68
4th	Timothy and alfalfa hay[2]	3.29	6 36
"	Pasture	87 days	

[1] Two cuts. [2] One cut, aftermath was grazed.

Of the five rotations undertaken, best results came from the four-year rotation, recorded in Table 32. In this totation, fertilizers were applied during the first two years of rotation—16 tons of manure per acre for the sunflower and corn crop and 400 lb. of 20 per cent superphosphate for cereals.

The seed mixture used per acre for sowing of meadows in this rotation consisted of 8 lb. of timothy, 5 lb. of red clover, 2 lb. of alsike clover, 1 lb. of white clover, 6 lb. of alfalfa, 2 lb. of Kentucky blue grass, and 1 lb. of tall oat grass.

As listed in Table 32, this rotation over a 13-year period gave a yield per acre of 16·41 tons of silage of sunflower and corn, 78·5 bushels of Banner oats, 39·6 bushels of wheat, 4·87 tons of hay mixed with clover and alfalfa for the third rotation year, and 3·29 tons of alfalfa timothy hay, to which must be added 87 days of pasture for last year of rotation.

ROTATIONS OF SECOND GROUP (1937-45)

In 1937, another group of six rotations was started, one of which was a continuation of those classed as best in 1936. Five of these rotations were on clay soil and one on sandy loam soil. The descriptions of these different rotations, as well as their yields and cost of crop production for an average varying from seven to thirteen years, are listed in succeeding tables.

Three-year rotation

(Sandy Loam Soil)

First year.....Potatoes
Second year.....Oats
Third year.....Clover and alfalfa

TABLE 33.—YIELD AND COST PRICE OF CROPS

Rotation year	Crops	Average yield per acre for 13 years	Average cost per ton or bushel for 13 years
		bushels	$ cts.
1st	Potatoes	325.96	0 25
2nd	Oats	39.3	0 64
		tons	
d	Clover and alfalfa	1.26	12 67

For this rotation, 12 tons of manure and 800 lb. of 4–8–10 per acre were used, all being applied to potato crop.

Three-year rotation

(Drained Clay Land)

First year.....Winter wheat Kharkov 22 M.C.
Second year.....Banner oat
Third year.....Clover and alfalfa

TABLE 34.—YIELD AND COST PRICE OF CROPS

Rotation year	Crops	Average yield per acre for 9 years	Average cost per ton or bushel for 9 years
		bushels	$ cts.
1st	Kharkov wheat	38.8	0 73
2nd	Oats	69.4	0 38
3rd	Clover and alfalfa	tons 2.38	7 97

Five-year rotation

(Partially Drained Clay Land)

First year.....Peas
Second year.....Barley
Third year.....Clover and alfalfa
Fourth year.....Timothy and alfalfa
Fifth year.....Timothy and alfalfa followed by partial summerfallow.

TABLE 35.—YIELD AND COST PRICE OF CROPS

Rotation year	Crops	Average yield per acre for 7 years	Average cost per bushel or ton for 7 years
		bushels	$ cts.
1st	Peas	25.5	2 27
2nd	Barley	36.0	0 69
3rd	Clover and alfalfa	tons 3.61	5 04
4th	Timothy and alfalfa	3.57	5 67
5th	Timothy and alfalfa[1]	3.09	5 04

[1] A cut of hay followed by partial summerfallow.

Four-year Rotation

(Partially Drained Clay Land)

First year.....Peas and oats mixed
Second year.....Oats
Third year.....Clover and alfalfa
Fourth year.....Timothy and alfalfa

TABLE 36.—YIELD AND COST PRICE OF CROPS

Rotation year	Crops	Average yield per acre for 9 years	Average cost per 100 lb., bushel or ton for 9 years
		lb.	$ cts.
1st	Peas and oats mixed	2,169 bushels	1 53
2nd	Oats	69·6 tons	0 35
3rd	Clover and alfalfa	4·01	6 12
4th	Timothy and alfalfa[1]	3·02	5 84

[1] A cut of hay followed by partial summerfallow.

Four-year Rotation

(Partially Drained Clay Land)

First year.....Corn
Second year.....Wheat
Third year.....Clover and alfalfa
Fourth year.....Timothy and alfalfa

TABLE 37.—YIELD AND COST PRICE OF CROPS

Rotation year	Crops	Average yield per acre for 9 years	Average cost per ton or bushel for 9 years
		tons	$ cts.
1st	Corn	13·95 bushels	3 19
2nd	Wheat	36·1 tons	0 86
3rd	Clover and alfalfa	4·31	5 02
4th	Timothy and alfalfa	4·32	4 19

Four-year Rotation

(Partially Drained Clay Land)

First year.....Corn
Second year.....Oats
Third year.....Clover and alfalfa
Fourth year.....Timothy and alfalfa

TABLE 38.—YIELD AND COST PRICE OF CROPS

Rotation year	Crops	Average yield per acre for 9 years	Average cost per ton or bushel for 9 years
		tons	$ cts.
1st	Corn	13·74 bushels	3 23
2nd	Oats	72·0 tons	0 37
3rd	Clover and alfalfa	4·31	5 03
4th	Timothy and alfalfa	4·33	4·27

Of the five rotations compared on clay soil, those which gave the best results are two 4-year rotations and one of five years. The four-year rotations shown in Tables 37 and 38 brought comparatively equal profits per acre. However, since the need for oats in lower Quebec is great, the usual practice is to sow oats in the second year or at least a part in wheat and the remainder in oats.

The fertilizer employed in these two rotations was manure and 20 per cent superphosphate. The manure was applied to the corn crop in the proportion of 16 tons per acre and the superphosphate to the cereal crops in the proportion of 300 lb. per acre.

The same hay mixture was seeded down for both rotations, that is, 7 lb. of timothy, 5 of red clover, 2 of alsike clover and 6 of alfalfa.

The five-year rotation (Table 35) with peas the first year, barley in second year, clover and alfalfa the third year and timothy and alfalfa in fourth and fifth years, gave very good results, especially with respect to profits per acre. This rotation would be advantageous in the growing of cash crops.

The Rotation That Gave Best Results from 1924-45

Of all rotations tried at this Station over a twenty-two-year period, the one that gave best results was a four-year rotation of sunflowers and corn or corn alone the first year, oats in second year, two cuts of clover-alfalfa hay in third year and one or two cuts of timothy-alfalfa hay followed by pasture in fourth year.

The fertilizer for this rotation consisted of 16 tons of manure per acre applied the first year and 300 lb. of superphosphate in the second year.

The seed mixture used was 7 lb. of timothy, 5 lb. of red clover, 2 lb. of alsike clover and 6 lb. of alfalfa.

Table 39 describes this rotation, giving the yields and cost price of crops for an average varying from seven to twenty-two years.

Four-year Rotation

(Partially Drained Clay Land)

First year.....Sunflowers and corn, or corn alone
Second year.....Oats
Third year.....Clover and alfalfa
Fourth year.....Timothy and alfalfa and aftermath grazed at times.

Table 39.—YIELD AND COST PRICE OF CROPS

Rotation year	Crops	Number of years	Average yield per acre	Average cost per ton or bushel
			tons	$ cts.
1st	Corn	7	13·62	3 15
"	Sunflowers and corn	15	16·07	3·10
2nd	Oats	22	bushels 76·2	0 35
3rd	Clover and alfalfa	22	tons 4·33	5 23
4th	Timothy and alfalfa followed by grazing	22	3·70[1] 1·35 months	5 46

[1] The fourth year of the rotation furnished, besides hay crop, pasture for 1·35 months.

Studies of Effect of Certain Crops on Others

The object of this experiment is to find the crops that have the best influence on other succeeding crops in the rotation. The first year, eight crops called "basic crops" were used each followed in the second year by four crops called "determinate crops"; while in the third year, oats are used. The relative value of the eight basic crops is determined by the four crops that follow in the rotation.

This project is so planned as to permit the comparison of the data obtained with crop rotation vs. continuous crops. In Table 40 are listed the average yields for seven years.

Table 40.—EFFECT OF CROPS ON SUCCEEDING CROPS

Average Yield For Seven Years

Preceding crops	Determinate Crops			
	Potatoes	Swede turnips	Barley	Oats
	bush.	tons	bush.	bush.
Oats	196·90	13·07	32·3	51·8
Swede turnips	150·37	7·38	35·4	55·8
Potatoes	193·80	10·63	50·2	70·1
Peas	200·83	11·25	40·4	60·6
Alfalfa	253·93	15·19	53·1	71·9
Timothy	115·23	7·08	23·1	43·1
Red clover	247·37	11·19	50·7	70·0
Fallow	198·21	10·88	53·5	66·9

Up to the time of writing, the best preceding crops for potato production are classed in the following order of importance: alfalfa, red clover, peas, fallow, oats, potatoes, swede turnips and timothy.

For swede turnip production, the best preceding crops are:—alfalfa, oats, peas, red clover, fallow, potatoes, swede turnips and timothy.

For barley production, the best preceding crops are: fallow, alfalfa, red clover, potatoes, peas, swede turnips, oats and timothy.

For oat production, the best preceding crops were: alfalfa, potatoes, red clover, fallow, peas, swede turnips, oats and timothy.

Table 41.—ROTATION CROPS VS. CONTINUOUS CROPS

Name of crop	Average yield per acre for 7 years	
	Continuous Crops	Rotation Crops
Oats	47·6 bushels	55·0 bushels
Swede turnips	5·51 tons	9·12 tons
Potatoes	103·57 bushels	201·01 bushels
Peas	8·4 bushels	24·8 bushels
Alfalfa	lb. Dry matter 7,787	lb. Dry matter 6,029
Timothy	4,429	2,741

Rotation crop yields are, in general, superior to continuous crops. There are exceptions, however, for alfalfa and timothy crops.

Yields and Production Costs of Crops

The following tables give the yields and production costs of cultivated crops.

Table 42.—YIELD AND PRODUCTION COST OF HOED CROPS

Crops	Number of years	Average yield per acre in green matter	Average cost per ton of green matter	Average yield per acre of dry matter	Average cost per ton of dry matter
		tons	$ cts.	tons	$ cts.
Sunflower	15	16·96	3 03	2·63	19 54
Sunflower and corn mixture	15	16·07	3 10	2·37	21 02
Corn	22	13·44	3 42	2·06	22 31
Swede turnips	22	20·78	2 78	2·24	25 79
Mangels	22	20·96	3 35	2·54	27 64

After pasture, hay is the most economical crop for producing milk.

A glance at the average cost per ton of dry matter of the various hoed crops listed in Table 42 gives the comparative cost picture. This Station is of the opinion that sunflower and corn silage or corn alone could be recommended on farms specializing in dairying or where the herd is large enough to justify the construction of a silo and silage machine. But on ordinary farms, in a region where a limited number of cows are kept, and especially if one can cultivate hoed crops under St Lawrence valley conditions without engaging extra labour, the root crops are always more economical.

TABLE 43.—YIELD AND PRODUCTION COST OF HAY CROPS

Crops	Number of years	Average yield per acre of dried hay	Average cost per ton of dried hay	Average yield per acre of dry matter	Average cost per ton of dry matter
		tons	$ cts.	tons	$ cts.
Clover and alfalfa	21	4·33	5 23	3·27	6 87
Clover	13	2·98	7 23	2·14	10 07
Timothy	13	2·71	6 71	1·98	9 19
Timothy and alfalfa	9	4·34	4 10	3·44	5 16
Clover and alfalfa	9	4·28	4 95	3·33	6 36

Alfalfa added to clover or to timothy caused a considerable increase in hay yield, a decrease in cost price, and an increase in yield of dry matter, the latter varying from 53 to 73 per cent while the production cost ranged from 32 to 44 per cent lower.

TABLE 44.—YIELD AND PRODUCTION COST OF CEREALS

Crops	Number of years	Average yield per acre	Cost price per 100 lb.
		bush.	$ cts.
Oats	22	76·2	1 14
Wheat	22	34·2	1 51
Barley	22	41·3	1 43
Peas	22	36·1	2 33

The yields and production costs summarized in Table 44 for a period of 22 years indicate a profitable undertaking. However, it must be noted that these results were obtained on partially drained fertile clay land.

YIELD AND PRODUCTION COST OF POTATOES

The yields and production costs of potatoes grown on this Station were determined with the Green Mountain variety grown on a sandy loam soil to which was applied 10 tons per acre of manure and 800 lb. of chemical fertilizer 4–8–10. On a thirteen-year average the yield was 326 bushels per acre, the production cost per acre was $80.43 and cost price per bushel was 25 cents.

CULTURAL METHODS

PREPARATION OF SOIL FOR GRAIN

The purpose of this project is to determine which is the better method of preparing the soil for grain crops. The following Table describes the methods of preparing the soil, as well as the average yields obtained for seven years on heavy lowland.

TABLE 45.—PREPARATION OF SOIL FOR GRAIN ON HEAVY LOWLAND

Methods of Preparation of Soil	Yield per acre of wheat Average for 7 years
	bu.
Ploughing 4 inches deep in August with harrowing during summer and second ploughing 7 inches deep on October 15	31·5
Ploughing 4 inches deep in August with harrowing during summer	28·4
Ploughing 7 inches deep on September 15	21·2
Ploughing 7 inches deep on October 15	18·5
Ploughing 4 inches deep on October 15	19·5
Ploughing 7 inches deep in Spring	17·8

From this table the following conclusions may be drawn:

(1) Ploughing 4 inches in August with harrowing during the summer and second ploughing 7 inches on October 15, was superior to all other soil preparation methods.

(2) Ploughing 4 inches in August with harrowing during the summer was an advantageous method.

(3) Ploughing on September 15 gave better results than ploughing done October 15 or in spring.

(4) The depth of ploughing has not yet given any significant results.

DEPTH OF PLOUGHING

This project is undertaken to determine the best depth of ploughing. Two depths of ploughing were compared on grass and stubble on heavy lowland.

The following table gives the results obtained for an average of seven years.

TABLE 46.—DEPTH OF PLOUGHING ON GRASS AND STUBBLE ON HEAVY LOWLAND.

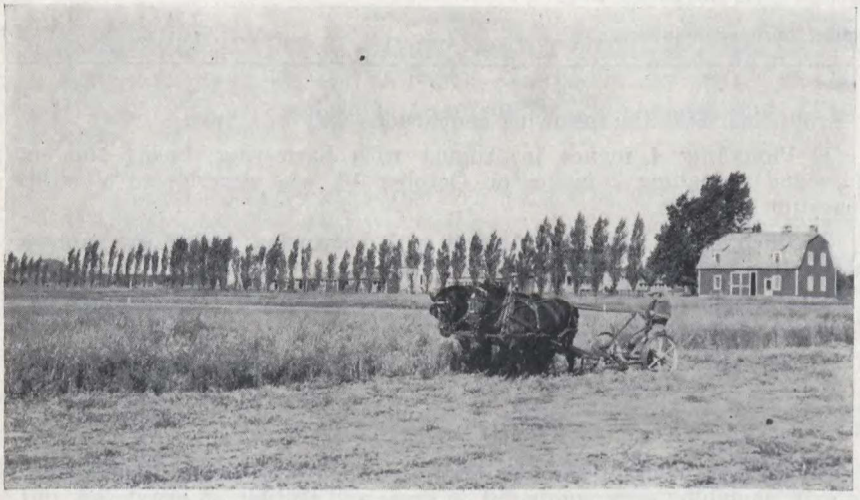
Depth of ploughing	Yield per acre of crops	
	Wheat 7-year average	Oats 7-year average
	bu.	bu.
On grass—		
Ploughing 7 inches deep	18·5	
Ploughing 4 inches deep	19·5	
On stubble—		
Ploughing 7 inches deep		43·9
Ploughing 4 inches deep		43·0

On grass and stubble, the difference in yield due to depth of ploughing was not significant. Ploughing 4 inches deep seems as advantageous as 7-inch ploughing.

Comparison of Drained and Undrained Land

For comparative purposes, two four-year rotations on clay land have been under way for thirteen years, one on under-drained land and the other open drained. The results obtained show that drainage was especially advantageous for hoed crops and cereals. Hay yields were almost as heavy in the undrained rotation as in the drained one.

This experiment shows that drainage of the soil is a very important factor in growing roots and cereals. This does not imply, however, that drainage is always profitable on all types of soil. Generally speaking, it is only practical in soil which suffers considerably from an excess of moisture or on parts of fields which cannot be drained by open ditches.



A splendid crop of alfalfa filled the silo as well as the loft.

Commercial Fertilizers vs. Farm Manure for Hay and Grain on Clay Land

The object of this experiment was to determine the value of chemical fertilizers and farm manure for hay and grain on clay land. It was carried on with a five-year rotation, including wheat and oats in first year, peas and oats in the second, oats in the third, clover and alfalfa in the fourth year and timothy and alfalfa in the fifth year. The various treatments were applied in part to the oat crop and part to the timothy alfalfa hay crop but the results were determined for each of the crops. Each field of the rotation was divided into three plots, one of which received *farm manure,* one *chemical fertilizers* and the third was left *unfertilized.*

The manured plot received 16 tons of manure per acre, half of which was applied to the oat crop and half to the timothy alfalfa hay crop.

The plot receiving chemical fertilizers was fertilized as follows: 300 lb. of 2–12–6 for the oat crop and 300 lb. of the same fertilizer for the timothy alfalfa crop.

The results for an average of nine years are given in Table 47:

TABLE 47.—COMMERCIAL FERTILIZERS AND FARM MANURE FOR HAY AND GRAIN ON CLAY LAND.—9-year average.

Year of rotation	Crops	Farm manure		Commercial fertilizer		Neither manure or chemical fertilizer	
		Yield per acre	Value of crops per acre after deduction of cost of fertilizer	Yield per acre	Value of acre of crops after deduction of cost of fertilizer	Yield per acre	Value per acre of crops
		lb.	$ cts.	lb.	$ cts.	lb.	$ cts.
First	Wheat and oats mixed	1,727	28 60	1,655	29 91	1,607	30 45
Second	Peas and oats mixed	1,538	26 82	1,366	26 18	1,379	26 80
Third	Oats	bush. 44·3	19 25	bush. 44·1	22 68	bush. 40·0	22 79
Fourth	Clover and alfalfa	tons 2·04	23 85	tons 1·97	25 37	tons 1·50	19 97
Fifth	Timothy and alfalfa	3·33	34 99	3·07	36 15	2·57	32 54

On an average of 9 years, the plot treated with farm manure gave a 10 per cent greater yield per acre for grain and 32 per cent higher for hay than the plot which received neither manure or fertilizer. The plot treated with chemical fertilizer 2–12–6 gave only 1 per cent more in grain yield and 24 per cent for hay yield than the plot that received no treatment. Table 47 then shows that farm manure increased appreciably the yields of grain and hay, while chemical fertilizers had effects only on hay.

It is noted also that the treatments of manure or chemical fertilizers were economical only for the hay crop, that is to say, the increase in yield of grain due to fertilizers was only high enough to cover expenses. These results were obtained on a naturally fertile clay land.

COMMERCIAL FERTILIZERS AND FARM MANURE FOR THE PRODUCTION OF HAY AND GRAIN ON SANDY SOIL

The object of this experiment was to compare the fertilizing value of manure alone, manure and commercial fertilizers, of heavy and light applications of chemical fertilizers on unfertile gravelly and sandy soil. It was carried on with a four-year rotation, including pea and oat hay in first year, oats in the second, clover and alfalfa in the third and timothy and alfalfa in the fourth.

Each rotation field is divided into five plots, one of which received a heavy application of chemical fertilizer, another a small quantity; one received manure alone, another manure and chemical fertilizer, while one was left unfertilized.

The plot with the heavy application of commercial fertilizer received 950 lb. per acre during the rotation. The first-year crop received an application of 100 lb. of ammonium sulphate, 300 lb. of superphosphate and 75 lb. of muriate of potash; the second, 100 lb. of superphosphate and 25 lb. of muriate of potash; the third, 100 lb. of superphosphate and 25 lb. of muriate of potash; and the fourth-year crop, 100 lb. of ammonium sulphate, 100 lb. of superphosphate and 25 lb. of muriate of potash.

The plot selected for manure alone received 16 tons of manure an acre, half to the first-year crop and half to oat stubble the following year.

The plot with farm manure and chemical fertilizers received 8 tons per acre of manure and 300 lb. of superphosphate applied to the first-year crop and 8 tons of manure applied to second-year crop.

TABLE 48.—COMMERCIAL FERTILIZERS AND FARM MANURE FOR HAY AND GRAIN ON SANDY SOIL

9-Year Average

Crops	Heavy application of chemical fertilizer			Manure			Manure and chemical fertilizer			Light application of chemical fertilizer			Neither manure nor chemical fertilizer		
	Actual yield per acre	Percentage yield in relation to check	Value per acre of crops after deduction of cost of fertilizers	Actual yield per acre	Percentage yield in relation to check	Value per acre of crops after deduction of cost of fertilizers	Actual yield per acre	Percentage yield in relation to check	Value per acre of crops after deduction of cost of fertilizers	Actual yield per acre	Percentage yield in relation to check	Value per acre of crops after deduction of cost of fertilizers	Actual yield per acre	Percentage yield in relation to check	Value per acre of crops after deduction of cost of fertilizers
	tons	%	$ cts.	tons	%	$ cts.	tons	%	$ cts.	tons	%	$ cts.	tons	%	$ cts.
Pea and Oat Hay	2·27	372	22 33	1·93	316	16 79	2·07	340	18 10	1·75	287	17 69	0·61	100	7 22
Oat	bu. 31·1	285	13 72	bu. 32·1	294	13 21	bu. 34·0	312	9 46	bu. 26·5	243	12 78	bu. 10·9	100	6 19
Clover and alfalfa	tons 2·24	393	28 12	tons 2·45	450	26 04	tons 2·37	416	26 21	tons 1·42	249	18 63	tons 0·57	100	7 91
Timothy and alfalfa	2·68	339	33 16	2·51	318	29 05	2·38	301	28 26	1·59	201	21 02	0·79	100	10 40
Average	.....	347	24 33	.....	339	21 27	.....	342	20 51	.....	245	17 53	.....	100	7 93

The plot with a light application of chemical fertilizer received 100 lb. per acre of ammonium sulphate, 300 lb. of superphosphate and 75 lb. of muriate of potash applied to first year crop.

The unfertilized plot was used as a check and received neither manure nor chemical fertilizer.

In the following tables the actual yields and value of crops are given, after having deducted the cost of fertilizers, as well as the yields expressed in percentage of check.

Table 48 indicates that chemical fertilizers and manure were of greatest importance on sandy soil, both for the production of grain and hay. The average given at the base of the table constitutes a good basis of comparison from the point of view of yield as well as economy of production.

With the yield on *the unfertilized plot* being represented by 100 and the average value per acre of crops $7.93, it will be observed these figures, approximately, were doubled by the light application of chemical fertilizer and tripled by each of the other treatments.

Chemical Fertilizers and Manure for Potatoes

This experiment was undertaken to determine what elements of fertility, what chemical fertilizer formulae, and what rates and systems of application were most suitable for raising potatoes on rather poor gravelly soil.

For the purpose of this experiment, plots of 1/60 of an acre were used with three replications of each treatment and a three-year rotation of potatoes, grain and clover was followed. The fertilizers were applied to the potato crop but the yields of all the crops were noted in order to determine, apart from the potato yield, the residual effects of these fertilizers on the other crops. The various treatments and results obtained for the whole experiments are given in Table 49.

Table 49.—NITROGEN SERIES

Treatments	Average yields of crops per acre			
	Potatoes (14 years)		Oats (12 yr.)	Dried clover at 85% dry matter (7 yr.)
	Marketable	Non-marketable		
	bush.	bush.	bush.	tons
500 lb. of 0-8-8	217·69	52·45	31·7	0·85
500 lb. of 3-8-8	236·84	46·65	31·9	0·86
500 lb. of 6-8-8	253·97	49·67	30·5	0·88

The increase in yield of potatoes is proportional to the nitrogen units contained in different formulae. Nitrogen did not, however, increase the yields of the other two crops.

Table 50.—PHOSPHORIC ACID SERIES

Treatments	Average yields of crops per acre			
	Potatoes (14 years)		Oats (12 yr.)	Dried clover at 85% dry matter (7 yr.)
	Marketable	Non-Marketable		
	bush.	bush.	bush.	tons
500 lb. of 4-0-8	220·23	42·40	28·1	0·64
500 lb. of 4-6-8	234·69	47·90	30·4	0·73
500 lb. of 4-12-8	234·71	50·74	31·7	0·83

An application of 6 per cent phosphoric acid was shown to be as advantageous as a 12 per cent application on potatoes. On the other hand, subsequent crops profited little by residual effects of this element.

TABLE 51.—POTASH SERIES

Treatments	Average yields of crops per acre			
	Potatoes (14 years)		Oats (12 yr.)	Dried clover at 85% dry matter (7 yr.)
	Marketable	Non-Marketable		
	bush.	bush.	bush.	tons
500 lb. of 4-8-0	221·55	51·09	29·3	0·91
500 lb. of 4-8-4	229·39	51·61	28·7	0·82
500 lb. of 4-8-8	226·61	53·50	24·0	0·83

By adding 20 lb. of potash an acre, an increase of 8 bushels of potatoes was obtained. However, in doubling the 20 lb. rate, no better results with potatoes or the other two crops occurred.

TABLE 52.—COMMERCIAL FORMULAE

Treatments	Average yields of crops per acre			
	Potatoes (5 years)		Oats (5 yr.)	Dried clover at 85% dry matter (4 yr.)
	Marketable	Non-Marketable		
	bush.	bush.	bush.	tons
1,200 lb. of 6-20-16	188·47	64·14	23·9	0·93
1,200 lb. of 2-12-6	193·46	63·02	20·5	0·82
1,200 lb. of 4-8-10	227·69	61·21	17·7	1·19

The formula 4-8-10 was shown to be more advantageous than 2-12-6 from the point of view of yield, as well as economy.

TABLE 53.—COMPARISON OF MANURE AND CHEMICAL FERTILIZERS

Treatments	Average yields of crops per acre			
	Potatoes (14 years)		Oats (12 yr.)	Dried clover at 85% dry matter (7 yr.)
	Marketable	Non-Marketable		
	bush.	bush.	bush.	tons
Neither manure nor chemical fertilizer	187·03	44·11	29·2	0·71
15 tons of manure	278·23	54·53	41·1	1·34
6 tons of manure and 400 lb. of 3-10-6	264·83	54·77	32·6	1·12
6 tons of manure and 700 lb. of 3-10-6	277·66	55·63	34·3	1·07

The application of manure alone, or manure with the addition of chemical fertilizer, gave a surplus yield varying from 88 to 102 bushels per acre when compared to check. Comparing the manure alone with manure plus chemical fertilizer, it will be noted that the results are about equal.

While the check yield is high, the reason is that this is probably the result of ploughing under clover aftermath.

TABLE 54.—METHODS OF APPLICATION OF CHEMICAL FERTILIZERS

Treatments	Average yield of crops per acre			
	Potatoes (14 years)		Oats (12 yr.)	Dried clover at 85% dry matter (7 yr.)
	Marketable	Non-Marketable		
	bush.	bush.	bush.	tons
800 lb. 3-8-8 broadcasted	258·07	50·83	29·6	0·96
400 lb. 3-8-8- broadcast and 400 lb. drilled	266·96	49·60	30·3	1·07
800 lb. 3-8-8 drilled	270·49	49·28	32·0	1·05

A study of Table 54 indicates that it is more advantageous to apply drilled fertilizer than to broadcast it.

TABLE 55.—APPLICATION RATE OF CHEMICAL FERTILIZERS

Treatments	Average yield of crops per acre			
	Potatoes (14 years)		Oats (12 yr.)	Dried clover at 85% dry matter (7 yr.)
	Marketable	Non-Marketable		
	bush.	bush.	bush.	tons
6 tons of manure and 400 lb. of 3-10-6	264·83	54·77	32·6	1·12
6 tons of manure and 700 lb. of 3-10-6	277·66	55·63	34·3	1·07
400 lb. of 3-8-8	236·51	49·05	30·4	0·80
800 lb. of 3-8-8	258·07	50·83	29·6	0·96
1,200 lb. of 3-8-8	293·60	50·00	31·3	0·99
1,600 lb. of 3-8-8	307·36	51·22	35·6	1·08

From the results observed in Table 55 it may be concluded that:

(1) All crop yields are increased by using the highest rate of application of fertilizers.

(2) By doubling and even quadrupling the quantities of certain fertilizers for potatoes, economic yields are obtained. Thus, an application of 1,600 lb. produced 73 bushels more than when 400 lb. was applied, representing an increased profit of $28.14 per acre.

(3) The proportion of marketable potatoes increases 2 per cent with the increased rate of fertilizer.

USE OF LIMESTONE FOR POTATOES

Owing to difficulties experienced in securing a regular clover crop in a 3-year rotation, it was decided to compare different quantities of limestone in order to measure the advantages of its application. Since the direct application of limestone is not recommended for potatoes, it was applied to oats instead, while the commercial fertilizers were applied to the potatoes. The treatments and yields obtained are listed in Table 56.

TABLE 56.—USE OF LIMESTONE ON POTATOES

Treatments	Average yields of crops per acre				
	Potatoes (9 yr.)			Oats (9 yr.)	Dried clover at 85% dry matter (8 yr.)
	Marketable	Non-Marketable	Per cent scab		
	bush.	bush.		bush.	tons
800 lb. 3-8-8, no limestone	189.23	46.87	15.7	16.6	0.53
800 lb. 3-8-8, 500 lb. limestone	223.32	51.92	32.2	25.4	0.89
800 lb. 3-8-8, 1,000 lb. limestone	233.32	49.65	44.4	23.2	0.95
800 lb. 3-8-8, 2,000 lb. limestone	242.65	50.67	58.1	25.5	1.10
800 lb. 3-8-8, 4,000 lb. limestone	219.42	54.97	77.7	28.7	1.22

Limestone applied as high as 2,000 lb. per acre, caused a considerable increase in potatoes, clover and oats. Although not convenient to use, even if applied to oats, limestone increased the yield of potatoes, but reduced considerably the percentage of marketable potatoes because of scab, the degree of severity being proportional to the application rate. Therefore, in connection with potato production, it is best not to employ lime when the pH value is higher than 5.

SOURCES OF MAGNESIUM AND POTASSIUM FOR POTATOES

The object of this project was to determine the best sources of magnesium and potassium for potatoes.

TABLE 57.—SOURCES OF MAGNESIUM AND POTASSIUM FOR POTATOES

Treatments	Average yield of potatoes per acre (4 yr.)		
	Marketable	Non-Marketable	Per cent of scab
	bush.	bush.	
Check, without fertilizer	181.32	57.09	21.0
800 lb. of 4-8-10	233.33	66.29	28.0
800 lb. of 4-8-10 and 40 lb. of Kieserite	223.69	54.68	16.0
800 lb. of 4-8-10 and 48 lb. of magnesium and potassium sulphate	278.52	70.98	31.5
800 lb. of 4-8-10 with potassium muriate	233.33	66.29	28.2
800 lb. of 4-8-10 with potassium sulphate	217.61	68.70	24.5

From these data, the magnesium and potassium sulphate seem to be a good complement for the fertilizer 4-8-10, while Kieserite gives a negative result. As to the potassium, it seems best to apply it to potatoes in the form of muriate.

TESTING OF FERTILIZERS ON SWEDE TURNIPS ON A GRAVELLY SOIL

An experiment was carried on for fourteen years in order to determine the value of farm manure, chemical fertilizers and lime for swedes on gravelly soil. This experiment was conducted with a 4-year rotation, including swedes in the

first year, oats in the second, clover in the third and timothy in the fourth. Fourteen various treatments were tested, and while all fertilizers tried were applied to the swede crop, not only was a record kept of the yield of swedes but also of all the other crops in the rotation. This was done in order to establish at the same time, the residual effects of the various treatments upon subsequent crops.

The yields and total value of crops, after deducting the cost of fertilizers, are given in the following table.

TABLE 58.—TESTING OF LIME AND FERTILIZERS ON SWEDES ON SANDY SOIL

Treatment and quantity per acre	Yield of crops per acre				Total value of crops after deducting cost of fertilizers
	Swedes	Oats	Clover and alfalfa	Timothy and alfalfa	
	Average of 14 years	Average of 13 years	Average of 12 years	Average of 11 years	
	Tons	Bush.	Tons	Tons	$ cts.
2 tons—Ground limestone	5.18	30.4	1.29	1.05	58 34
350 lb.—Natural phosphate	9.10	30.0	1.49	1.22	84 12
2,240 lb.—Hydrated lime	5.53	36.3	1.51	1.22	55 78
750 lb.—Thomas phosphate	11.54	36.0	2.13	1.77	107 27
750 lb.—Superphosphate	13.90	36.0	1.92	1.72	114 49
20 tons—Manure	17.72	39.1	2.32	1.87	116 81
2 tons—Limestone 20 tons—Manure	19.06	46.5	2.68	2.15	130 95
500 lb.—Superphosphate 1 ton—Limestone	13.06	35.8	1.96	1.64	109 98
10 tons—Manure 100 lb.—Nitrate of soda 75 lb.—Ammonium sulphate 400 lb.—Superphosphate 100 lb.—Muriate of potassium	17.63	39.5	2.37	1.81	120 68
100 lb.—Nitrate of soda 75 lb.—Ammonium sulphate 400 lb.—Superphosphate 100 lb.—Muriate of potassium	14.12	30.5	1.76	1.33	102 67
100 lb.—Nitrate of soda 75 lb.—Ammonium sulphate 400 lb.—Superphosphate	13.12	34.8	1.85	1.39	104 95
100 lb.—Nitrate of soda 75 lb.—Ammonium sulphate 100 lb.—Muriate of potassium	4.92	28.5	0.95	0.85	50 13
400 lb.—Superphosphate 100 lb.—Muriate of potassium	12.14	34.5	1.46	1.21	94 33
Neither manure or chemical fertilizer	3.91	25.5	0.93	0.84	49 40

In this experiment, the best results were obtained by the following treatments:

(1) An application of 20 tons of manure and 2 tons of limestone gave a yield per acre of 19·06 tons of swedes, 46·5 bushels of oats, 2·68 tons of clover-alfalfa hay and 2·15 tons of timothy-alfalfa hay. With this treatment the value of the four rotation crops, after deducting the cost of fertilizers, was $130.95.

(2) An application of 10 tons of manure, supplemented by 675 lb. of chemical fertilizer composed of 100 lb. of nitrate of soda, 75 lb. of ammonium sulphate, 400 lb of superphosphate and 100 lb of muriate of potash gave a yield per acre of 17·63 tons of swedes, 39·5 bushels of oats, 2·37 tons of clover-alfalfa hay and 1·81 tons of timothy-alfalfa hay. With this treatment, the value of the four rotation crops, after deducting the cost of fertilizers, was $120.68.

(3) An application of 20 tons of manure alone gave a yield per acre of 17·72 tons of swedes, 39·1 bushels of oats, 2·32 tons of clover-alfalfa hay and 1·87 tons of timothy-alfalfa hay. With this treatment the value of the four rotation crops, after deducting the cost of the fertilizer, was $116.81.

The check plot, which received neither manure nor chemical fertilizers, gave a yield per acre of 3·91 tons of swedes, 25·5 bushels of oats, 0·93 tons of clover-alfalfa hay and 0·84 tons of timothy-alfalfa hay. The value of the four rotation crops was $49.40.

To sum up, it is not economical to cultivate a poor soil if the required fertilizer is not applied.

Chemical Fertilizers, Manure and Lime in Relation to Brown-Heart of Swedes

This experiment was undertaken to determine the relation which exists between a given treatment and the development of brown-heart.

Towards this end, a comparison was made of fourteen different treatments on sandy gravelly soil. In the autumn, at pulling time, the swedes were sliced, and the number affected with brown-heart noted. The following table gives the various treatments tried, as well as the average percentage of brown-heart infection with each.

Table 59.—FERTILIZERS, FARM MANURE AND LIME IN RELATION TO BROWN-HEART OF SWEDES ON SANDY GRAVELLY SOIL

Treatments	Length of trial	Number of roots affected in 20	Percentage of infection
	years		%
2 tons of ground limestone	9	7.31	36.6
350 lb. of Maroc phosphate	13	2.50	12.5
2,240 lb. of hydrated lime	9	9.23	46.1
750 lb. of Thomas phosphate	13	2.08	10.4
750 lb. of superphosphate	13	1.77	8.9
20 tons of manure	13	2.65	13.3
2 tons of limestone 20 tons of manure	13	6.29	31.5
500 lb. of superphosphate 1 ton of limestone	13	10.62	53.1
10 tons of manure 100 lb. of nitrate of soda 75 lb. of ammonium sulphate 400 lb. of superphosphate 100 lb. of muriate of potash	13	2.74	13.7
100 lb. nitrate of soda 75 lb. ammonium sulphate 400 lb. superphosphate 100 lb. muriate of potash	13	8.18	40.9
100 lb. nitrate of soda 75 lb. ammonium sulphate 400 lb. superphosphate	13	6.11	30.6
100 lb. nitrate of soda 75 lb. ammonium sulphate 100 lb. muriate of potash	7	5.35	26.7
400 lb. superphosphate 100 lb. muriate of potash	13	2.92	14.6
20 tons of manure 500 lb. superphosphate	3	6.00	30.0
20 tons of manure 500 lb. superphosphate 2 tons of limestone	3	7.33	36.7
No manure, no fertilizer	8	1.61	8.0

Table 59 shows that:

(1) Lime, in form of limestone or hydrated lime used alone or mixed with other fertilizers, caused a high percentage of brown-heart. The treatment which favours brown-heart most is the mixture of limestone and superphosphate.

(2) Composite fertilizer also favours the development of brown-heart.

(3) Thomas phosphate, superphosphate and manure seem to limit the development of this disease.

Formulae of Chemical Fertilizers for Swedes (Borax for the Control of Brown-heart).

In order to determine the effect of borax with different fertilizers in the control of brown-heart, two series of plots were used including sixteen treatments. One of the series received only treatments of fertilizers, while the other received an application of 15 lb. of borax an acre besides fertilizers.

Results of this experiment follow in Table 60.

Table 60.—FORMULAE OF CHEMICAL FERTILIZERS FOR SWEDES
(borax for the control of brown-heart)

Treatments	Length of trial	Without Borax	With 15 lb. of borax per acre
		Percentage infection Av.—11 yr.	Percentage infection Av.—11 yr.
	years	%	%
2 tons of ground limestone	8	38.1	3.7
350 lb. of natural phosphate	11	13.6	5.9
2,240 lb. of hydrated lime	8	50.7	5.6
750 lb. of phosphate Thomas	11	10.5	4.1
750 lb. of superphosphate	11	9.1	7.7
20 tons of manure	11	14.1	6.4
2 tons of limestone 20 tons of manure	11	33.6	4.5
500 lb. of superphosphate 1 ton of limestone	11	56.4	8.2
10 tons of manure 100 lb. nitrate of soda 75 lb. of ammonium sulphate 400 lb. superphosphate 100 lb. muriate of potash	11	14.1	5.0
100 lb. nitrate of soda 75 lb. ammonium sulphate 400 lb. superphosphate 100 lb. muriate of potash	11	41.8	5.0
100 lb. nitrate of soda 75 lb. ammonium sulphate 400 lb. superphosphate	11	32.3	3.6
100 lb. nitrate of soda 75 lb. ammonium sulphate 100 lb. muriate of potash	5	29.0	4.0
400 lb. superphosphate 100 lb. muriate of potash	11	14.5	7.7
20 tons of manure 500 lb. superphosphate	3	30.0	6.7
20 tons of manure 500 lb. superphosphate 2 tons of limestone	3	36.7	10.0
No manure, no fertilizer	5	10.0	1.8

It is to be noted from Table 60 that the use of 15 lb. of borax per acre reduced considerably the percentage of brown-heart with all the different treatments used. The reduction of infection by brown-heart, for all the treatments throughout the trial, was 79·2 per cent.

Weed Control

The object of this experiment is to determine if the arrangement of crops, farming operations and fertilizers have an influence on the quantity of weeds.

Three different rotations were chosen, differing one from another either on first- or second-year crops. One rotation received different cultural treatments while the other two rotations—4 and 5 years respectively—received different chemical fertilizer treatments.

To count weeds, the square-yard basis was adopted, which consists in counting six spots on each of the field plots when dealing with rotation crops, and on each treatment of the plot, for the parts receiving cultural or different chemical treatments.

The description of each of the treatments applied, as well as the results obtained up to the time of writing, are given in the following tables.

Table 61.—NUMBER OF WEEDS PER SQUARE YARD ON THREE 4-YEAR ROTATIONS ON CLAY SOIL

(5-Year Average)

Rotation and treatment	Crops	Yield per acre 5-yr. Average	Total number of weeds per square yard
		bush.	
4-year rotation: corn in first year, oats in second year, clover, alfalfa third year, timothy, alfalfa in fourth year.	Oat	68·4	8·66
	Clover and alfalfa	tons 4·66	4·16
Treatment: 16 tons of manure per acre for a hoed crop; 300 lb. superphosphate on oat crop.	Timothy and alfalfa	4·45	5·07
		bush.	
4-year rotation: corn in first year; wheat in second year; clover, alfalfa in third year; timothy, alfalfa in fourth year.	Wheat	33·4	11·49
	Clover and alfalfa	tons 4·57	5·15
Treatment: 16 tons of manure per acre to hoed crop; 300 lb. superphosphate per acre on wheat crop.	Timothy and alfalfa	tons 4·49	5·02
		bush.	
4-year rotation: peas and oats in first year; oats in second year; clover, alfalfa in third year; partial summerfallow.	Oat	67·5	6·92
	Clover and alfalfa	tons 4·30	8·72
Treatment: 16 tons of manure per acre on oat thatch; 300 lb. superphosphate on oat crop.	Timothy and alfalfa	tons 3·01[1]	4·69

[1] One cut.

The mixed grain rotation as a basis crop preceded by summerfallow is shown to be as efficient in control of weeds as the two other rotations with hoed crop in the first year. However, the hoed crop seems to control couch grass better than a mixed peas-oats preceded by partial summerfallow.

TABLE 62.—NUMBER OF WEEDS PER SQUARE YARD WITH DIFFERENT CULTURAL TREATMENTS

4-year average

Cultural treatments	Crops	Yield per acre 4-yr. average	Total number of weeds per square yard
		bush.	
Ploughing 4" deep in August, disking in autumn, second ploughing 7" deep on October 15.	Wheat	30·7	19·83
Ploughing 4" deep in August, disking in autumn	"	28·3	24·47
Ploughing 7" deep on September 15	"	22·7	27·42
Ploughing 7" deep on October 15	"	19·7	44·24
Ploughing 4" deep on October 15	"	21·7	37·51
Ploughing 7" deep in spring	"	19·1	41·13
		bush.	
Ploughing 4" deep in August, disking in autumn, second ploughing 7" deep on October 15.	Oat	49·8	22·15
Ploughing 4" deep in August, disking in autumn	"	46·3	26·46
Ploughing 7" deep on September 15	"	49·6	29·05
Ploughing 7" deep on October 15	"	44·8	30·95
Ploughing 4" deep on October 15	"	43·5	39·90
Ploughing 7" deep in spring	"	46·0	37·85
		tons	
Ploughing 4" deep in August, disking in autumn, second ploughing 7" deep on October 15.	Clover and alfalfa	2·67	6·73
Ploughing 4" deep in August, disking in autumn	"	2·74	9·45
Ploughing 7" deep on September 15	"	2·58	21·56
Ploughing 7" deep on October 15	"	2·60	20·45
Ploughing 4" deep on October 15	"	2·56	21·32
Ploughing 7" deep in spring	"	2·54	20·90

Although it is too early to draw conclusions on ploughing at different times, and to different depths, partial summerfallow and ploughing four inches deep in August, followed by disking, are very efficient in weed eradication, particularly for perennial weeds.

TABLE 63.—NUMBER OF WEEDS PER SQUARE YARD WITH DIFFERENT FERTILIZERS ON LIGHT SOIL

5-Year Average

Rotation and fertilizers	Crops	Yield per acre 5-yr. average	Number of weeds per square yard
		tons	
4-year rotation on sand with green fodder—first year, oats —second year, clover —third year, timothy —fourth year			
TREATMENTS:—			
1. Heavy application of chemical fertilizer	Green fodder	2·27	46·01
2. Manure		2·02	21·65
3. Manure and chemical fertilizer		2·22	30·63
4. Light application of chemical fertilizer		1·85	33·63
5. Neither manure nor chemical fertilizer		0·59	11·92
		bush.	
1. Heavy application of chemical fertilizer	Oats	33·0	62·55
2. Manure		31·9	76·59
3. Manure and chemical fertilizer		33·8	39·64
4. Light application of chemical fertilizer		27·7	23·73
5. Neither manure nor chemical fertilizer		12·3	17·43
		tons	
1. Heavy application of chemical fertilizer	Clover and alfalfa	2·49	33·33
2. Manure		2·67	29·98
3. Manure and chemical fertilizer		2·61	34·79
4. Light application of chemical fertilizer		1·44	35·53
5. Neither manure nor chemical fertilizer		0·58	31·28
		tons	
1. Heavy application of chemical fertilizer	Timothy and alfalfa	2·69	32·61
2. Manure		2·46	33·74
3. Manure and chemical fertilizer		2·26	35·86
4. Light application of chemical fertilizer		1·54	41·24
5. Neither manure nor chemical fertilizer		0·85	42·96

In this 4-year rotation there was no significant difference in the number of weeds between the different treatments. The check had less weeds but total vegetation was light.

TABLE 64.—NUMBER OF WEEDS PER SQUARE YARD WITH DIFFERENT FERTILIZERS ON HEAVY SOIL

5-Year Average

Rotation and fertilizers	Crops	Yield per acre 5-year average	Number of weeds per square yard
		bush.	
Rotation of 5 years on clay soil with: 1. wheat and oats in first year 2. peas and oats in second year 3. oats in third year 4. clover in fourth year 5. timothy in fifth year followed by after cultivation.			
TREATMENTS:			
1. Neither manure nor chemical fertilizer	Wheat and oats mixed	49·1	23·59
2. Manure		52·0	18·17
3. Chemical fertilizer		55·3	14·78
1. Neither manure nor chemical fertilizer	Peas and oats mixed	41·7	23·11
2. Manure		45·7	19·72
3. Chemical fertilizer		42·9	18·67
1. Neither manure nor chemical fertilizer	Oats	40·5	29·54
2. Manure		44·4	20·91
3. Chemical fertilizer		47·3	24·53
		tons	
1. Neither manure nor chemical fertilizer	Clover and alfalfa	1·81	30·67
2. Manure		2·40	27·66
3. Chemical fertilizer		2·15	23·30
1. Neither manure nor chemical fertilizer	Timothy and alfalfa	2·72	36·64
2. Manure		3·37	27·78
3. Chemical fertilizer		2·98	26·19

In this 5-year rotation on heavy soil three different treatments were applied to each crop, and the manure and chemical fertilizer treatments included less weeds than the check.

COST OF OPERATING A TRACTOR

The cost of operating a tractor, (1932 model), including repairs, depreciation, interest and gas was determined, along with noting the amount of work done by the machine, in order to fix the cost per acre and the cost per work hour for each of the different agricultural operations.

The following table describes the work done with respect to cost per work hour, per acre, as well as the number of acres cultivated per day for an average of ten years.

TABLE 65.—COST OF OPERATING A TRACTOR (1932 MODEL)

10-Year Average

Type of work	Number of hours of work	Cost per work hour (manual labour included)	Cost per acre (manual labour included)	Number of acres done per day
	Hr.	$ cts.	$ cts.	Acres
Ploughing	261	0 68	2 73	2·59
Disking	164	0 70	0 82	8·55
Harrowing	45	0 68	0 49	15·56
Threshing	70	0 69	0 73	9·90
Silo work	30	0 68	2 30	3·13
Miscellaneous	840	0 69	.....	.....

It will be noted from this table that the number of acres worked per day and the cost per acre vary with the different operations but the average cost per work hour varies little since the cost of all sorts of work is 69 cents.

LOSS IN SILAGE OF DIFFERENT CROPS.

While the climate of the lower St. Lawrence Valley is not the most favourable for corn, it does favour legume and grass species. Having in mind that corn or legume silage will become increasingly popular on dairy farms, it seems opportune to study these silages. One of the most important aspects of this question, if not the most important, is to determine the losses in the silo. This work was undertaken in 1941 and is still under way. It consists in determining, both for corn silage and for the leguminous hays, the losses in the silo, either by fermentation or waste caused by spoiled silage in middle or surface of the silo.

LOSS OF CORN IN SILO

Table 66 sums up the data established from 1941-46 to determine the loss of corn in the silo. It shows for each year and for the whole period, the weight of material put in the silo, the weight of consumable material taken out of the silo, its dry-matter content, as well as the percentage total loss and loss of dry matter which were respectively 24·1 and 16·6 per cent for an average of 4 years with 646,385 lb. of corn silage. As noted, the losses of surface layer are not included in table.

LOSS OF CLOVER AND ALFALFA IN SILO

Table 67 is a summary of the facts established from 1941-1944 in order to determine the losses of clover and alfalfa in the silo. As in the preceding table, the weight of all ensilage put in the silo, the weight of consumable silage taken from the silo with total contents and contents of dry matter are recorded. These facts are established in terms of each year, as well as for the whole period of trial. Also shown are the total loss and loss of dry matter, which were respectively 20·5 and 13·2 per cent for the average of 2 years based on 66,249 lb. of clover and alfalfa ensilage.

The losses of surface layer in corn silage, as well as in the clover-alfalfa silage were also determined during 1941-46. It was noted that these losses were less if a surface protection layer was added, made either of damp pressed sawdust or damp pressed chopped straw. However, the data indicate that in spite of this protection layer, sometimes 3,000 to 4,000 lb. of silage is spoiled. It was judged best not to include the loss of surface layer in the two preceding

TABLE 66.—CORN LOSSES IN SILO*

Years	Corn put in silo			Edible silage taken from silo			Percentage Losses	
	Total weight	Percentage of dry matter	Weight of dry matter	Total weight	Percentage of dry matter	Weight of dry matter	Total loss	Loss of dry matter
	lb.	%	lb.	lb.	%	lb.	%	%
1941–42	133,850	19·26	25,775	103,732	19·49	20,217	22·5	21·6
1942–43	119,025	19·35	23,037	97,585	19·40	18,930	18·0	17·8
1943–44	212,360	.....	.....	160,131	.....	.....	24·6	.....
1944–45	217,460	13·97	30,379	146,250	17·80	26,033	32·7	14·3
1945–46	176,050	17·91	31,531	143,080	18·99	27,171	18·7	13·8
Total—(4 years)	646,385	17·13	110,772	490,647	18·92	92,351	24·1	16·6
(5 years)	858,745	.....	.....	650,778	.....	.....	24·2	.....

* The losses of surface layer are not contained in this table.

TABLE 67.—LOSS OF CLOVER AND TIMOTHY IN SILO*

Years	Green hay put in silo			Consumable silage taken from silo			Percentage loss	
	Total weight	Percentage of dry matter	Weight of dry matter	Total weight	Percentage of dry matter	Weight of dry matter	Total loss	Loss of dry matter
	lb.	%	lb.	lb.	%	lb.	%	%
1941–42	27,818	22·55	6,274	20,420	26·91	5,494	26·6	12·4
1942–43	38,431	26·69	11,409	32,264	30·53	9,849	16·0	13·7
1943–44	31,300	.....	.....	21,345	35·72	7,625	31·8	.....
Total—(2 years)	66,249	26·69	17,683	52,684	29·12	15,343	20·5	13·2
(3 years)	97,549	.....	.....	74,029	31·02	22,968	24·1	.....

* The losses of surface layer are not contained in this table.

tables, because, expressed in percentage, they are variable with silo capacity. Thus, the losses of silage in a 20-ton silo might be from 7 to 10 per cent while in a 200-ton silo, they might be only 1 to 2 per cent.

Preparation and Conservation of Silage

SUNFLOWERS AND CORN MIXED

A mixture of sunflowers and corn always kept well during the fifteen years it was used on a large scale at this Station. No special preparation, that is to say, no water or preservative was added, but the silage was made when the sunflowers were in full bloom.

PURE CORN

Pure corn was shown to be more difficult to keep than sunflowers and corn as was shown during the seven years it was used on a large scale at this Station. However, when cut and put in the silo before it was dry, or after being exposed to the first September frost, it kept well without any special preparation, that is without adding water or a preservative. But if it happens that the corn dries some in the field before it is cut, then the resulting silage has a tendency to heat up and become mouldy. In this case, conservation would probably be better if a little water was added to the silage to bring it to a normal moisture content.

RED CLOVER AND ALSIKE MIXED

Various trials made during the last seven years of the period under review have shown that red and alsike clover when mixed keep well in the silo even without being subjected to partial drying in the field, after cutting and without adding a preservative, provided they were put in the silo at a good stage of maturity, at full flowering and when they contained no external water as rain or dew. However, a partial drying on the field after cutting so as to lower the humidity by about 15 per cent, or the addition of molasses in the proportion of 4 gallons per ton, will more surely guarantee keeping quality.

PURE ALFALFA AND A MIXTURE OF ALFALFA AND CLOVER

Several trials undertaken during the last seven or eight years of the period under review have shown very clearly that pure alfalfa and red and alsike clover with a high proportion of alfalfa are more difficult to keep in a silo than red and alsike clover alone. Conservation becomes easier as the stage of maturity is increased; but to avoid losing nutritive value, it is wiser not to put alfalfa in the silo at a stage exceeding 25 per cent bloom.

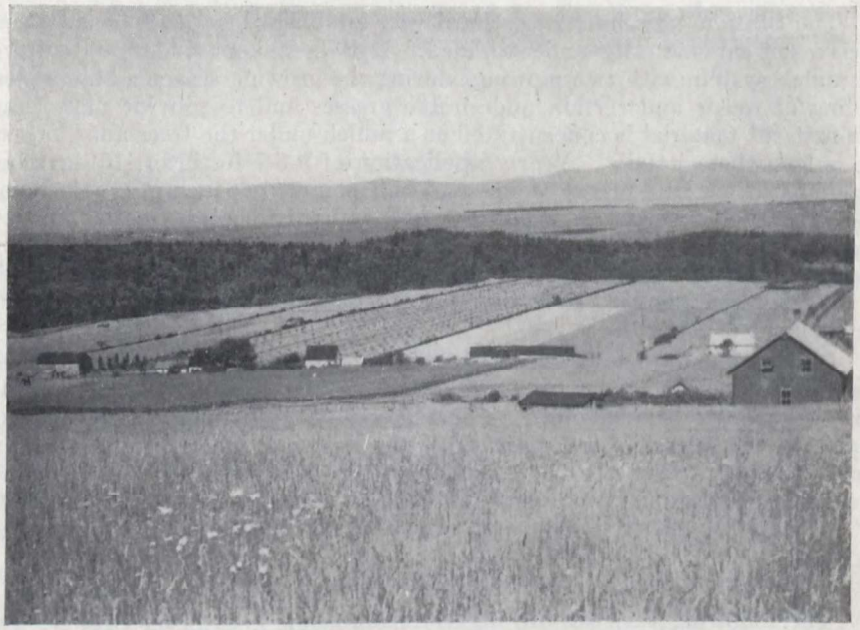
Under these conditions, pure alfalfa or red and alsike clover with a high proportion of alfalfa, even when cut without external moisture in the form of rain or dew, requires for conservation a partial drying on the field after it is cut in order to reduce humidity by about 15 per cent. The addition of molasses in the proportion of 6 gallons a ton, although it is not absolutely necessary after partial drying, ensures better conservation.

Special Note.—For these four types of silage, energetic packing from the beginning to the end of filling the silo is necessary to ensure best conservation.

HORTICULTURE

The horticultural work at this Station has been re-organized and the investigation of problems in fruit and vegetable growing has received considerable attention, especially since the closing down of the Cap Rouge Experimental Station in 1940.

Market gardening has developed rapidly in the district and it is now an important branch of agriculture. For the benefit of farmers and market growers of the eastern section of Quebec, more elaborate trials of fruit and vegetable strains, varieties and species were carried to measure their market quality, yield and adaptation to this district. New projects were added to study special problems of this branch of vegetable growing.



At the foothill a commercial orchard which is particularly well protected from dominant winds.

The area devoted to orchards, nurseries, small fruits and vegetables is actually 20 acres, compared with 11 acres for the years 1936-40. Needless to say, the development of the work of the horticulture division at the Ste-Anne de la Pocatiere Experimental Station has been very rapid during the last five years of the period under review.

Orchards

Thirty-two years of fruit growing experimental work at this Station has shown there are possibilities in this region, one of the best potential horticultural areas in the lower St. Lawrence Valley. The Station orchard has never been

seriously affected by winter injury since it was planted in 1913 and was only slightly injured by spring frosts which cut down the western Quebec apple crop in 1945. The average yield per tree of the best varieties was 8·8 bushels in 1945 as compared with the 10-year average of 6·4 bushels.

Whether this district becomes a specialized fruit growing area or not, experimental results show that it is not a risky business to plant a home orchard or even a small commercial orchard in the immediate vicinity of cities and towns of the lower St. Lawrence, especially from Quebec to Ste. Anne. The climatic conditions are favourable to fruit growing and apple trees are productive and thrive as far as Temiscouata. The Kamouraska-L'Islet district, which was very well known for its plums about 50 years ago, is more favourable to fruit growing than is generally known. The wide St. Lawrence waters have a moderating effect upon the climate and lend for successful fruit growing in this district.

The Station experimental orchard was established in 1913 on a flat piece of clay soil satisfactorily under-drained. It is been kept under sod culture or the mulch system with two mowings during the growing season so as to control seeding of weeds and certain undesirable grasses and to provide more humus. The first cut material is concentrated as a mulch under the trees and the second one is left where it falls. Yearly application of 9-5-7 fertilizer, 10 days before blooming, at the rate of one to one and half pounds per inch of trunk diameter has given good results. A windbreak of Lombardy poplars, spruce and cedar trees is effective against prevailing winds if planted at least 100 feet from the first row of apple trees. For disease and insect control, the grower is referred to the "Spray Calendar" issued by the Horticultural Service of the Provincial Department of Agriculture.

One of the most important factors in fruit growing is the choice of varieties adapted to local conditions. Growers who plant unsuitable or unprofitable varieties are at once involved in troublesome readjustment problems. Consequently the selection and planting of the best and most suitable kinds may insure greater profits. In the selection of the best varieties, the Ste-Anne de la Pocatiere Experimental Station is endeavouring to assist fruit growers.

APPLE VARIETIES

The following varieties are highly recommended: Crimson Beauty, Yellow Transparent, Lowland Raspberry, Melba, Duchess, Wealthy, Fameuse, McIntosh and Lobo. Hume, Cortland, Macoun and Sandow, of more recent introduction, are also very promising.

TABLE 68.—AVERAGE ANNUAL YIELD PER TREE OF THE BEST APPLE VARIETIES

Variety	Season	Number of trees	Age of trees	Average annual yield in bushels per tree 1936-1945
Crimson Beauty	Summer	5	34	5·86
Melba	Summer	2	34	4·91
Fameuse	Fall	4	35	7·99
McIntosh	Winter	4	35	5·54
Lobo	Winter	2	35	7·85

PLUM VARIETIES

The European plum varieties thriving under local conditions are: Damson, Reine Claude, Bradshaw, Green Gage, Lombard, Mirabelle, Mount-Royal, Bonne Ste-Anne and Yellow Egg. The following hybrids are also promising: Kahinta, Omaha, Prescott, Lanark, Carleton and Underwood.

CHERRY VARIETIES

The variety known as Cerise de France is hardy and produces good fruit. Large Montmorency and Early Richmond are also recommended.

PEAR VARIETIES

Many fruit growers will be surprised to know that pear trees planted in 1919 at this Station are healthy and productive. For those who want to plant a few pear trees, Clapp's Favourite, Bartlett and Flemish Beauty varieties are recommended.

Small Fruits

STRAWBERRIES

Strawberry is the most important of all small fruits produced commercially in the lower St. Lawrence district. Varieties which have been or are being tested are listed with accompanying brief notes. It has seemed of more importance to indicate special qualities or limitations, or some particular distinction of value to the grower, in determining whether or not to plant.

Good Cropper Varieties: Jim, Claribel, King, Cassandra, Dunlap.

High Quality Varieties: Fairfax, Marjorie, King.

Early Varieties: Mackenzie, Vanguard, Laurier, Jim, King, Dunlap.

Mid-Season Varieties: Magee, Marjorie.

Late Varieties: Howe, Fairfax, Claribel, Louise.

Varieties recommended: (a) Jim, King, Laurier and Dunlap, which are early and good croppers.

(b) Magee and Marjorie which are mid-season varieties of high quality.

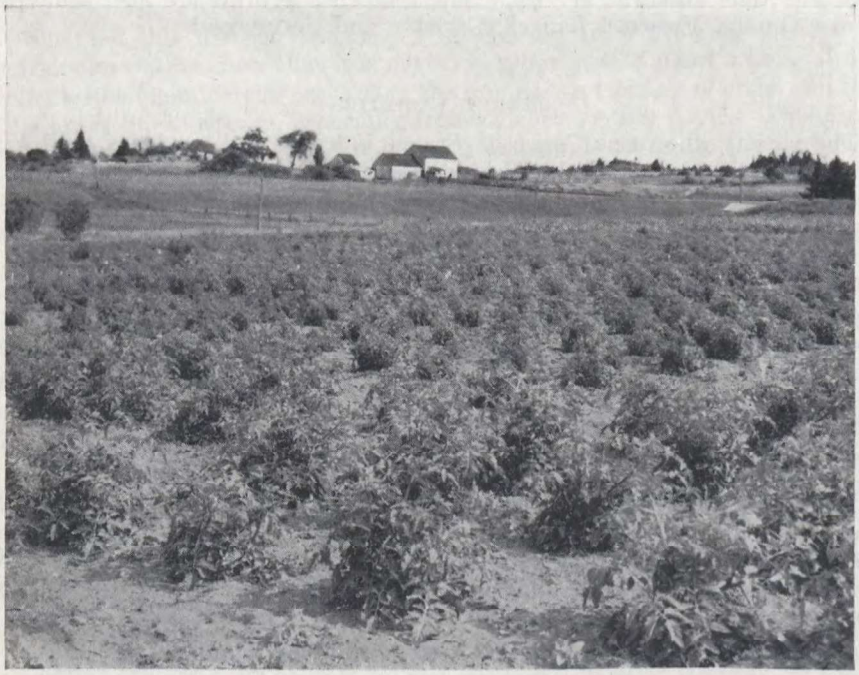
RASPBERRIES

Preliminary trials have been carried out with raspberry varieties and a few promising varieties are: Madawaska, Newburgh, Trent and Ottawa.

Vegetables

When the Cap Rouge Experimental Station was closed in 1940, many projects of variety trials and selection were transferred to this Station. The variety tests have an important place in attempting to evaluate, under local conditions, the value of vegetable varieties offered to the grower. Adequate-sized plots are grown of each variety, actual size of plot varying with the type of vegetable. Records are kept of plant and crop development and brief descriptions made with a comparative valuation of the variety as to commercial

yield and marketability. More than 300 varieties of different vegetable species have been tested during the last few years. Based on these tests, the following list of varieties is recommended for this region.



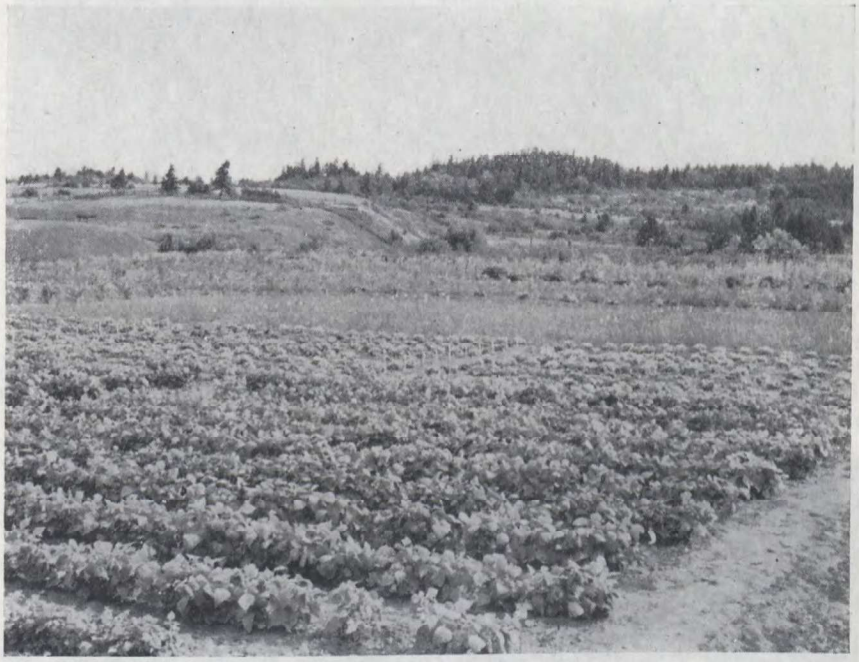
A trial of varieties and selection of tomatoes.

TABLE 69.—LIST OF RECOMMENDED VEGETABLE VARIETIES

Asparagus	Mary Washington
Beans (Yellow podded)	Round Pod Kidney Wax, Pencil Pod
Beans (Green podded)	Tendergreen
Beans (field)	Michelite, Boston Pea Beans
Beets	Detroit Dark Red
Broccoli	Italian green
Brussels Sprouts	Improved Dwarf
Cabbage (Early)	Golden Acre, Copenhagen Market
Cabbage (Late)	Penn State Ballhead
Cabbage (Red or Pickling)	Haco or Red Acre, Nigger Head
Carrot	Imperator, Nantes Half Long
Cauliflower	Super Snowball, Early Dwarf Erfurt
Celery	Golden Phenomenal, Golden Yellow, Salt Lake
Chervil	Improved curled
Chicory	Witloof
Corn, Sweet (Early)	Spancross (78 days), Seneca 60 (78 days) Seneca Dawn (79 days), Mutiple (81 days)
Corn, Sweet (Mid-Season)	Old Hickory (83 days), Carmelcross (87 days), Golden Bantam (88 days), Lincoln (90 days)
Cucumber	Straight-8, Davis Perfect, Windermoor Wonder
Cucumber (Pickling)	Boston, Heinz, National
Eggplant	New-Hampshire Hybrid
Leek	Giant Verrieres
Lettuce	Grand Rapids, Imperial 456, Imperial 44, Great Lakes

TABLE 69.—LIST OF RECOMMENDED VEGETABLE VARIETIES—*Concluded*

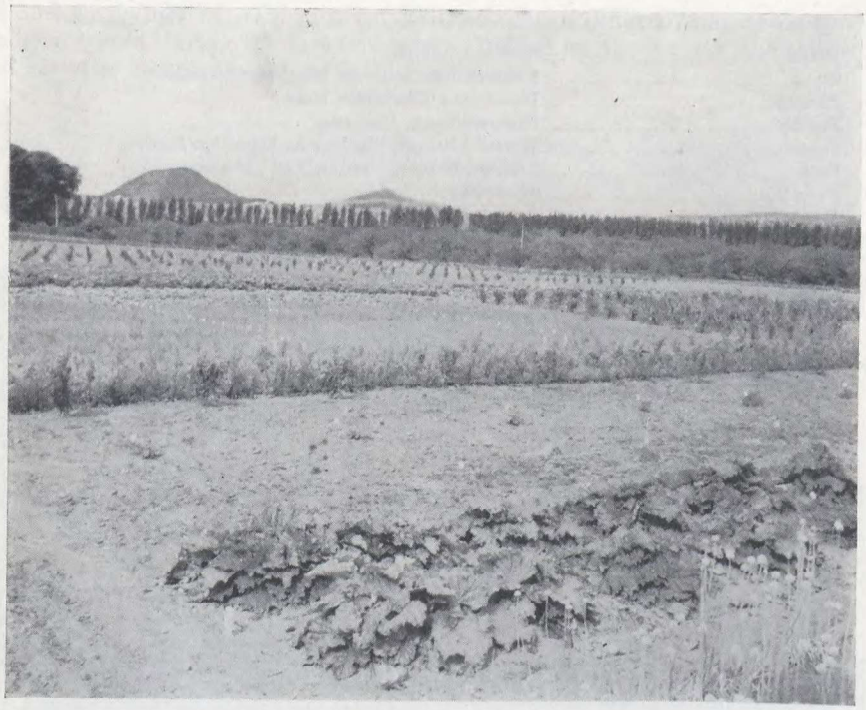
Melon	Golden Champlain
Onion	Yellow Globe Danvers, Southport Red Globe
Parsley	Paramount, Champion Moss
Parsnip	Hollow Crown, Guernsey
Pepper	Harris' Earliest, Windsor A, Hamilton Market
Peas	Thomas Laxton, Gradus, Tall Telephone
Pumpkin	Small Sugar
Radish	Saxa, Scarlet Turnip
Rhubarb	Macdonald
Salsify	Mammoth
Spinach	Long Standing Bloomsdale, Princess Juliana
Squash	Golden Hubbard
Swede	Laurentian
Swiss Chard	Giant Lucullus
Tomato (Early)	Early Chatham, Abel, Bestal
Tomato (Mid-Season)	Bounty, John Baer, Nystate, Super Bonny Best
Tomato (Pink)	June Pink



Variety test of green beans, lettuce and onions.

VEGETABLE SEED PRODUCTION

This phase of work was undertaken during the Second World War in order to study the best methods of seed production and grow some improved material of the leading varieties to increase production. An effort was made to stimulate production of seeds of the species specially adapted to local conditions, and as a result, a great deal of good seed was produced in this region. The maintenance of top quality seed stocks being an important problem, this Station is producing good seed stocks of the best varieties of a few species of vegetables.



The experimental garden and orchard of the Experimental Station.

Ornamental Gardening

Variety experiments have been discontinued and the work has been confined to the upkeep of lawns and shrubs and the maintenance of flower beds for ornamental purposes.

Few shrubs improved significantly the buildings at one Illustration Station even located too close to the highway.

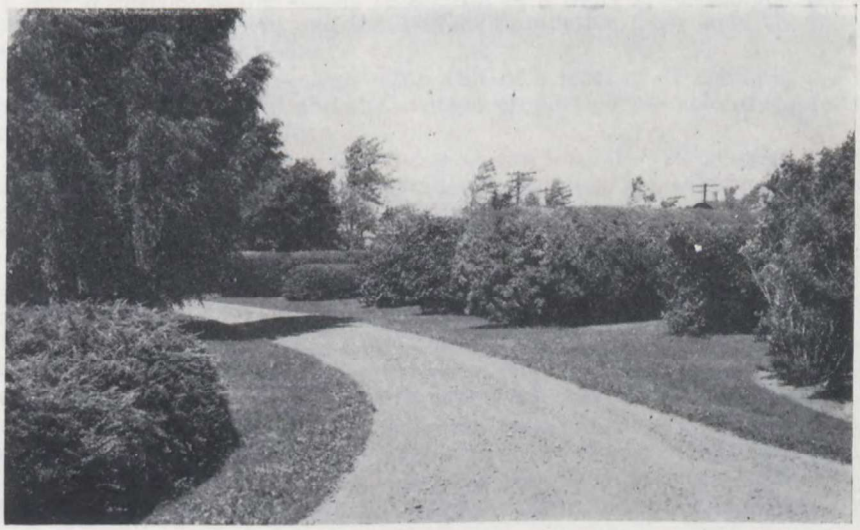
ANNUAL FLOWERS

Many species of annual flowers can be sown in the open, but, when earliness or extended blooming season is desired, seeding in greenhouse or hotbeds is recommended. The following species have done well under local conditions: Antirrhinum, Chrysanthemum, Marigold, Petunia, Phlox Drummondii, Zinnia, Pansies, Alyssum, Ageratum.

A few shrubs improved greatly the appearance of home surroundings.

PERENNIALS

A collection of perennials is grown at this Station and the following give bloom from the end of April until November: Crocus, Narcissus, Dicentra, Tulip, Iris, Aquilegia, Paeonia, Delphinium, Phlox and Aster.



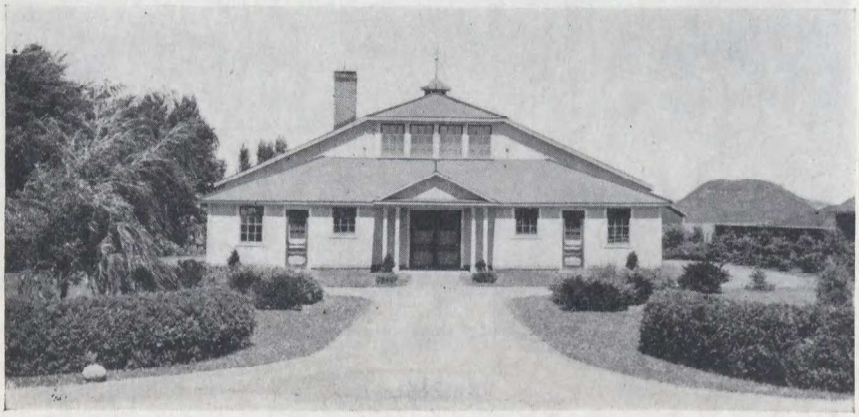
Comparison of ornamental hedges.

HEDGES

The following shrubs are recommended for hedges: Berberis Thunbergii, Thuya occidentalis, Picea canadensis, Caragana arborescens.

ARBORETUM

The arboretum was established in 1940. It is a garden containing 30 kinds of evergreen trees, 65 deciduous trees and 50 species of shrubs. It exemplifies the principles of landscape design and promotes to the highest degree the educational value of species grown. It serves as a laboratory for the study of hardiness of species and varieties of woody plants. Planting is in 31 generic groups, so that any one may find the oaks near each other, and the maples, pines, and other groups in the same fashion.



The Pavilion, the meeting centre for farmers and farmerettes visiting this Station.

BEEKEEPING

This report summarizes briefly the types of problems handled for the beekeepers of eastern Quebec from 1936 to 1945 inclusive.

The average production of honey per colony in the Station Apiary has been 90 pounds of No. 1 honey during the past ten years of the period under review.

Study of Pollination

Observations made on apple blossoms have shown that bees are of great value for pollination purposes. As a result of the last thirteen years studies, the percentage of visitors to apple blossoms is given as follows: hive bees 82·2 per cent, wild bees 5·2 per cent, bumble bees 1·1 per cent, and miscellaneous 10·5 per cent.

Wintering Bees

WINTERING IN CELLAR

A total of 702 colonies were wintered in the cellar during the last ten years covered by this report. The average temperature of the cellar was 50·4°F. The average length of the wintering period was 156 days and the average quantity of food consumed per colony was 19·5 pounds. Losses amounted to 59 hives or 8·4 per cent. The average production per colony the following year was 89·1 pounds of honey.

WINTERING IN CASES

Three types of cases have been used: those containing one, two and four colonies. Four inches of shavings were used on the bottom and around the cases and eight inches on top for insulating purposes of four- and two-colony cases; whereas six inches of shavings were used on the bottom and around the cases and ten inches on top for insulating single-colony cases.

Here are summarized the results obtained during the last ten years:

(1) *Wintering in four-colony cases:* Out of a total of 96 colonies, the losses amounted to 4·5 per cent and the average production per colony the following year was 103¾ pounds of honey.

(2) *Wintering in two-colony cases:* Out of a total of 57 colonies, the losses amounted to 5·7 per cent and the average production per colony the following year was 98½ pounds of honey.

(3) *Wintering in single-colony cases:* Out of a total of 22 colonies, the losses amounted to 9 per cent and the average production per colony the following year was 81¼ pounds of honey.

Control of Swarming

Five different methods of swarming control were compared:

(1) *Control of swarming by dequeening and requeening:* At the first appearance of larvae in the queen cells, the queen was taken from the hive and all queen cells were destroyed. Nine days later, the queen cells were again destroyed but one.

From 1927-38, 5·1 per cent of swarming occurred out of a total of 98 colonies thus treated. The average honey production was 74⅓ pounds per colony.

(2) *Control of swarming by separating the queen from the brood:* In this method all the queen cells were destroyed at the first appearance of larvae in the

queen cells. The frames containing brood were placed in a super, the brood chamber was filled with drawn combs and the queen was left in this new brood chamber. A queen-excluder was placed over the latter above which the supers of honey and the supers containing the brood were placed. Nine days later, the super containing brood was again inspected and all the queen cells were destroyed.

From 1927-38, 24·4 per cent of swarming occurred out of a total of 90 colonies thus treated. The average honey production was 85½ pounds per colony.

(3) *Prevention of swarming by giving more space:* In order to give more laying space to the queen, an additional hive body is added to colonies at the beginning of June. When the honey flow is about over, the queen is placed in the lower brood chamber.

Out of a total of 157 colonies thus treated during eight years, 39·5 per cent made preparation for swarming. The average honey production was 99·6 pounds per colony.

(4) *Control of swarming by early introduction of young laying queen:* About one week before the main honey flow commences colonies of equal strength and condition were selected and divided into two groups. The queens were removed from one group and replaced by young laying queens. The second group of colonies was not dequeened.

In the first group 7·1 per cent of swarming occurred whereas 30·9 per cent occurred in the second group, and the honey production was respectively 86 pounds and 104 1/3 pounds per colony.

(5) *Prevention of swarming:* In the spring, thirty colonies of equal strength in double brood chambers are selected and divided into three equal groups treated as follows:

Group I: One week before the main honey flow all brood except one frame of open brood is moved to super on top of colony. The lower brood chamber is filled with empty combs and the queen placed on them with queen excluder above. Seven days later, the super containing brood is again inspected and all the queen cells are destroyed.

In this group, two colonies made swarming preparation and the average production was 171⅓ pounds of honey per colony.

Group II: During the first week of the main honey flow all queens were removed and if no queen cells containing larvae were present, young laying queens were introduced within twelve hours. When queen cells containing eggs or larvae were present, the colony was left queenless nine days and requeened on tenth day.

In this group, two colonies out of ten made swarming preparations, and the average honey production was 143¾ pounds per colony.

Group III: The check colonies were manipulated by regular methods, and did not receive any special treatment unless they developed swarming fever in which case the brood and queen were separated.

In this group, four colonies out of ten made swarming preparations, and the average honey production was 196⅞ pounds per colony.

Spring Protection of the Brood Chamber

Two groups of 63 colonies each were included in this experiment during the past ten years under review. One group was protected by means of an outside case from the time it was taken out of the cellar until the beginning of June. No protection was given to the other group.

The average production per colony was $99\frac{1}{2}$ pounds for the protected group and $93\frac{1}{2}$ pounds for the unprotected group.

It must be pointed out that the spring protection of the brood chamber is necessary in an apiary exposed to the wind.

Methods of Supering Colonies for Honey Flow

Two groups of ten colonies each were selected and supered for the flow as follows:

(1) Each additional super was placed immediately above the brood chamber or chambers.

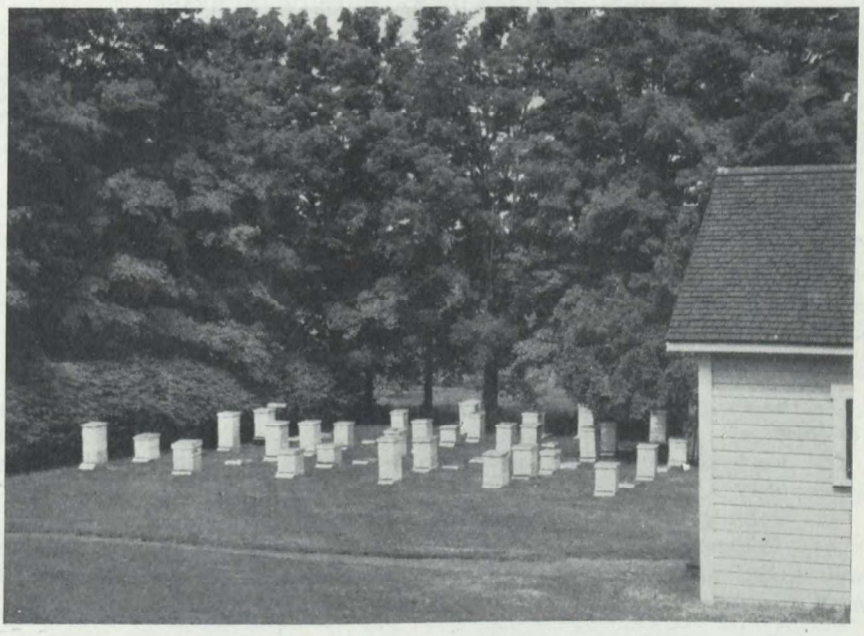
(2) Each additional super was placed on top of the colony.

The results of a nine-year period indicate that the saving of time and labour of supering in group 2 did not reduce the crop produced, and did not increase the swarming tendency. The average production was $121\frac{1}{4}$ pounds and $122\frac{1}{3}$ pounds per colony respectively for the first and the second groups whereas the percentage of swarming was 22·3 per cent and 24·7 per cent respectively.

Single, Divided and Reunited Colonies for Production

Eight colonies of equal strength and condition were selected in the spring and treated as follows:

(1) Two colonies are treated as single colonies throughout the season and used as checks.



The experimental apiary is protected by an excellent windbreak.

(2) The remaining six colonies are divided equally putting half of bees and brood of each colony into a new hive standing alongside the original hive. The old queen is left in the original hive and the new hive is requeened with a young

laying queen. As soon as the main honey flow commences, this six colony-group is treated as follows:

(a) Two colonies are left in this position throughout the season.

(b) Two colonies are reunited as soon as the main honey flow commences and the old queen in the original hive is destroyed.

(c) Two colonies are reunited as soon as the main honey flow commences and the young queen is destroyed.

The check colonies have produced an average of $115\frac{1}{8}$ pounds of honey for a six-year period whereas the other colonies have produced respectively: *(a)* $116\frac{1}{2}$ pounds, *(b)* $87\frac{1}{2}$ pounds, and *(c)* $87\frac{1}{3}$ pounds.

Comparison of Different Methods and Times of Increase

Colonies of equal strength and condition are selected in the spring and treated as follows:

(1) Colonies are divided equally putting half of bees and brood of each colony into a new hive standing alongside the original hive. The old queen is left in the original hive and the new hive is requeened with a young laying queen. As soon as the main flow commences, this group is treated as follows:

(a) One group of colony is left in this position throughout the season.

(b) The new hives of the other group are moved to another stand.

(2) Colonies treated as single colonies throughout the season are used as checks.

Table 70.—RESULTS OF METHODS OF INCREASE

Method	Average production of 24 hives during six years	Number of colonies in good wintering conditions
	lb.	
New hive standing alongside the original one	88·7	4·4
New hive moved to another stand	97·5	4·4
Check colonies	131·3	2·2

Package Bees as a Means of Strengthening Weak Colonies

In the spring eight weak colonies are divided into two groups and treated as follows:

(1) Each colony in the first group is strengthened with a 2-lb queenless package of bees.

(2) Colonies of the other group are not strengthened and act as checks.

For the last five years of the period under review, the average increase of honey production was 33·5 pounds per strengthened colony and the clear profit was $2.33.

OVER-WINTERED VERSUS PACKAGE BEES

During the last seven years covered by this report, the average production of honey per colony was respectively: 59·5 pounds, 73·7 pounds and 119·6 pounds for 2-pound package bees, 3-pound package bees and over-wintered colonies.

STRENGTHENING WEAK COLONIES BY RELOCATION

One week before the main honey flow starts, four extra strong colonies and four weak ones are selected and divided into two groups of two strong and two weak colonies each and manipulated as follows:

Group I: In early morning the two weak colonies are moved from their stands and replaced with the two strong colonies and the weak colonies are then moved to the stands from which the strong were taken.

Group II: The four colonies of this group were not switched and used as checks.

In the first group, no queen has been lost. . The four colonies made swarming preparation and produced 130·3 pounds of honey per colony.

In the second group, only one colony made swarming preparation and the average honey production was 147·3 pounds per colony.

CEREALS

The Cereal Division is being operated for the main purpose of finding the best varieties of wheat, oats, barley, rye, field peas, fibre flax, field beans and buckwheat most suitable to the lower St. Lawrence district.

Yield of grain of a variety is the true expression of its value, but the yield is influenced by many factors, such as resistance to diseases, strength and length of straw, number of days to maturity, the grain quality and other specific characteristics of each species.

To find varieties that possess all the desired properties, hundreds of strains or varieties introduced from all possible sources, were compared. Those less suitable were discarded. The remaining ones were compared with the best known varieties during many years. Results secured from these trials are summarized in tables which follow.

Variety test of spring wheat and fibre flax.

Since 1930, a number of experiments have also been conducted on grain mixtures for feeding with the purpose of ascertaining the best combinations of species and varieties, and also to determine the most profitable rates of seeding from the standpoint of yields in pounds of grain, as well as for pounds of total digestible nutrients.

Production of Registered Seed

During the last ten years of the period under review, crop registration certificates were issued by the Canadian Seed Growers' Association for the following quantities of grain produced at this Station:

2,790 bushels of Huron and Coronation wheats
2,876 bushels of Mensury 60 barley
14,928 bushels of Banner oats
265 bushels of Arthur field peas.

About three-quarters of this seed was distributed to farmers of the lower St. Lawrence Valley. Small quantities were sold to specialized grain farmers of British Columbia, Manitoba, Ontario and elsewhere.

Variety Trials of Spring Wheat

Trials of spring wheat varieties were conducted with a view to finding the most productive and best adapted varieties. Special attention was given to rust resistance. The baking quality, strength and length of straw, and the number of days to ripen were also considered.

Table 71.—RESULTS OBTAINED WITH THE SPRING WHEAT VARIETIES SINCE 1933

(a) on clay land

Varieties	Days to ripen	Average yields in bushels per acre		
		1933–38 (6 years)	1940–45 (6 years)	1942–45 (4 years)
Reliance	103	37·3	.....	.....
Reward	97	32·3	.....	.....
Marquis	104	32·8	.....	.....
Garnet	97	34·9	.....	.....
Huron Ott. 3	103	35·9	36·3	36·9
N.S. 2489-B	100	.....	39·5	37·5
Regent 975.11	100	.....	.....	34·6
Coronation II	102	.....	.....	36·0
C.D. 3285	99	.....	.....	40·5

(b) on sandy land

Varieties	Days to ripen	Average yields in bushels per acre		
		1939–42 (4 years)	1940–44 (5 years)	1942–44 (3 years)
Garnet	89	14·4	.....	.....
Huron Ott. 3	92	12·8	14·6	15·0
N.S. 2489-B	91	.....	13·5	14·2
Regent 975.11	91	.....	.....	11·7
Coronation II	92	.....	.....	14·4
C.D. 3285	91	.....	.....	14·0

Table 71, shows the relative value of the best varieties. Huron was abandoned on account of its rust susceptibility and was replaced by Coronation II and Regent which are doing well. Garnet is still useful on account of its earliness and its satisfactory yield. It is most likely that before long these will be replaced by new ones, like N.S. 2489-B or C.D. 3285, which are showing considerable promise.

Variety Trials of Oats

Oats is the grain most generally grown in this district. It constitutes the basic feed for the various classes of animals in spite of its relatively low content of total digestible nutrients.

Since 1936, nearly one hundred varieties or strains have been tested in comparative trials. Such factors as the yield of grain, the strength of straw, the grain quality, the resistance to rusts and smut, and the number of days to maturity were evaluated.

Table 72.—RESULTS OBTAINED WITH THE OAT VARIETIES

(a) On clay land

Varieties	Days to ripen	Average yields in bushels per acre		
		1933–39 (7 years)	1937–45 (9 years)	1942–45 (4 years)
Lasalle	100	93·5	.....	.....
Cartier	89	81·6	.....	.....
Banner 44	98	94·6	85·3	80·8
Mabel	90	89·6	83·9	76·9
Vanguard 7	95	.....	86·3	83·3
Erban G	95	.....	87·8	86·2
Ajax	91	.....	.....	88·7
Roxton	102	.....	.....	90·2
Beaver	94	.....	.....	81·9

(b) On sandy land

Varieties	Days to ripen	Average yields in bushels per acre		
		1939–44 (6 years)	1940–44 (5 years)	1932–44 (3 years)
Banner 44	90	32·4	32·7	32·8
Mabel	84	32·0	32·1	30·6
Vanguard 7	88	33·3	33·6	33·7
Erban G	87	35·2	34·9	33·8
Ajax	86	.....	37·7	39·0
Roxton	92	.....	33·1	33·6
Beaver	87	.....	.....	35·6

The results are summarized in Table 72. Banner variety is the oldest and the most generally seeded in this district. However, on account of its lateness and high susceptibility to rusts, it is being slowly replaced by new varieties, of which the most outstanding ones are: Erban, Ajax, Mabel and Roxton.

Variety Trials of Barley

Considerable time has been spent on the testing of barley varieties, since 1936, on both clay and sandy soils. In 1944 and 1945, 25 varieties were tested in comparative trials. The relative productiveness, resistance to shattering and strength of straw were chiefly measured. Earliness is also an important factor as it is associated with smooth awns and resistance to the important diseases. In some cases, the malting quality of grain was taken into consideration.

TABLE 73.—RESULTS OBTAINED WITH THE BARLEY VARIETIES, SINCE 1936

(a) On clay land

Varieties	Days to ripen	Average yields in bushels per acre		
		1936–39 (4 years)	1936–45 (10 years)	1940–45 (6 years)
Charlottetown 80	96	56·5	.....	.....
Pontiac	92	60·0	.....	.....
Olli	87	62·8	.....	.....
Peatland	93	59·8	.....	.....
Nobarb	97	65·1	.....	.....
O.A.C. 21	90	67·4	61·9	58·3
Velvet	92	58·1	53·8	50·8
Byng	91	68·6	64·5	61·7
Montcalm	93	.....	.....	62·9
Galore	96	.....	.....	60·0

(b) On sandy land

Varieties	Days to ripen	Average yields in bushels per acre		
		1939–44 (6 years)	1940–44 (5 years)	1941–44 (4 years)
O.A.C. 21	84	19·7	21·2	20·6
Velvet	86	17·9	19·1	18·6
Byng	86	19·4	20·8	20·1
Galore	87	.....	22·1	20·8
M.C. 2716–5026	85	.....	24·3	24·1
Montcalm	87	.....	.....	18·4

Variety test of oats and barley.

The Mensury variety, a sister of O.A.C. 21, does not appear in this table. It resembles closely O.A.C. 21 and it has been adopted by this Station on account of its higher shattering resistance. The Byng variety is evidently the best yielder of them all, but unfortunately it is weak in straw and lodges almost every year when seeded on fertile land. The Montcalm variety is at the top of the new varieties. It is a very good yielder, possesses an excellent straw and is being highly recommended for the malt industry; furthermore it is a smooth-awn variety.

Variety Trials of Fall Wheat and Rye

Fall wheat and fall rye are generally seeded between August 15 and September 15. When they are seeded early, they can be pastured in the fall and still give good grain yields the next year.

The most desirable character of these varieties is their winter hardiness which spells failure or success with this crop. However, if the land is not well drained or if ice forms on the surface, considerable damage may be expected whatever varieties were seeded.

Winter wheat is a relatively early crop which gives high yields. The Kharkov M.C. variety is very well adapted to the local conditions and is generally productive. The new Rideau variety seems to be very good but it has not been tested enough here.

Rye is the grain of poor lands, where it is better adapted than wheat. It is a good energy producer but its protein content is low. It is chiefly used in the feeding of horses and pigs. According to the studies made, the following varieties are well adapted to local conditions: Crown, Dakold and Rosen.

Variety Trials of Field Peas

In determining the value of a soup variety of peas, the following characters must be taken into consideration: the quality and size of grain, the total yield, the length of time for ripening and the resistance to diseases. Of the numerous varieties or strains tested since 1937, only those appearing in Table 74 are worthy of recommendation. From that table it is evident that the old varieties, Arthur and Chancellor will be dropped in favour of newly created and improved strains.

Table 74.—RESULTS OBTAINED WITH FIELD PEA VARIETIES ON CLAY LAND, SINCE 1937

Varieties	Days to ripen	Weight of 1000 seeds in grams	Average yields in bushels per acre	
			1937–45 (8 years)	1943–45 (3 years)
Arthur	98	260	40·6	42·9
Chancellor	92	130	35·5	40·8
1181-A	97	191	36·4	44·4
1189-C	96	246	39·7	46·0
1184-A	101	191	39·8	42·3
1187-C	97	241	.....	52·0
1188-A	96	219	.....	47·5
1190-A	105	193	.....	39·4

Study on the Origin of Seed

This trial was conducted with a view to finding the influence, if any, of the origin of seed on the behaviour of wheat and oat varieties in this particular district. Samples of Regent wheat of similar grade from Swift Current, Ottawa,

Brandon, Lethbridge, Beaverlodge and Ste. Anne de la Pocatière were so compared during three consecutive years. The same test was conducted also with Vanguard oats originating from Brandon, Beaverlodge, Lacombe, Nappan, Ottawa and Ste. Anne de la Pocatière.

Results indicate clearly that the behaviour of a pure variety of oats or wheat of similar grade is unchanged, whatever the origin of the seed variety used. In other words, the origin of the seed has no influence on the behaviour of a pure oat or wheat variety.

Variety Trials of Linseed

The four following linseed varieties: Royal, Novelty, Siberian and Red Wing, compared since 1935, have shown themselves to be of equal value under local conditions.

Variety Trials of Field Beans

The results secured on sandy land since 1935 with the comparative tests of field bean varieties, show that the yield differences are small between the varieties Burbank, Navy, Grainer and Hunter, The Michelite variety has yielded slightly less but it is superior in quality.

Variety Trials of Buckwheat

Buckwheat is a very useful crop. It can replace a seeding that has failed, serve as green manure crop, or for cleaning a badly weeded field. Its flour is also much appreciated for human consumption. The best adapted varieties to the local conditions are: Silver Hull and Japanese B & O for human food, and Red Stem Grave I.

Production of Mixed Grains

The practice of seeding grain mixtures continues to be popular in this district. As this method presents certain difficulties, it is essential to know which are the best combinations of species and varieties, as well as the best rates of seeding. The most important factor of success is to have varieties which ripen uniformly, as otherwise, serious grain losses of one species are likely to occur. The behaviour of species in mixture is also important on account of the strong competition occurring between species growing in mixture, which behaviour is influenced by the prevailing climatic conditions.

From 1930 to 1940, oats, barley, wheat and peas were mixed and tried under all possible combinations, and these were compared with single species being grown alone under the same field conditions. Trial combinations of species were carried with early and late varieties. Unfortunately, some of the varieties that were used in these experiments have since disappeared from the market. Nevertheless, the trials have brought out some general practical conclusions which are significant and interesting.

The combination of oats and barley has demonstrated its value throughout the years of test. Both species grow well in mixture and they even seem to give superior yields to the pure crops. The rate of seeding was $1\frac{3}{4}$ bushels of oats and $\frac{3}{4}$ bushel of barley, per acre.

The oat-wheat combination has done well also. Wheat, particularly, has benefited from being grown in mixture with oats in this way and higher yields in mixture have resulted. The rate of seeding was $\frac{2}{3}$ bushel of wheat and 2 bushels of oats per acre.

The oat-pea combination has produced lower grain yields than the pure crops, but on the other-hand the yield of protein was higher than with either of the pure crops. However, this latter factor is not so important wherever a good quality hay is harvested.

Mixtures of Various Proportions of Oats and Barley

This experiment was started in 1942 and discontinued in 1945. The main object was to determine if oats and barley when grown in mixture of various relative proportion give higher yields of grain or total digestible nutrients than the same crops grown singly.

The trial included the comparison of three proportions, namely 75 per cent oats with 25 per cent barley; 50 per cent oats with 50 per cent barley; and 25 per cent oats with 75 per cent barley, besides pure oat and barley seedings. The trial was conducted on both sandy and clay soils.

Table 75.—AVERAGE RESULTS WITH THE VARIOUS PROPORTIONS OF OATS AND BARLEY IN THE TWO COMBINATIONS

Percentage Seeded	Percentage harvested		Yield of grain			Yield in Total Digestible Nutrients			Days to ripen
			lb. per acre			lb. per acre			
Banner Charlottetown 80	Oats	Barley	Total	Oats	Barley	Oats	Barley	Total	
100..... 0	100	0	2,954	2,954	.....	2,003	.....	2,003	99
75..... 25	66·3	33·7	2,926	1,940	986	1,315	772	2,087	95
50..... 50	45·8	54·2	3,110	1,424	1,686	965	1,320	2,285	95
25..... 75	21·2	78·8	3·021	642	2,379	435	1,863	2,298	99
0.....100	0	100	2,808	.....	2,808	.....	2,199	2,199	95
Mabel O.A.C. 21									
100..... 0	100	0	2,997	2,997	.....	2,032	.....	2,032	90
75..... 25	73·4	26·6	2,822	2,071	751	1,404	588	1,992	93
50..... 50	50·4	49·6	2,751	1,387	1,364	940	1,068	2,008	90
25..... 75	28·7	71·3	2,972	853	2,119	578	1,659	2,237	93
0.....100	0	100	2,973	.....	2,973	.....	2,328	2,328	93
(b) On sandy soil (1943-44)									
Banner Charlottetown 80									
100..... 0	100	0	886	886	.....	600	.....	600	95
75..... 25	63·6	36·4	845	543	302	369	236	605	95
50..... 50	42·8	57·2	843	375	468	256	366	622	95
25..... 75	18·8	81·2	722	141	581	96	455	551	95
0.....100	0	100	898	0	898	.....	702	702	95
Mabel O.A.C. 21									
100..... 0	100	0	916	916	.....	621	.....	621	86
75..... 25	69·3	30·7	816	548	268	371	210	581	86
50..... 50	45·2	54·8	772	374	398	254	312	566	86
25..... 75	29·7	70·3	808	260	548	177	429	606	86
0.....100	.....	100	834	.....	834	.....	654	654	86

It is interesting to note the different behaviour of mixtures in the two combinations and also the different reactions of mixtures to sandy and clay soils. Everywhere, barley grown alone has outyielded all other mixtures in pounds of total digestible nutrients. This is probably the main conclusion to draw from this experiment. In fact, the higher the percentage of barley in the seed, the better the chance of obtaining a superior yield of total digestible nutrients.

FORAGE CROPS

Dairying is the major source of revenue for Quebec farmers and the farm crop program should be organized accordingly. Dairy production may be most economically obtained through grassland farming, that is with lush crops of hay and pasture. In fact, Station studies on the cost of producing a ton of total digestible nutrients have shown that pasture and hay were the most economical with silage crops, roots and concentrates being of second importance. The latter, however, are needed in periods when pasture fails or when hay is of poor quality.

Experiments conducted at this Station with forage crops involved the trial of species most suitable to local natural conditions, and also a determination of the varieties which, alone or in combination, yield the most, winter the best, and produce the best quality of herbage or hay.

In this regard, it appears that the introduction of ladino clover in 1935 was a progressive step. This species is particularly well suited to grazing conditions. It is a good yielder and builds up quickly its aftermath after grazing. It is also very nutritious but it needs a rich land and plenty of moisture. Its hardiness has also some limitation.

As a whole, it is too early to make a definite commitment on its agronomic value, although the results, up to the time of writing, are encouraging.

Variety Test of Field Roots

Where family hand labour is abundant, field roots, either mangels, or turnips, or even carrots represent an interesting crop. They are relished by cattle, and at the same time, they constitute a supplementary food convenient to cattle receiving a great amount of dry hay.

Since 1936, several varieties of mangels have been compared and the best varieties, Prince and Frontenac, have yielded respectively 19·44 and 18·07 tons per acre. They have established their superiority over other varieties like Tip Top and Giant White Sugar.

As to turnips, the varieties Ditmars, Acadia, Wilhelmsberger and Laurentian are about of equal value, although Laurentian is superior to others for human consumption as it is of finer texture.

Variety Test of Silage Corn

Since 1938, several varieties of corn have been compared as to yield, earliness and hardiness. It is important that the varieties be early enough if a good quality silage is to be secured having a high percentage of dry matter obtained from ears at advanced stage of growth when cut. The varieties Algonquin and Longfellow are among the best, the former giving a particularly high yield and large ears. There are also the double-cross hybrids which are becoming increasingly popular. Among these, the earliest is Canada 355 but its yield is lower. The other recommended hybrids are 531 and 606.

Variety Test of Alfalfa

Alfalfa produces the best hay crop from both types of sandy and clay land. However, the objective has been to find varieties that are the most productive and winter resistant under local climatic conditions. The varieties Grimm, Ladak, Cossack and Ontario Variegated have, since 1935, proved to be of equal

value. With regard to yield and winter hardiness, the Ladak variety has the peculiarity of producing a higher yield at the first cutting than the others but the aftermath is lighter.

Comparison of hay aftermath with and without alfalfa.

Variety Test of Red Clover

To be successful in this district, this species must be represented by productive varieties resistant to the cold winters. In Table 76, the experimental results obtained from the comparative tests of several varieties of red clover are given.

Table 76.—AVERAGE YIELDS OF DRY MATTER AND HAY AT 15 PER CENT MOISTURE AS OBTAINED HERE SINCE 1939, ON CLAY LAND

Tons per acre

Varieties	1939–45		1942–45	
	Dry matter	Hay at 15 per cent moisture	Dry matter	Hay at 15 per cent moisture
Two cuttings				
Dollard	3·464	4·075	2·177	2·561
Ottawa	2·819	3·316	1·547	1·820
Temiscamingue	2·805	3·300	1·911	2·248
Soulanges	2·326	2·736	1·610	1·894
Single cutting				
Altaswede	3·089	3·634	2·146	2·525
Late M.C.	.....	.....	2·429	2·858
Graham	.....	.....	1·778	2·092

The variety Dollard is undoubtedly the best in the two-cut group with regard to high yield, greater resistance to winter-killing and better habit of maintenance. Among the single-cut varieties, Altaswede is the leader for winter resistance. The new variety Late M.C. is also very promising.

Variety Test of Timothy

Timothy is the old stand-by hay species in this province. It is used in all mixtures for both hay and pasture. Some of the recently improved varieties are rather promising. In Table 77, the results obtained on clay land with both groups of varieties, improved and commercial are given.

Table 77.—YIELD OF DRY MATTER FROM 1934 TO 1945 ON CLAY LAND

Tons per acre

Varieties	From 1934-1945 (6 seedings)*		1936-2945 (6 seedings)*		1940-1945 (3 seedings)*	
	Dry matter	Hay at 15 per cent moisture	Dry matter	Hay at 15 per cent moisture	Dry matter	Hay at 15 per cent moisture
Early						
Swallow	2·931	3·448	.....	.....	.....	.....
Cornell 1777	2·789	3·281				
Boon	2·723	3·204	2·581	3·036	2·171	2·554
Milton	.....	.....	2·684	3·158	2·142	2·520
Medon	.....	.....	.....	.....	2·208	2·598
Vaudreuil	.....	.....	.....	.....	2·079	2·446
Late						
Drummond	.....	.....	.....	.....	2·230	2·624
Ottawa 1602	.....	.....	.....	.....	2·286	2·689

* Each seeding represents average yield of 3 consecutive seasons.

Among the early varieties, Boon and Milton are recommended for the whole of the province. In this group, there are two particularly late varieties which are best adapted to this district and also where farmers have large acreages of hay, involving a long period of harvesting.

Variety Test of Annual Hay Crops

It is necessary in periods of drought or in years of seeding failure to have all-purpose hay crops in case of emergency. For this purpose, several species have been under trial since 1936. Among these are oats alone and in combination with peas and vetch; also soybeans, millets, sorghum, sudan grass, spring rye and Italian rye grass, etc.

It appears after ten years of trial that oats alone, or in mixture with peas or vetch have given the best results. This crop is well adapted to this climate and is palatable and much relished by cattle.

Variety Test of Soybeans

Soybeans are recognized as a highly nutritive crop and also as a good producer. Yields vary from 15 to 25 bushels per acre, according to trials carried on for ten consecutive seasons. Among the varieties tried, Pagoda and Manitoba Brown are preferred. They are early enough in this district and give a reasonable good yield of seed.

Variety Test of Red Fescue

This trial was initiated on clay land in 1943 to compare varieties of creeping red fescue for lawn purposes and as productive pasture plants. They were tried in combination with Kentucky blue grass and red top.

Three-year results show clearly that red fescue is well adapted to the wet Champlain clay habitat. A local strain has shown its superiority over the others named Olds and Duraturf, with regard to quick establishment, competing ability and yield of forage.

Trial of Legumes and Grasses for Hay

Since 1935, some trials have been made with a view to determining the best grass and legume species when seeded alone or in mixture for the production of hay. Some new species were introduced and compared with those generally used by farmers and data were obtained in regard to yield, hardiness and persistency. Yield data were collected during the three years following each seeding and one or two cuttings were made each year according to the habits of the species.

Table 78.—AVERAGE YIELD OF MIXTURES OR SINGLE SPECIES TRIED ON CLAY LAND

Tons of dry matter per acre

Species with respective rates of seeding per acre	1935-45 (7 seedings)	1937-45 (6 seedings)
Alfalfa 12 lb.	.....	4·396
Timothy, 8 lb.; alfalfa 8 lb.	4·400	4·358
Timothy 8, alfalfa 6, red clover 6, alsike 2, wild white clover 2	4·068	4·014
Timothy 8, red clover, 8, alsike, 2, wild white clover 2	2·944	2·805
Timothy 8, red clover 8, alsike 2, wild white clover 2, Kentucky blue grass 2, red top 2	2·820	2·652
Timothy 8, red clover 8, alsike 2, ladino 2	2·765	2·572
Brome grass 20	2·734	2·389
Timothy 12	2·096	2·014
Crested wheat grass 20	2·173	1·941
Red Top 30	.....	1·786
Meadow fescue 30	.....	1·718
Orchard grass 30	.....	1·354

Table 78 does not show data obtained since 1935, with rye grass, tall oat grass and mixtures of timothy-ladino and brome-alfalfa.

The feature of these trials is the ability of alfalfa to surpass others in yield, either alone or in mixture. Alfalfa is certainly the highest yielding hay crop in this district.

The mixture brome-alfalfa, even though it has been tried only since 1942 has shown to be very promising. Where alfalfa thrives, brome grass very often gives good results. Ladino clover for hay has not done as well as alfalfa. Nevertheless, the latter will prove valuable if it can survive in reasonable proportion so as to constitute the principal legume species in the pasture after two or three years of hay.

Mixture for Pasture

In 1934, a project of this kind was started on sandy soil with a view to finding a more suitable mixture than that most commonly used by farmers, namely, timothy, red clover, alsike and wild white clover. Nine kinds of grasses including meadow fescue, Kentucky blue, Canada blue, red top, brome, perennial rye grass, crested wheat grass, orchard grass and one legume species, namely alfalfa, were added to the basic mixture and compared with it. Plots were seeded in triplicate and grazed. Yields were determined through the use of cages.

The data from five-year results show clearly that under the conditions prevailing in this project, none of these species added to the basic mixture has significantly increased the yield of green herbage nor of dry matter. Meadow fescue and blue grass have brought a light increase in yield and alfalfa a slight decrease, while other species have given significant yield decreases.

Other Pasture Mixtures

This project was started in 1944 with the purpose of establishing the value of ladino clover as a pasture species in comparison with wild white clover and to find a grass species superior to timothy. The grass species tried were timothy, brome grass, orchard grass, reed canary grass, meadow fescue, red fescue, Kentucky blue and red top. In the same mixtures, the following legumes were tried: alfalfa, red clover, ladino clover, alsike clover and wild white clover.

The productivity of these mixtures was established by cuttings from cages kept under grazing. Botanical analysis are made each year to determine the relative predominance of species in each of the mixtures.

Results obtained show the superiority of ladino clover in the first year. In fact, all mixtures containing ladino have produced the highest yields.

Grasses were classed in the folllowing order: red fescue, reed canary grass, brome grass, meadow fescue, orchard grass and timothy.

Ecological Studies

This experiment was inaugurated in 1941 on Champlain clay with the purpose of determining the effect of different systems of grazing and cutting on the botanical composition and yield of a timothy sward. It also served to a certain extent to show the relationship of certain pasture types and hay swards.

The experiment involved the study of 16 treatments, which are divided in three different systems: grazing, cutting and the combination of grazing and cutting. These treatments differ in intensity and frequency. Grazing was done by sheep and cutting with a regular Gravely mower.

The botanical analysis was made at the beginning of the experiment and repeated in 1943 and 1945. Treatments were suspended in 1945, and yield data were then collected.

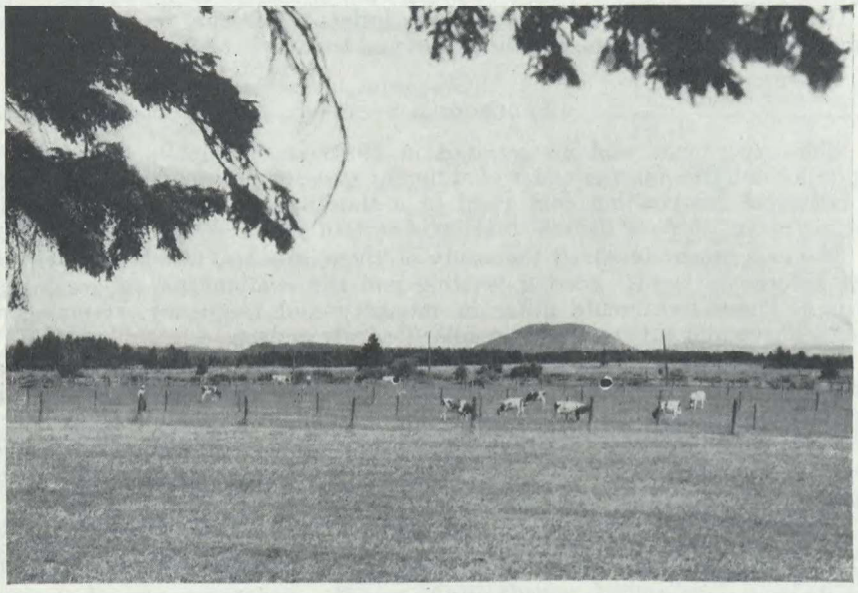
From this trial, the following conclusions may be drawn. There was a significant decrease of timothy, a gradual increase of red fescue and a light proportion of red top and blue grass.

There was also an increase of wild white clover with the reduction of other legumes. As this sward got older, everywhere the percentage of weeds and bare land increased.

Generally speaking, cutting increased the percentage of timothy as well as bare land, while grazing and frequent clippings favoured the increase of red fescue, wild white clover and certain weeds.

PASTURES

For a great many years pastures may be considered to have been the most neglected crop on the farms in the district. It was customary for all farmers to reserve for such a crop the unploughable land and the least fertile fields. On the other hand, it has been fully realized in recent years that milk can be produced at the lowest cost with this crop, and of late considerable attention has been given to pastures. In fact, many farmers are now reserving the best fields for pastures. When good natural pastures have shown their worth, attempts are made by farmers to improve them even further through the use of fertilizers and by the right cultural practices. Much of the experimental work at Ste-Anne has been along such lines. Another problem which has been studied here is the testing of seed mixtures that would be more productive and better suited for grazing. However, with erratic rainfall causing varied vegetation, another project has been undertaken with a view to combining different kinds of pastures to meet all circumstances.



A study of pasture grass mixtures where heifers are used to collect comparative experimental data.

Comparison of Manure and Commercial Fertilizers for Pasture on Sandy Land

This project was initiated in the spring of 1937 and modified in 1940. For five years, the respective values of different fertilizers, used to obtain maximum production, have been measured. In 1944, this project was moved into another field, where the same treatments were tested further. At both places, the soil was light, sandy, and the natural fertility very low.

The five following treatments of fertilizers were compared.

Treatment 1.—Application of 100 lb. of ammonium sulphate annually in spring; 600 lb. of superphosphate and 100 lb. of muriate of potash applied every 3 years, in the fall.

Treatment 2.—Check, no manure, no fertilizers.

Treatment 3.—9 tons of manure per acre applied in fall every three years.

Treatment 4.—600 lb. of superphosphate per acre applied in fall every three years.

Treatment 5.—600 lb. of superphosphate and 100 lb. of muriate of potash per acre, every 3 years.

The yields of these different treated pastures were collected as green herbage through small wire cages. The grazing animals used were Ayrshire heifers, which were also employed to measure the relative producing ability of the treatments, through their increase in live weight.

The increasing weight of the animals, besides the energy needed for their upkeep, permitted the evaluation of the digestible nutrients extracted from the herbage. The yields of herbages collected from the cages were taken each time the cages were moved to a different representative area following each cutting. The percentage of dry matter was determined for each sample obtained in each cage of all the individual cuttings.

Results obtained are given in Table 79.

TABLE 79.—COMPARISON OF MANURE AND COMMERCIAL FERTILIZERS FOR PASTURES YIELDS OBTAINED PER ACRE—1940-1944 INCLUSIVE

Item	No. 1 N P K	No. 2 Check	No. 3 Manure	No. 4 Super-phosphate	No. 5 Super-phosphate and potash
Acreage of the paddock.....acre	1·35	1·63	1·65	1·62	1·60
Duration of grazing periods.....days	75	65	75	81	83
Number of grazing days obtained per acre.....	114	40	92	124	146
Average number of animals per acre.....	1,50	0·61	1·22	1·52	1·77
Total gain in live weight per acre.....lb.	178·1	70·8	155·8	255·5	278·3
Daily gain per head.....	1·58	1·79	1·70	2·07	1·92
Digestible nutrients obtained per acre.....	1,277	517	1,087	1,636	1,935
Grazing capacity per day and per acre.....A.U.*	1·08	0·50	0·91	1·25	1·46
Grazing capacity per day and per acre for a season of 150 days.....A.U.	0·53	0·22	0·45	0·68	0·80
Yield of dry matter per acre as calculated from cage measurements.....lb.	3,261	375	2,495	3,469	3,987
Cost of treatment per acre..... $	5·14	.....	4·86	2·51	3·51
Revenues from pastures per acre, once the cost of treatments has been deducted..... $	12·27	7·04	9·96	19·78	22·81

* A.U.—16 lb. of digestible nutrients.

The average yields obtained show clearly that commercial fertilizers, such as superphosphate alone or superphosphate with potash, have given much better yields than the other treatments. On the other hand, part of this increase in both paddocks may be accounted for by the fact that they were on lower land and may have benefited from a little more moisture.

Results obtained on the newly renovated field are not given because the trial has not run long enough. Nevertheless, they can be tentatively classified as to their relative yielding capacity based on one-year results in the following order of merit: treatments 1, 3, 5, 4, 2.

Long Term Pastures vs. Rotated Pastures

This experiment was established in 1939 to ascertain the relative value of a long-term pasture *vs.* one organized within a series of rotated crops. It was located on both fertile clay soil rich in organic matter, and poor sandy land of a rolling nature, low in organic matter.

TREATMENTS APPLIED ON SANDY SOIL

Long-term pasture: An annual application of 100 lb. of sulphate of ammonia, with an additional application every four years of 600 lb. of superphosphate and 100 lb. of muriate of potash was used. This pasture was established on an old meadow that had been thoroughly tilled. The sward is now made up mostly of Canada blue and wild white clover with a smaller proportion of timothy, red fescue and bent grass. The proportions of these various grasses have varied within the years.

Rotated pasture: Under a four-year rotation, oats were seeded the first year at the rate of 2½ bushels per acre and grazed the same year. The seed mixture included 2 pounds of alsike, 6 pounds of red clover and 10 pounds of timothy. In 1943, on the second rotation cycle, the following mixture was used: 10 pounds of timothy, 2 of ladino and 1 of white Dutch clover. Along with these seedings, the fertilizers applied were 100 lb. of sulphate of ammonia, 600 lb. of superphosphate and 100 lb. of muriate of potash.

For the second year, clover grazed during the full season.

For the third year, an application of 100 lb. of sulphate of ammonia was made in the spring, while grazing was allowed until August, at which time the field was ploughed and seeded again to winter wheat for further grazing towards the end of September.

An application of 100 lb. of sulphate of ammonia was made the fourth year while early grazing of fall wheat was allowed until the middle of June. Then the field was ploughed and seeded to rape for grazing till the end of the summer and the early part of the fall.

Afterwards, the cycle was started anew including grazing crops like oats, clover, timothy, wheat and rape.

TREATMENTS ON CLAY LAND

Long-term pasture: An annual application of 100 lb. of sulphate of ammonia was made, plus 600 lb. of superphosphate and 100 lb. of muriate of potash every three years. This pasture was established in 1931 with a seeding of red clover and grazed afterwards until 1936, when it was renovated by vigorous disking followed by a new seeding including timothy, Kentucky blue, red and alsike clovers, white dutch and other grasses. In 1945, the sward of this pasture was made up mostly of Kentucky blue and wild white clover, along with timothy, couch grass and annual weeds. There was a small proportion of red fescue and bent grass.

Rotated pasture: Using a three-year rotation, oats were seeded for the first year at the rate of 2½ bushels per acre and grazed the same year. The following seed mixture was used: 6 pounds of timothy, 6 of red clover, 2 of alsike, 2 of alfalfa, 2 of white dutch and 2 of ladino. This mixture was adopted in 1943 only as previously there was no ladino. Previous to seeding in the first year, 100 lb. of sulphate of ammonia, 600 lb. of superphosphate, and 100 lb. of muriate of potash were used.

For the second year, grazing was allowed all season, while for the third year there was grazing all year with ploughing under taking place in the fall.

YIELDS RECORDED

All these pastures are operated like any ordinary grazed pasture fields with milch cows doing the grazing. The pasture yielding capacity is measured through experimental cages, 2 by 3 feet placed at representative points in each of the different fields. The cages are moved after each cutting and placed in other representative areas in the same field that had been previously well grazed. Cuttings are made as often as the grass reaches 4 to 6 inches or more in height. Yields in green matter are first recorded, then the percentage of dry matter is established for each cutting of each experimental cage, and with these two factors, the yields of dry matter per acre are established to get the final comparison.

COST OF TREATMENTS AND NET REVENUES

In the cost of pasture treatments are included fertilizers, seed, labour and horse power. Fertilizer and seed were charged at the regular trade price, at the time they were used, while the manual labour was evaluated at 25 cents per hour and the horse power at 10 cents per hour. Although these rates have increased in recent years, they were the prevailing ones at the time of inaugurating this experiment.

Revenues are based on yields of dry matter, the latter being estimated at $20.00 per ton as an average for the last seven years of the period under review.

On clay land, the experimental results obtained (Table 80) follow the same trends as those obtained on sandy land. Yet, the superiority of long-term pasture is not so striking there, although it is somewhat significant. Another factor to consider in a trial of this kind, besides the total yield, is the seasonal fluctuations of the herbage growth. The long-term pasture gives a high yield in the spring and early summer, then the yields diminish significantly while the herbage becomes less nutritive. On the other hand, the rotated pasture, having a high percentage of legumes, produces a good yield during dry periods when generally the grass is short and scarce elsewhere. Considering the latter point, the rotated pasture is of a great value even if it costs more than the long-term pasture to get established.

On sandy soil, the comparison between production of a long-term pasture (Table 81) *vs.* rotated pasture has given definite differences during the seven years that this project lasted. In fact, in each of the seven years, the long-term pasture has produced a higher total yield of green grass than the rotated. Furthermore, this long-term pasture has cost less during all that period, leaving a net profit nearly twice as large as that with the rotated pasture. These results can be explained by the fact that the land, where such an experiment was organized, is very coarse and low in organic matter. It is also rather

difficult to obtain a good stand of legume species from such land which contributed to the reduced total herbage yield. From the soil conservation standpoint, such poor and rolling land should be ploughed as little as possible, hence all the more reason to avoid rotated pasture.

TABLE 80.—COMPARISON OF LONG-TERM vs. ROTATED PASTURE. RESULTS IN YIELD OF HERBAGE AND REVENUES AS OBTAINED ON CLAY SOIL FROM 1939 TO 1945 INCLUSIVE

Types of pasture	Cost of treatments	Yield of green matter in lb. per acre	Yield of dry matter in lb. per acre	Revenues after deduction of expenses	Number of years results collected
	$ cts.			$ cts.	
(a) Long term	5 26	27,667	6,373	51 18	7
(b) Rotated—					
(1) Oats	.....	21,544	3,526	.....	7
(2) Clover and alfalfa	.....	21,559	4,702	.....	6
(3) Timothy and alfalfa	.....	18,905	4,167	.....	5
Average	8 42	20,815	4,096	29 06	.....

TABLE 81.—COMPARISON OF LONG TERM *vs.* ROTATED PASTURE. RESULTS IN YIELD OF HERBAGE AND REVENUES AS OBTAINED ON SANDY SOIL FROM 1939 TO 1945 INCLUSIVE

Types of pasture	Cost of treatments	Yield of green matter in lb. per acre	Yield of dry matter in lb. per acre	Revenues after deduction of expenses	Number of years of results collected
	$ c.			$ c.	
(a) Long term	4 51	17,525	3,959	35 07	7
(b) Rotated—					
(1) Oats[1]	.....	12,631	2,216	.....	7
(2) Clover	.....	13,896	3,140	.....	6
(3) Timothy	.....	11,211	2,679	.....	5
Fall wheat[2]	.....	1,815	371	.....	5
(4) Fall wheat[3]	.....	7,029	1,611	.....	4
Rape	.....	14,055	1,773	.....	4
Average	9 37	14,602	2,877	17 43	.....

[1] In 1943, a part of the oat section was seeded with Italian rye grass, which appeared even inferior to oats.
[2] In 1941 and 1942, winter rye was used instead of winter wheat.
[3] In 1941 and 1942, winter rye was used instead of winter wheat.

FERTILIZERS AND CULTURAL PRACTICES IN RENOVATING PASTURES

This experiment was inaugurated in order to establish which was the best treatment to apply in renovating old pastures: fertilizers, cultural practices or both.

TREATMENT

Three methods were compared: ploughing with fertilizers, disking with fertilizers and fertilizers alone. In each case the treatments were duplicated. On the large plots where cultural practices were applied for instance, sub-plots were established with several combinations of fertilizers including phosphoric acid, potash, lime and manure.

PROCEDURE

This experiment was carried out on clay soil in a meadow which had been previously in hay for two years, and grazed during another three years. The renovated section received the following seed mixture: 4 pounds of timothy

per acre, 5 pounds of brome, 2 of red clover, 1 of alsike, 1 of wild white clover, 3 of alfalfa, 2 of Kentucky blue grass and 2 of Canada blue grass.

Yields were recorded from several cuttings representing closely the regular grazing cycle. About four cuttings were taken every year. The yield of green matter was totalled for the four cuttings representing the growth of a full season, while the yield of dry matter was established as well from the percentage found in each green sample collected from each plot and each of the different cuttings.

Fertilizers were applied at the following rates at the beginning of this experiment. The letter symbols given below represent the different single fertilizers applied and the quantity used in each case.

P = 500 lb.of superphosphate 20 per cent per acre

K = 100 lb. of muriate of potash 50 per cent per acre

Ca = 1 ton of lime per acre.

M = 20 tons or manure per acre.

In addition a botanical analysis was made annually on each plot, so as to ascertain further the actual influence of cultural practices and fertilizers on the composition of the sward or rather to understand the succession of species occurring within any sward as a result of the treatments.

Actual yields and botanical analysis data are given in the following tables: 82, 83, 84.

TABLE 82.—AVERAGE YIELDS OF BOTH GREEN AND DRY MATTER PER ACRE, FROM VARIOUS CULTURAL PRACTICES FROM 1942 TO 1945 INCLUSIVE

Cultural practices	Average yields from 64 plots, in pounds per acre			
	1945		1942–45 (4 yr.)	
	Green matter	Dry matter	Green matter	Dry matter
Fertilizer alone	13,343	2,856	9,136	2,200
Disking and fertilizer	16,654	3,646	13,899	3,107
Ploughing and fertilizer	81,339	3,890	16,625	3,743
Average for the 3 treatments	16,112	3,464	13,220	3,017

TABLE 83.—AVERAGE YIELDS FROM 12 REPLICATES OF THE FERTILIZER PLOTS, FROM 1942 TO 1944 INCLUSIVE

Fertilizers	Yields per acre, in pounds of	
	green matter	dry matter
Check	7,624	1,895
P—superphosphate	12,138	2,788
K—potash	8,489	2,017
Ca—lime	10,275	2,429
M—manure	13,103	2,992
PK	11,550	2,630
PCa	13,065	2,949
PM	16,729	3,740
KCa	11,375	2,663
KM	13,241	3,076
CaM	13,905	3,169
PKCa	14,838	3,298
PKM	15,440	3,576
PCaM	16,806	3,800
MCaK	15,710	3,447
PKCaM	17,233	3,801

TABLE 84.—RELATIVE PERCENTAGE OF SPECIES IN THE FLORA AS BASED ON THE 1945 SURVEY

Cultural practices	Mean percentage from 4 replicates of 16 plots			
	Bare land	Legumes	Grasses	Weeds
Check	55·6	7·3	22·7	14·4
Disking	57·0	8·7	22·1	12·2
Ploughing	56·2	10·7	18·4	14·7
Fertilizers	**Mean percentage from 12 replicates**			
Check	57·4	7·6	19·4	15·6
P	55·2	9·0	20·5	15·3
K	58·4	7·4	18·5	15·7
PK	56·4	9·0	19·6	15·0
Ca	56·0	10·8	19·4	13·8
CaP	57·8	9·7	18·6	13·9
CaK	56·6	10·0	19·8	14·6
CaPK	57·2	10·8	19·1	12·9
M	55·9	10·7	20·2	13·2
MP	56·6	8·5	22·3	12·4
MK	56·0	8·1	23·9	12·0
MPK	56·0	9·3	21·9	12·8
CaM	55·0	10·0	22·3	12·7
CaMP	55·8	10·0	21·9	12·3
CaMK	57·2	8·4	21·3	13·1
CaMPK	55·8	8·9	22·7	12·6
Average	56·4	9·2	20·7	13·7

GENERAL CONCLUSIONS

1. Cultural Practices:

Results obtained during four years (Table 82) demonstrate clearly that ploughing has increased the total yield of herbage far more than disking; the latter, in turn, has produced more than fertilizer alone.

2. Fertilizers:

The average results for four years (Table 83) clearly show that manure and superphosphate are the most efficient single-manuring treatments for pastures located on clay land. In reviewing the annual yields obtained, one learns that manure has produced a quicker effect than superphosphate at the beginning of this trial, but superphosphate has shown a more sustained beneficial effect throughout the years. Lime has also been effective but to a lesser degree than manure or superphosphate. On the contrary, potash has not brought any remarkable increase in yield.

As a practical conclusion, it may be said that on pasture established on clay land, it is recommended to apply manure or superphosphate, or preferably both together, particularly if supplemented with an application of lime.

3. Botanical Analysis

A botanical analysis was made on each of the plots in 1945, of which a summary is given in Table 84.

In a general way, cultural practices have modified the flora. Alfalfa appeared where ploughing and disking were practised, while wild white clover is more abundant where fertilizer alone was applied without any cultural practice. The predominant native species that grow in such pastures are red fescue and bent grass, and they were far more numerous on the check plot than on the ploughed one.

Botanical composition also differs in relation to the kind of fertilizers applied. Lime has favoured alfalfa and, in general, all legumes; on the other hand, manure seemed to stimulate the grass species.

FIBRE FLAX

The growing of flax for domestic use has always been popular throughout this area, but during the second world war a considerable expansion took place, since all flax by-products were so urgently needed for military purposes.

Local farmers in 1938 organized a co-operative mill when their early efforts were directed by the Station staff, applying the knowledge acquired through the experimental studies. In 1940, some 300 members belonging to this co-operative grew 1,500 acres of flax.

To further enlighten the growers, experiments were established to ascertain the varieties best suited to this district, and the most favourable stage of maturity at which pulling should be done for the highest yield of top quality fibre. In addition, experiments were carried on with different fertilizers on different soil types.

Flax Variety Tests

This trial was inaugurated in 1934 with a view to selecting the best varieties and strains adapted to this particular area. The three original varieties were the only ones sufficiently improved and generally used by growers throughout the province to justify their being included in that trial. These varieties were measured as to their respective yield in fibre, tow and seed. Other agronomic characters were also considered, and results are given in Table 85.

Table 85.—YIELD OF FIBRE, TOW AND SEED FROM 1934 TO 1942 INCLUSIVE

Varieties	Height in inches	Average yields per acre				
		Fibre		Tow		Seed
		lb.	%	lb.	%	bu.
Cirrus	32	446	11·9	332	8·9	12·1
J.W.S.	31	395	11·8	286	8·5	13·9
Gossamer	29	354	11·5	255	8·3	14·5
	1943 and 1944					
Cirrus	29	166	6·3	234	10·1	14·9
L. Dominion	28	155	6·2	226	10·2	16·7

These nine-year results show decidedly that, under conditions prevailing where this trial was conducted, the variety Cirrus is superior to J.W.S. and Gossamer as to yield of fibre. On the other hand, the yield of seed was lower, and this is a general result obtained through all these years.

In 1943, the variety Liral Dominion was introduced in place of J.W.S., and in 1945 the variety Gossamer was replaced by Liral Prince. At time of writing, it is not satisfactorily established how much better these new varieties are than those commonly used, but the prospect is encouraging.

Pulling Flax at Different Stages of Maturity

This experiment was started in 1938, to study the stage of maturity when flax should be pulled for high yield and top quality of fibre. Comparisons were made, as shown in Table 86, between flax pulled when one third of the balls had turned brown, *(a)*, and pulling made one week later *(b)* and two weeks later *(c)*.

At time of writing, the results obtained could be summarized as follows:

Table 86.—YIELDS OF FIBRE, TOW AND SEED UNDER PULLING AT VARIOUS STAGES OF MATURITY, AS OBTAINED SINCE 1938

Stages	Length of straw in inches	Average yields per acre				
		Fibre 1938–45		Tow 1938–44		Seed 1938–45
		lb.	%	lb.	%	
Pulling *(a)*	28·5	321	10·1	226	7·8	13·3
" *(b)*	31·5	332	10·5	193	6·0	15·9
" *(c)*	28·9	310	9·8	220	6·6	16·2

These results suggest that pulling flax a week after $\frac{1}{3}$ of the balls have turned brownish *(b)* would be the most suitable. At this particular stage, the yield of fibre was the highest as was also the quality, but the yield of seed was slightly lower.

Commercial Fertilizers for Flax

Several trials were conducted on both clay and sandy soils to learn the respective values of commercial fertilizers with regard to the yield and quality of fibre, as well as the yield of seed.

Starting in 1938, different commercial formulae were compared. Then in 1943, single elements were compared alone and in different combinations, at the following basic rates:

Nitrogen = 100 lb. per acre (Sulphate of Ammonia)
Potash = 320 lb. per acre (Muriate of Potash)
Phosphoric acid = 600 lb. per acre (Superphosphate).

Table 87.—RESULTS OBTAINED WITH COMMERCIAL FERTILIZERS FROM 1938–41 INCLUSIVE

Fertilizers	Average yields per acre, on clay soil			
	Fibre lb.	Fibre %	Tow lb.	Seed bu.
2-12-6	442	14·8	260	6·7
2-10-0	441	13·4	252	6·9
2-0-16	418	14·7	233	7·0
0-12-6	416	14·8	211	7·2
Lime	418	14·2	215	6·9
Check	441	14·6	245	6·4
	Average yields per acre, on sandy soil			
2-12-6	240	10·9	67·9	5·2
2-12-0	252	11·9	76·4	5·8
2-0-16	218	12·0	62·2	4·7
0-12-16	162	10·6	56·7	4·3
Lime	188	12·0	67·2	6·0
Check	210	11·7	64·3	6·0

TABLE 88.—RESULTS OF COMMERCIAL FERTILIZERS ON THE YIELD OF FIBRE AND SEED, FROM 1943 TO 1945 INCLUSIVE

Fertilizers	Yields per acre—averages of 5 trials						
	Fibre		Tow		Total fibre		Seed
	lb.	%	lb.	%	lb.	%	bu.
Check	271	13·6	215	8·8	486	22·4	12·6
N	338	14·9	203	9·1	541	24·0	12·5
P	314	13·9	225	9·6	539	23·5	13·2
K	326	14·4	215	9·2	541	23·6	12·8
NP	348	13·9	230	9·6	578	23·5	12·8
NK	297	12·9	222	9·1	519	22·0	12·0
PK	320	15·9	208	9·1	528	25·0	12·0
NPK	317	12·9	213	8·3	530	21·2	13·3

These results are somewhat variable. No striking difference occurred on clay soils, while the effectiveness of good fertilizers would be far more significant on poorer sandy soils. In a general way clay soils do not benefit from additional applications of commercial fertilizer. On the other hand, sandy soils produce superior flax, in volume and quality, after superphosphate and potash have been applied. Nitrogen increases the total tonnage or yield, but the quality, that is strength of fibre, is somewhat reduced. It is the right combination of all these single elements that guarantee uniform yields and quality, depending on the normal weather conditions, which are usually rainy enough in this district.

ILLUSTRATION STATIONS

The Illustration Stations of the eastern Quebec district are operated in collaboration with this Experimental Station. They have been established at representative places and the work is carried on the farms owned by farmers. The aim is to promote the development of the regional agriculture by helping the farmers to solve the different problems that they have to face every day in their farming operations.

Group of young breeders holding their annual field day at one Illustration Station.

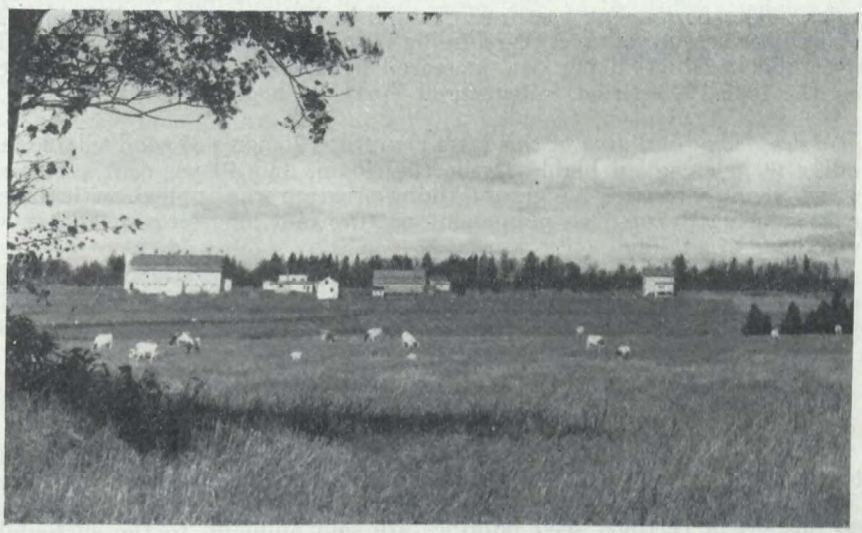
Experimental work conducted on these stations deals with livestock raising and field husbandry, and encouragement in the use of better seed. Work is also directed toward the more effective use of farm manure, commercial fertilizers and limestone.

Considerable work has been carried on with pasture improvement, the aim of which was to determine the most economical and more appropriate fertilizer formulae for the leading soil types, climatic or other local conditions. This work was done realizing that dairy and livestock production are the basic farming enterprises in this district which covers all the south shore of the St. Lawrence from Isle of Orléans down to Gaspé, including the Baie des Chaleurs, the Matapedia Valley and other important regions. Altogether, twelve Illustration Stations are operated in twelve different counties.

The name of the operators with the location of each unit is shown below:—

Name of Operators	Parish	County
Rousseau, Adelard	St-Pierre, I.O.	Montmorency
Aubé, Albert	St-Vallier	Bellechasse
Gaudreau, Hilaire	St-Paul	Montmagny
Lemieux, Jos. C.	L'Islet	L'Islet
Caillouette, Antonio	St-Arsène	Temiscouata
Plourde, Georges	Notre Dame du Lac	Temiscouata South
Bouchard, Philippe	Luceville	Rimouski
Bélanger, Jos-Alfred	Sayabec	Matapedia
Lavoie, Léon	Nouvelle	Bonaventure
Deschênes, Bertr nd	Ste-Anne des Monts	Gaspe-Nord
Hall, Wilson	New Carlisle	Bonaventure
Degarie, Pierre	Cap d'Espoir	Gaspe

St-Pierre, I.O.—This station is situated on the Island of Orleans, about 15 miles from Quebec city. The total area under cultivation comprises 125 acres. The local and surrounding soil is of low fertility. However, by employing good cultural methods, a rational use of the farm manure and progressive use of commercial fertilizers as well as lime, some satisfactory yields are being obtained. A four-year crop rotation system has been established with the following crop sequence: hoed crops (swede turnips, potatoes, fodder corn), cereals, clover and alfalfa and mixed hay. The fodder corn is a very useful crop as supplement to pasture during a dry weather period.



Herd and buildings of the operator of Rivière du Loup Illustration Station.

The herd consists of 28 head of Ayrshire dairy cattle headed with an AA sire. The milk products are sold on the local market. During the ten years under review, average milk production was increased from 6,805 to 7,511 pounds of milk per cow.

The poultry consists of 300 Barred Plymouth Rock laying hens and most of the egg production is sent to the local co-operative hatchery. In 1946, poultry-keeping was responsible for 38 per cent of the total revenues of this unit.

St-Vallier—This station is situated 25 miles from Quebec city. The total area in tillable land is 45 acres, of a soil type made up of 85 per cent clay loam and 15 per cent sandy soil. As dairying is the main enterprise on this station, and as the soil is most suitable for the growing of alfalfa and other forage crops, grass farming has been developed on a large scale during recent years. In fact, it might be said that at least 60 per cent of the total area is devoted to meadows or permanent pasture. On the other 40 per cent, a three-year rotation for hoed crops, (mostly fodder corn for silage) is being practised. A fine Ayrshire herd made up of 20 head and headed by one AA sire is improving steadily. All the cows are under the R.O.P. control. The herd is accredited and in good sanitary condition. Whole milk is sold to the Quebec city dairies. Each year, milk products contribute over 50 per cent of the total revenues.

St-Paul—At this station, a suitable crop rotation system was established, drainage conditions on some of the fields were improved, and better grain species introduced. The fertility of this soil was rebuilt to a great extent by the use of barnyard manure, commercial fertilizers, and liberal applications of ground limestone.

In this district, the dominant soil type is a kind of gravelly-loam of low fertility. However, by following an improved plan of operations, the yield of grains was raised to 40 or 45 bushels per acre, while the yield of hay reached 1½ to 2 tons per acre. Weeds, which usually made up most of the hay crop, are being replaced by better forage species especially clover. Alfalfa tests have not been successful at time of writing.

The main rotation is a four-year one. The total area under cultivation is 50 acres. The permanent pasture is established on stony, rough land. The dairy herd is made up of an A Ayrshire bull, and 15 grade Ayrshire cows. The average milk production per cow increased by 2,880 pounds of milk per cow during the 1940-1946 period. Registered Yorkshire hogs are also kept.

L'Islet—The total area of this farm comprises 76 acres of good tillable land, including 60 per cent of highly fertile clay loam, and 40 per cent sandy soil. In recent years, a progressive grass farming program was applied, with the clay loam area being devoted to permanent pasture and long-term meadows with heavy covers of alfalfa.

The dairy herd consists of 30 head of Canadian registered cattle. The average milk production of the herd has been increased from 7,087 in 1937 to 8,685 pounds in 1946. Each year, many good individuals are sold as breeding stock to surrounding farmers.

St-Arsène—This station is located half-way between Quebec and the Gaspé peninsula. The total acreage under cultivation is 96 acres, comprising 35 per cent clay loam and 65 per cent sandy soil. The latter light sandy soil is highly suitable for potatoes. While dairying is the main enterprise on this farm potatoes are grown each year to the extent of close to seven acres and around 1,000 bushels of certified seed potatoes are sold annually to the surrounding farmers. In spite of the fact that 65 per cent of the soil on this farm is of rather light coarse texture, the yields of the different crops are satisfactory, due, of course, to good farm management, such as rational use of farm manure and liberal application of commercial fertilizers and limestone.

The dairy herd consists of an AA Ayrshire bull and 20 head of other registered Ayrshires. In recent years considerable progress has been made with respect to the production and type of animals. The whole herd is under R.O.P. control and the majority of the cows are accredited. Raising of registered Leicester sheep has been carried on with great success at this station.

Notre Dame du Lac—This station is located in the southern part of Temiscouata county. The total area under cultivation is 55 acres, including 40 per cent gravelly clay and 60 per cent gravelly loam, both particularly low in organic matter.

By following improved cultural methods and farm management, the fertility of the soil has been considerably improved. This has enabled the introduction of good species of forage crops, such as alfalfa and clover, replacing weeds that were growing abundantly at the time this station was inaugurated. There is a fine improved permanent pasture which is supplying ample grazing to the dairy cattle.

In order to build up the organic-matter content of the soil, a five-year rotation system was established with the following crop sequence: cereals seeded down to clover, alfalfa, cereal clover alfalfa, mixed hay. The aftermath is to be

ploughed under twice during each rotation cycle. The dairy herd consists of one Ayrshire bull, five cows and a few head of young stock.

Luceville—Located in the heart of an outstanding potato district, this station has 200 acres of land under cultivation made up of 25 per cent clay loam, 30 per cent black, and 45 per cent sandy soil. A four-year rotation system is operated on both clay and black loam fields with cereal and three hay crops following. A five-year rotation is practised on sandy soil with cereals, clover alfalfa, cereals, clover alfalfa, mixed hay. A three-year rotation is in force for potato production. Fodder corn is grown as a supplementary crop for pasture and turnips are raised as succulent livestock feed during the winter.

Dairy cattle and potato production are the main enterprises on this farm, each respectively contributing 40 and 34 per cent of the total revenues of this unit. The herd is made up of 30 head of Canadian cattle. Hog raising is successfully pursued with three breeding sows, from which 50 bacon hogs are raised annually.

Sayabec—This station is situated in the center of the Matapedia Valley. The total area under cultivation is 80 acres, 50 per cent clay, 30 per cent light gravelly, and 20 per cent black loam. A 4-year crop rotation system includes cereals and three hay crops with a long-term improved pasture highly productive.

The dairy herd comprises 20 head of grade Ayrshires with a mean annual production of 8,107 pounds of milk. The milk is retailed locally direct to the consumer. Dairy cattle are responsible for 62 per cent of the total revenues of this unit. The poultry flock, made up of 150 Barred Plymouth Rock laying hens, provides a fair side-line source of income.

Nouvelle—Although the area under cultivation at this farm is limited to only 45 acres, the fields produce abundant crops of good quality, providing for the satisfactory maintenance of a fairly good dairy herd.

The establishment of long-term meadows on the low flat area of this farm has been considered a progressive step, providing abundant roughage of high quality which constitutes the bulk of the dairy cattle feeding. On the light soil, a four-year rotation system is operated for the production of fodder corn as a supplementary crop and for swede turnips as a winter succulent feed. Such a combined cropping system has permitted the herd population to almost double in size during recent years and at the same time has enabled better feeding.

The herd is made up of 18 Ayrshire cows headed by an AA sire. The average milk production has increased from 5,237 to 6,378 pounds in recent years. Dairying is the main enterprise on this farm.

Ste-Anne des Monts—The total area in tillable land of this unit is 100 acres. This station is located on the northern section of the Gaspe peninsula, about 300 miles below Quebec city. The soil of this district is rather hilly and of low fertility. However, reasonable yields are secured with good field management and rational cultural methods. The combination of manure and commercial fertilizers has proved very effective with every crop. Ground limestone assists in the production of legumes, such as alfalfa and clover.

Two crop rotation systems are followed on this station: one of four years with a crop sequence of one grain and three hay crops; the other having three years with hoed crops, cereals and hay. The main revenues are obtained from marketing turnips, potatoes, milk and sheep products.

New Carlisle—The total area of land under cultivation at this station is 75 acres, comprising 50 per cent of red clay loam and 50 per cent of gravelly clay loam of medium fertility. This station is located on Chaleur Bay in Bonaventure county. The main rotation is of four years with one grain and three hay crops. A three-year rotation is planned particularly for hoed crops. Following the general liming program, clover and alfalfa grow abundantly and

the improved long-term pastures are supplying satisfactory grazing for milk cows. Furthermore, potato culture provides a good side-line, two acres being grown each year.

Cap d'Espoir—This station is located on the Gaspé coast, near the Gulf of St. Lawrence. The total area under cultivation is 70 acres of red clay loam of reasonable fertility, which gives a good response to proper cultural methods. The crops are grown under a four-year rotation. Having a marl deposit right on the farm, making abundant application possible, and employing a rational use of barnyard manure and commercial fertilizers, the fertility of the soil was rebuilt, with consequent heavy yields being obtained. Such soil treatment was especially favourable to clover and alfalfa.

With green pea production being a horticultural specialty in this part of the district, some experimental work was conducted in connection with methods for controlling mildew. Also a pea varietal test was carried on.

For mildew control, sulphur powder and bordeaux mixture were compared, the latter giving the best results at the time.

The dairy herd is made up of 7 milk cows and a few head of younger stock.

Cropping Plan of an Illustration Station

The cropping plan which follows on page 125 shows the preliminary work necessary in order to establish an Illustration Station. The special agricultural conditions on such a farm are generally representative of a large area in the district.

In this case, the total area of tillable land is 96·2 acres representing 65 per cent sandy and 35 per cent clay loam. The two main specialties are dairying and the production of certified seed potatoes. Two crop rotation systems have been adopted, a four-year rotation for the production of forage crops needed for livestock and a three-year potato rotation.

Close to the farm buildings is a good permanent pasture periodically fertilized and well managed for the dairy herd, while the sheep and the young breeding stock graze at the far end of the farm on a long-term improved pasture. A small orchard close to the house supplies apples and small fruits for the family.

To establish a sound cropping program and proper management of a farm, the exact area must first be known in order to divide the fields into nearly equal parts according to the future needs of the herd. Consequently, the measurement and the division of the farm is a fundamental operation essential to successful field husbandry. On each station in this district, the crop rotation is combined with long-term improved pasture, permitting in that way a more adequate division as well as a reduction of fences. In addition, it makes possible a more appropriate production of forage crops in relation to milk production, the latter being by far the main enterprise in this district.

Plant Food Deficiency Study

This project has been carried on for the last eight years of the period under review at the following stations: New Carlisle, Notre Dame du Lac, Sayabec, Ste-Anne des Monts, St-Arsène, St-Paul, St-Pierre I.O., St-Vallier. The aim is to determine the nitrogen, phosphoric acid and potash deficiencies of local soils. The work is carried under a four-year rotation including swede turnips, cereals, clover-alfalfa hay, and mixed hay. The sixteen treatments are duplicated on 1/40-acre plots, and the fertilizers are applied on turnips at the first year of the rotation.

This work was carried on light soils at all stations, except at St-Vallier, where the soil is a clay loam of high fertility.

A summary of the treatments, along with the results obtained for an eight-year average, are given below:—

TABLE 89.—PLANT FOOD DEFICIENCY STUDY ON TURNIPS AND OATS

Treatment	Turnips	Oats
	13-yr. average yield per acre	7-yr. average yield per acre
	tons	bu.
Check	6.51	29.48
Superphosphate 500 lb	15.11	37.90
Muriate of potash 100 lb	8.39	34.55
Superphosphate 500 lb.—Muriate of potash 100 lb	15.96	37.25
Ammonium sulphate 250 lb	7.95	35.59
Ammonium sulphate 250 lb.—Superphosphate 500 lb	16.60	40.48
Ammonium sulphate 250 lb.—Muriate of potash 100 lb	9.47	39.05
Ammonium sulphate 250 lb.—Superphosphate 500 lb. muriate of potash 100 lb	19.56	46.39
Manure 10 tons	16.32	40.12
Manure 10 tons—Superphosphate 480 lb	19.41	43.74
Manure 10 tons—Lime 1 ton	18.35	42.95
Manure 10 tons—Lime 3 tons	18.70	46.44
Manure 10 tons—2-12-6 400 lb	18.75	41.62
Manure 10 tons—2-12-6 800 lb	20.79	44.04
Manure 10 tons—2-12-6 800 lb. bore 20 lb	20.23	42.15
Manure 10 tons—2-12-6 1,600 lb	23.86	49.15

The above table shows that nitrogen and potash alone, or both in combination, had not much effect on turnips. On the other hand, superphosphate was fairly effective for this crop. Barnyard manure alone, or in combination with commercial fertilizer, has given satisfactory results for both crops, turnips and oats.

Manure plus lime gave an interesting reaction in comparison with more costly treatments. The heavy application of 1,600 pounds of 2-12-6 has not given a proportional increase in yield.

TABLE 90.—PLANT FOOD DEFICIENCY STUDY IN RELATION TO CLOVER-ALFALFA AND MIXED HAY

Treatment	Clover and alfalfa		Mixed hay	
	7-yr. av. yield per acre	A-C-T-W*	9-yr. av. yield per acre	A-C-T-W*
		%		%
Check	1.02	25-25-32-18	0.72	9-13-69-9
Superphosphate 500 lb	1.03	24-25-35-16	0.79	10-14-64-12
Muriate of potash 100 lb	1.01	29-16-41-14	0.72	15-18-59-8
Superphosphate 500 lb Muriate of potash 100 lb	1.34	33-23-32-12	0.81	13-14-65-8
Ammonium sulphate 250 lb	1.01	19-26-35-20	0.75	8-17-65-10
Ammonium sulphate 250 lb Superphosphate 500 lb	1.19	22-22-37-19	0.76	9-16-66-9
Ammonium sulphate 250 lb Muriate of potash 100 lb	0.97	29-17-36-18	0.78	14-19-58-9
Ammonium sulphate 250 lb Superphosphate 500 lb.—Muriate of potash 100 lb.	1.20	20-22-35-14	0.92	14-16-61-9
Manure 10 tons	1.23	33-28-21-18	0.87	14-17-58-11
Manure 10 tons Superphosphate 480 lb	1.38	32-20-23-16	0.96	16-17-58-9
Manure 10 tons Lime 1 ton	1.48	52-25-14-9	1.18	33-15-45-7
Manure 10 tons Lime 3 tons	1.81	52-23-17-8	1.35	36-18-38-8
Manure 10 tons 2-12-6 400 lb	1.35	28-26-27-17	1.04	15-13-62-10
Manure 10 tons 2-12-6 800 lb	1.40	32-27-25-16	1.08	17-14-58-11
Manure 10 tons—2-12-6 800 lb Borax 20 lb	1.22	31-28-23-18	1.12	20-15-57-8
Manure 10 tons 2-12-6 1,600 lb	1.46	45-22-22-11	1.16	21-12-58-9

* A—Alfalfa; C—Clover; T—Timothy; W—Weeds.

From Table 90 it appears that light soils require a well balanced application of fertilizer for the production of satisfactory hay crops. Barnyard manure seems to be especially useful to sustain the soil at a reasonable fertility level in this district.

A complete fertilizer application comprising 250 lb. of ammonium sulphate, 500 lb. superphosphate 20 per cent, and 100 lb. of muriate of potash had about the same effect as 10 tons of manure alone. On clay loam, the fertilizers alone or in combination with manure were very effective.

The combination of manure plus lime has given the highest yield of the best quality hay, as shown by the botanical analysis in Table 90. This was especially true for the stations of St-Pierre, I.O., St-Arsène, New Carlisle and Ste-Anne des Monts.

The application of three tons of lime as compared with one ton, showed an increase of half a ton of hay According to the experimental data and observations made, it seems that 2 tons of ground limestone per acre is a fair application.

Farmers discussing problems with the supervisor of Illustration Station.

Effect of Commercial Fertilizers on Pasture—Study of Formulae

As pasture is one of the most important crops in this district of dairy farming, considerable work was carried out along this line especially during the ten years under review. As a matter of fact, long-term pastures were established on each station and fertilizer experimental work was carried on in order to determine the most effective fertilizer formulae, as well as the most economical rate of application. Five different treatments were tested. The growth of herbage was recorded by way of wire pens from which monthly cuttings were made. The value of grazing was obtained by botanical analysis of the herbage.

The treatments as well as the yields and the botanical analysis are shown in the table which follows:—

TABLE 91.—YIELDS AND PER CENT CLOVERS, GRASSES AND WEEDS IN FERTILIZED PASTURE TRIALS

Station	No. of Years	100 lb. Amm. Sulph. annually 600 lb. of Super. 20% 120 lb. Mur. of Pot. every three years				600 lb. Super. 20% 120 lb. Mur. of Pot. every three years				600 lb. Super. 20% every three years				100 lb. Amm. Sulph. 200 lb. Super. 20% 40 lb. Mur. of Pot. annually				100 lb. Amm. Sulph. 600 lb. Super. 20% 120 lb. Mur. of Pot. annually				Average of Checks			
		Yield per acre	Clovers	Grasses	Weeds	Yield per acre	Clovers	Grasses	Weeds	Yield per acre	Clovers	Grasses	Weeds	Yield per acre	Clovers	Grasses	Weeds	Yield per acre	Clovers	Grasses	Weeds	Yield per acre	Clovers	Grasses	Weeds
		ton	%	%	%	ton	%	%	%	ton	%	%	%	ton	%	%	%	ton	%	%	%	ton	%	%	%
Cap d'Espoir	3	6·9	52	32	16	5·8	49	37	14	6·9	46	36	18	8·3	52	32	16	8·4	57	27	16	4·4	32	45	23
L'Islet	4	13·7	56	40	4	13·0	60	37	3	11·3	56	40	4	11·9	60	37	3	13·7	53	43	4	9·6	40	50	10
Luceville	3	13·8	53	35	12	9·7	58	26	16	8·6	53	33	14	9·0	53	31	16	11·1	55	32	13	6·1	33	37	30
New Carlisle	3	11·4	63	30	7	7·4	54	39	7	6·6	49	42	9	8·1	52	40	8	8·2	56	38	6	5·3	28	40	32
Notre Dame du Lac	4	7·9	52	39	9	7·5	54	37	9	7·0	52	37	11	8·2	67	26	7	9·0	66	28	6	5·4	42	46	12
Nouvelle	4	8·7	50	43	7	7·1	49	45	6	6·5	49	44	7	7·0	48	46	6	6·8	44	49	7	4·4	41	47	12
Sayabec	3	10·5	68	27	5	11·1	68	26	6	9·1	57	34	9	11·1	69	25	6	12·2	68	27	5	7·6	37	39	24
Ste-Anne des Monts	3	4·2	26	61	13	4·2	38	51	11	2·4	30	58	12	3·6	30	55	15	4·1	38	50	12	1·6	16	60	24
St-Arsène	3	6·9	27	66	7	6·1	34	59	7	6·2	35	57	8	5·8	26	68	6	6·6	31	62	7	4·9	28	62	10
St-Pierre, I.O	3	9·5	66	29	5	8·8	67	28	5	10·5	65	30	5	8·3	64	30	6	9·2	60	35	5	7·3	42	43	15
St-Vallier	4	13·0	61	28	11	13·6	65	23	12	11·7	65	23	12	10·7	61	27	12	12·4	62	26	12	7·0	40	39	21

From Table 91, it is shown that generally, the first treatment (complete fertilizers applied every three years) is the most effective. The 100 pounds of ammonium sulphate applied annually has given an average increase of nearly 2 tons of green matter. Comparing the second and third treatments, one learns that the addition of 120 pounds of muriate of potash has given an increase of about $\frac{3}{4}$ of a ton per acre.

On the other hand, the fifth treatment in a general way has not shown a proportional increase in comparison with its cost. The average yield for the five treated plots was 2·97 tons higher than the average of the two check plots. The quality of herbage and grazing conditions were considerably improved by the use of fertilizers and by better care or management of the pasture.

TABLE 92.—COMPARISON OF RATE OF APPLICATION OF 0-16-6

Treatments applied every three years	Average yield of green matter in 24 different tests	Botanical Analysis of 24 tests		
		Clover	Grass	Weeds
	tons	%	%	%
1. 900 lb. 0-16-6 (6 yr.)	8.93	64.6	29.2	6.2
2. 600 lb. 0-16-6 (6 yr.)	8.20	60.3	33.7	6.0
3. 300 lb. 0-16-6 (6 yr.)	6.95	57.2	35.7	7.1
4. Check (6 yr.)	4.48	28.5	52.0	19.5

From the above table it seems that the average yield of the three treated plots was approximately twice as high as the check. Furthermore, it will be noted that the quality of the herbage was considerably improved, as weeds were replaced by better species, mainly legumes. The treatment of 600 lb. of 0-16-6 was cheaper and nearly as effective as the 900 lb. rate.

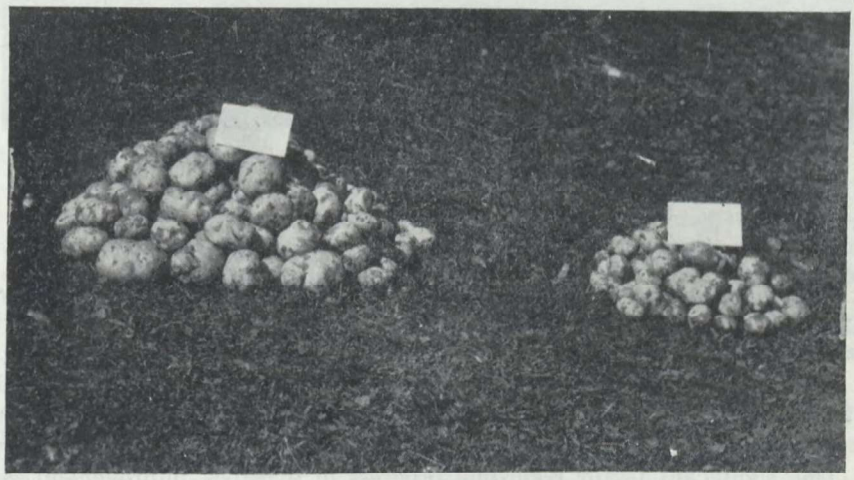
It was observed that fertilizer 0-16-6 was more effective on clay loam than on light soil.

COMMERCIAL FERTILIZERS FOR POTATOES—STUDY OF FORMULAE

Due to the weather conditions as well as to the soil type of a large area of this district, more especially in Témiscouata, Rimouski and Matane counties, potato growing is considered as one of the most important cash crops. As fertilizers are used more and more each year for potato growing, experimental work was undertaken along this line, in order to determine the value of the different single elements, nitrogen, phosphoric acid and potash, as well as the best formulae and the most suitable rate of application. The work was carried on at Luceville, and the commercial formula 4-8-8 was used as the comparative basis with or without manure. The work was conducted on a four-year rotation with the following crops: potatoes, cereals, clover-hay and mixed hay. The fertilizers were applied on potatoes the first year. The treatment as well as the yields for the experimental work are given below:—

TABLE 93.—COMMERCIAL FERILIZERS FOR POTATOES—STUDY OF FORMULAE

Treatment	Two-year average potato yields per acre (bushels)		
	Marketable	Small	Total
Check	156	18	174
Manure 15 tons	179	22	201
Manure 15 tons and 800 lb. 0–8–8	186	16	202
Manure 15 tons and 800 lb. 4–8–8	216	20	236
800 lb. 0–8–8	158	20	178
800 lb. 4–8–8	203	17	220
800 lb. 8–8–8	185	18	203
800 lb. 4–0–8	187	21	208
800 lb. 4–4–8	188	25	213
800 lb. 4–12–8	205	17	222
800 lb. 4–16–8	200	18	218
800 lb. 4–8–0	191	21	212
800 lb. 4–8–4	202	19	221
800 lb. 4–8–12	225	18	243
1,200 lb. 4–8–8	229	20	249
1,600 lb. 4–8–8	245	21	266



Proportional yield potato samples as obtained with and without commercial fertilizers.

This work was carried on during two rotation cycles and the yields appearing in the preceding table were obtained from two crops only. The yield for the last cycle was low on account of the exceedingly dry weather that prevailed during the greater part of the growing period. Such conditions have marked the effect of the fertilizers, which is shown to a certain extent, by comparing the untreated and manure-only plots.

The application of 15 tons of manure alone has given an increase of 23 bushels of marketable potatoes. Furthermore, this treatment was nearly equivalent

to most of the incomplete chemical fertilizer mixtures tried. The formula 4–8–12 at 800 pounds seems to be the most recommendable considering the grass yield and the economy viewpoint.

The highest yield was obtained on the plot which received 1,600 lb. 4–8–8. However, the resulting increase is not proportional to the purchase cost of the fertilizer treatment.

Proportional yield samples of turnips as obtained with and without commercial fertilizers.

Animal Husbandry Progress

The improvement of dairy herds is a most important part of Illustration Station work, because over 50 per cent of the total farm revenues is derived from dairying.

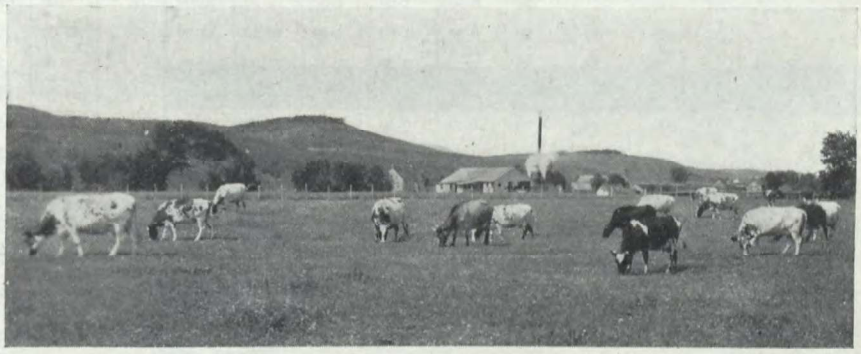
The dairy herds on the twelve Illustration Stations total 240 head, valued at $14,111 as of December 31, 1946. Three of these herds are entirely made up of registered stock, headed by AA sires, namely St-Vallier, L'Islet and St-Arsène.

One significant factor regarding progress in livestock improvement is the selection based on type and on production as measured by official milk production control which is applied in each herd. Incidentally, from 1937 to 1946, the average production increased by nearly 1,000 pounds of milk and 45 pounds of butterfat per cow. Furthermore, the per cent butterfat increased from 3·8 to 4·1 per cent. The average production for the 137 cows under control in 1946 was a little over 7,000 pounds. Nearly every animal in these herds has been tested for Bang's disease and tuberculosis while the herd at St-Vallier has been accredited for many years.

During the ten-year period under review, 145 cattle were sold for breeding purposes to surrounding farmers. As far as hog raising is concerned, considerable

progress has been made. Common hogs have been almost entirely replaced by purebred Yorkshires. In 1946, the swine population on the 12 stations was as follows: 4 XXX boars, 25 purebred Yorkshire sows, 104 bacon hogs marketed during the year. Hog raising contributes annually from 10 to 12 per cent of the total revenue of the stations. The Illustration Stations also contributed to swine improvement by distributing 113 pigs of breeding stock to district farmers.

Seven operators out of twelve are keeping sheep. The operator at St-Arsène is keeping registered Leicesters of high quality, while others are keeping grade ewes with registered rams at the head of the flock. During the ten years under review, 108 head were sold as breeding stock in the surrounding district.



Herd of milch cows on improved pasture at the Ste-Angèle Illustration Station.

Poultry is in third place as a source of revenue on the Illustration Stations, coming after dairy cattle and field crops, with a total contribution of 12·69 per cent. Every flock consists of Barred Plymouth Rocks, while the total number of laying hens kept annually ranges from 600 to 700. According to the records kept, the average production ranges around 150 eggs per hen. Two stations out of the twelve are supplying hatching eggs. They are: St-Pierre, I.O. and St-Vallier. Each year, from 400 to 500 dozen are supplied to the local co-operative hatcheries. Altogether in the ten-year period, 72,792 eggs were sold for this purpose.

Utilization of Land

According to the 1946 farm inventory for the 12 Illustration Stations of this district, there is an area of 1,061 acres in tillable land and 506 in bush and waste land. The area of tillable land consists of 55 per cent clay loam, 15 per cent clay and 30 per cent light soil. The different farm crop acreages are as follows: 44·58 per cent hay; 28·62 per cent pasture; 21·70 per cent cereals and 4·89 per cent other crops such as potatoes, swede turnips and fodder corn.

These figures show that at least 75 per cent of the cropped land is in meadows and pasture which are essential to dairy farming in the lower St-Lawrence valley.

The mean acreage in pasture per station is 23 acres, of which 50 per cent is of improved long-term and 50 per cent of unimproved natural grazing land. In the Table 94, a summary of the land utilization for the 12 units is given.

TABLE 94.—UTILIZATION OF LAND ON ILLUSTRATION STATIONS OF EASTERN QUEBEC DISTRICT

Station	Total area	Cropped land	Waste, pasture, woods, roads and farmstead	Corn	Potatoes	Roots	Grain	Hay	Alfalfa	Pastures	
										Improved	Native
Cap d'Espoir	110	70	40	0·50	2·00	0·50	9·00	36·00	.....	6·00	16·00
L'Islet	104	76	28	3·00	2·00	3·00	11·00	8·00	21·00	16·00	12·00
Luceville	198	182	16	1·00	8·00	1·00	36·00	80·00	.....	26·00	30·00
New Carlisle	95	73	22	1·00	1·75	0·25	22·00	33·00	.....	10·00	5·00
Notre Dame du Lac	54	54	.....	0·50	1·50	0·50	16·50	20·00	1·00	10·00	4·00
Nouvelle	113	61	52	0·50	1·00	1·00	9·50	29·00	.....	9·00	11·00
Sayabec	175	79	96	0·50	1·00	1·00	10·50	44·00	.....	22·00	.....
Ste-Anne des Monts	136	98	38	.....	2·50	2·50	23·00	40·00	.....	8·00	22·00
St-Arsène	170	109	61	0·50	7·00	1·00	30·00	46·50	.....	14·00	10·00
St-Paul	146	94	52	0·25	0·50	0·25	20·00	34·00	.....	.....	39·00
St-Pierre, I.O.	210	125	85	1·00	2·00	1·00	40·00	50·00	4·00	7·00	20·00
St-Vallier	66	40	26	2·00	0·25	0·25	3·00	26·50	.....	8·00	.....
Total	1,577	1,061	516	10·75	29·50	12·25	230·50	447·00	26·00	136·00	169·00
Average acres per farm	131·4	88·4	43	0·89	2·46	1·02	19·21	37·25	2·16	11·33	14·08
Percentage of average area	100	67·2	32·7	0·68	1·88	0·78	14·71	28·52	1·65	8·67	10·78

DISTRIBUTION OF FARM CAPITAL

The average farm capital distribution in 1946 for the twelve Illustration Stations was as follows: land, 32·08 per cent; buildings, 30·78 per cent; livestock, 18·96 per cent and machinery, 18·18 per cent. From these figures it is seen that farm buildings involve nearly one-third of the total capital investment. Such a high investment in buildings is necessary due to long cold winters requiring that abundant crops be stored and that warm comfortable space and pens for the herds be supplied. The high investment in farm machinery is due mainly to the scarcity of hand labour; also because new cultural methods require more mechanization in the march of progress.

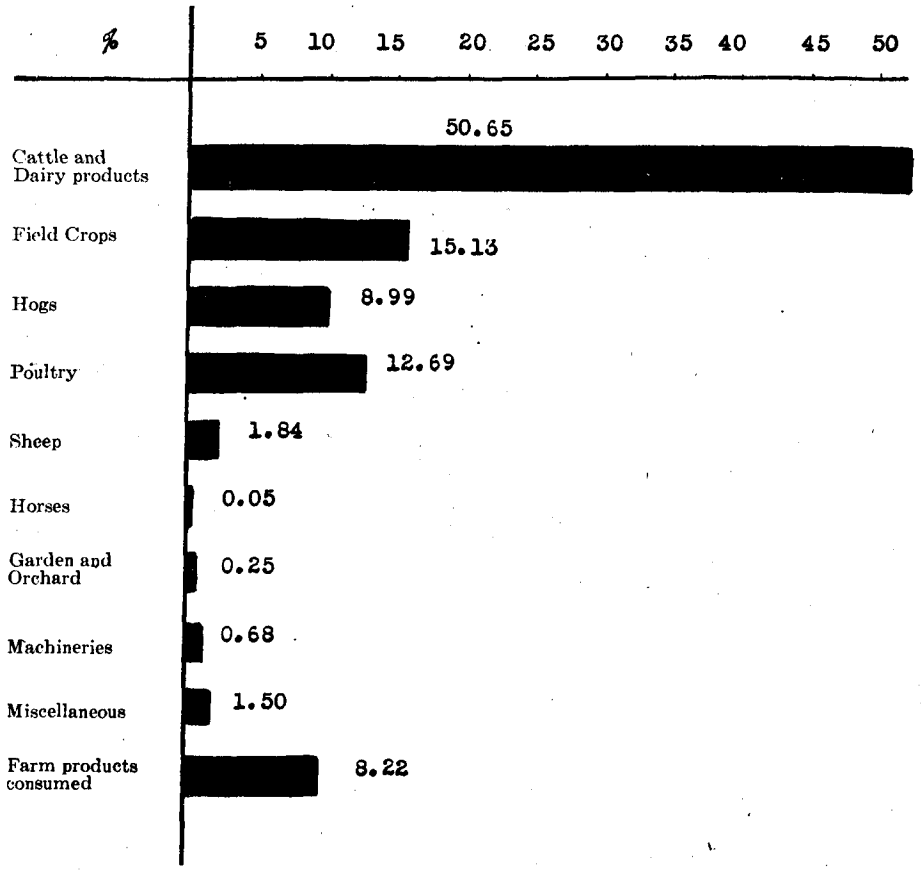
TABLE 95.—DISTRIBUTION OF FARM CAPITAL ON ILLUSTRATION STATIONS

Station	Land	Buildings	Livestock	Machinery
	%	%	%	%
Cap d'Espoir	33·01	30·82	17·19	18·98
L'Islet	22·89	36·33	19·80	20·98
Luceville	33·39	31·57	16·04	19·00
New Carlisle	38·58	32·86	14·96	13·60
Notre Dame du Lac	34·90	33·02	17·13	14·95
Nouvelle	27·95	28·26	30·93	12·86
Sayabec	31·43	34·80	15·58	18·19
Ste-Anne des Monts	44·74	30·04	13·05	12·17
St-Arsène	34·12	27·68	15·91	22·29
St-Paul	20·42	20·37	23·53	35·68
St-Pierre, I.O.	37·95	24·38	19·93	17·74
St-Vallier	25·54	39·19	23·51	11·76
Average	32·08	30·78	18·96	18·18

Source of Income on These Illustration Stations

A short analysis of the transactions operated on the 12 units shows that cattle and milk products are contributing 50·65 per cent of the total revenue. Field crops follow with 15·13 per cent; hens, 12·69 per cent; swine, 8·99 per cent and farm products consumed by the household amounted to 8·22 per cent. The balance of 4·32 per cent was supplied by other pursuits such as sheep, horses, garden, orchard and machinery. A revenue summary for 1946 is presented on the accompanying chart.

Sources of Income on Illustration Stations, 1946



Field Days

Each year, field days are held on illustration stations. Farmers of the district are invited to attend these meetings, where instruction is given on livestock raising and on modern cultural methods or field crop practices. Farmers meet each other and discuss their own local problems. The experimental work under way is described and the results are explained.

Since 1937, 57 field days have been held with 3,935 farmers attending. These meetings were organized in collaboration with the staff of the Experimental Station of Ste-Anne de la Pocatière and the provincial county agronomes.

Group of farmers inspecting an improved pasture at one Illustration Station.

Group of visitors attending a field day on Illustration Station.

APPENDIX

LIST OF EXPERIMENTAL PROJECTS CONDUCTED DURING THE TEN YEARS 1936–1945

Animal Husbandry

Cattle

A. 58—Record of Performance
A. 59—Cost of rearing dairy-bred calves and heifers
A. 93—Control of tuberculosis in cattle
A. 501—Breeding Ayrshire cattle
A. 660—Serum test for contagious abortion
A. 769—Manure *vs.* commercial fertilizer for pasture
A. 813—Feed cost of milk and butterfat production
A. 833—Permanent pasture *vs.* pasture in a crop rotation
A. 859—Roots *vs.* mixed corn and sunflower silage *vs.* corn silage, pea and oat silage, legume hay silage for milk production
A. 916—Losses in ensiling various crops

Swine

A. 158—Cost of feeding brood sows
A. 160—Cost of raising pigs to time of weaning
A. 163—Cost of pork production
A. 165—Value of unmarketable potatoes in the feeding of market hogs
A. 166—Cost of maintaining herd boar
A. 513—Breeding Yorkshire swine
A. 679—Advanced Registry Policy for purebred swine
A. 799—Comparison of protein supplement levels, hand *vs.* self-feeding
A. 854—Comparison of barley grades oats and corn for market hogs
A. 858—Study of fecundity and nursing capacity in swine

Sheep

A. 311—Cost of maintaining breeding ewes
A. 316—Cost of rearing ewe lambs to breeding age
A. 328—Breeding ewe lambs *vs.* breeding as yearling ewes
A. 408—The economy of early *vs.* late lambs for market
A. 510—Breeding Leicester sheep
A. 516—Cost of rearing ram lambs for breeding purposes
A. 875—Cross-breeding *vs.* purebred breeding of sheep

Horses

A. 293—Cost of horse labour
A. 294—Periodic costs of rearing draft horses
A. 331—Cost of maintaining work horses
A. 409—Wintering horses in barn *vs.* outside
A. 529—Breeding Canadian horses
A. 531—Breeding Percheron horses

Poultry

P. 3—Best date for incubation
P. 15—Incubation costs
P. 22—Brooding costs
P. 28—Rate of growth in rearing
P. 60—Pullets *vs.* hens for egg production
P. 62—Cost of egg production
  (a) per dozen for different periods
  (b) winter months only
  (c) for entire year
  (d) eggs required to pay for winter's feed
  (e) eggs required to pay for year's feed
P. 56—Pedigree breeding for egg production
P. 76, P. 79—Comparison of home mixed mash and grain *vs.* standard commercial mash and grain
P. 113—Relation of winter production to fertility, hatchability and livability
P. 114—Breeding for egg size
P. 154—Time taken for trap-nesting
P. 157—Improving quality of poultry in district
P. 163—Relation between annual production and date first egg is laid

APPENDIX—Continued

LIST OF EXPERIMENTAL PROJECTS CONDUCTED DURING THE TEN YEARS 1936-1945—*Continued*

Field Husbandry

F. 4—Three-year rotation—potatoes—oats—clover
F. 7—Three-year rotation—s nflowers and corn, wheat—clover
F. 16—Four-year rotation—corn, sunflowers and roots, wheat, clover, timothy
F. 24—Four-year rotation—Corn, peas and oats mixed, oats and wheat, clover and alfalfa mixed, timothy and alfalfa mixed
F. 30—Five-year rotation—roots, wheat, clover, timothy, O.P. hay
F. 48—Preparation of land for grain
F. 52—Depth of ploughing
F. 72—Tile drained *vs.* undrained land
F. 90—Cost of operating tractor
F. 305—Meteorological records
F. 322—Sequence of crops
F. 328—Degree of weed infestation on designated areas
F. 358—Manure and fertilizer combinations for potatoes
F. 359—Methods of applying commercial fertilizer for potatoes
F. 360—Rate of applying commercial fertilizer for potatoes
F. 361—Manure and commercial fertilizer combinations for root crops (in relation to brown heart disease in swede turnips)
F. 408—Commercial fertilizer formulae for potatoes
F. 451—Commercial fertilizer formulae for turnips (borax in control of brown heart)
F. 455—Three-year rotation—fall wheat, oats, clover and alfalfa
F. 456—Five-vear rotation—peas and corn, barley, clover and alfalfa, timothy and alfalfa, corn and flax

Pasture

F. 369—Commercial fertilizer formulae for pasture
F. 372—Renovation of pastures on clay soil
F. 373—Rotated *vs.* continuous pasture
F. 398—Manure *vs.* commercial fertilizer for pasture
F. 400—Permanent pasture *vs.* pasture in a crop rotation

Horticulture

H. 21—Strawberry variety experiment
H. 102—Corn variety experiment
H. 652—Registered vegetable seed production
H. 793R—Raspberry variety experiment
H. 795B—Beans variety experiment
H. 795P—Peas variety experiment
H. 803B—Beets variety experiment
H. 803C—Carrots variety experiment
H. 803O—Onions variety experiment
H. 804CE—Early and late cabbages variety experiment
H. 804CR—Cauliflowers variety experiment
H. 804L—Lettuce variety experiment
H. 806PO—Potatoes variety experiment
H. 806T—Tomatoes variety experiment
H. 815A—Apples variety experiment
H. 815C—Cherries variety experiment
H. 815PM—Plums variety experiment
H. 815PR—Pears variety experiment
IV-B—A comparison of the effect of commercial preparations of 2, 4-D on lawn weeds

Apiary

Ap. 1—Control of swarming by dequeening and requeening
Ap. 2—Control of swarming bv separation of brood and queen
Ap. 7—Wintering in cellar
Ap. 8—Wintering in 4-colony cases
Ap. 9—Wintering in 2-colony cases

APPENDIX—Continued

LIST OF EXPERIMENTAL PROJECTS CONDUCTED DURING THE TEN YEARS 1936-1945—*Continued*

APIARY—*Concluded*

Ap. 10—Wintering bees in single colony cases
Ap. 28—Study of honey flows
Ap. 31—Prevention of swarming by giving room
Ap. 32—Spring protection of brood chamber
Ap. 52—Swarm control by early introduction of young laying queens
Ap. 54F—Comparison of different methods and times of increase
Ap. 54F—Single, divided and reunited colonies for production
Ap. 57—Increasing strength of colony for main flow
Ap. 58—Package bees as a means of strengthening weak colonies
Ap. 60—Overwintered *vs.* 2-3-pound package bees
Ap. 60—Overwintered *vs.* 2-pound package bees
Ap. 89—Supering for extracted honey
Ap. 103—Swarm prevention
Ap. 121—Strengthening weak colonies by relocation

CEREALS

Ce. 1—Common spring wheat—tests of varieties
Ce. 5—Oats—test of varieties
Ce. 6—Barley—variety tests
Ce. 7—Field peas—variety tests
C. IX—Influence of source of seed on production of cereal crops
Ce. 8—Field beans—variety tests
Ce. 9—Flax—variety tests
Ce. 12—Buckwheat—variety tests
Ce. 50—Production of registered grain

FORAGE PLANTS

Ag. 1—Variety tests for ensilage purposes
Ag. 16—Mangels—variety test
Ag. 16—Swedes—variety test
Ag. 101—Soybeans—variety test
Ag. 126—Alfalfa—variety test
Ag. 146—Red clover—variety test
Ag. 201—Timothy—variety test
Ag. 246—Annual hay crops—variety tests
Ag. 264—Hay and pasture mixtures
Ag. 267—Pasture mixtures—variety tests
Ag. 267A—Red fescue—variety test

FIBRE FLAX

E. 3—Variety tests with flax
E. 7—Harvesting flax at different stages of maturity
E. 13—Fertilizer tests with flax
Ce. IX—Influence of source of seed on production of flax

ILLUSTRATION STATIONS

IS-E1·31—Three-year rotation—hoed crops, cereal, clover
IS-E1·42—Four-year rotation—hoed crops, cereal, clover, timothy and alfalfa
IS-E1·54—Five-year rotation
IS-02·03, 02·03B, 02·03C2—Chemical fertilizer as a supplement to farm manure
IS-02·04—Chemical fertilizer—study of formulae
IS-02·08—The effect of ground limestone on farm crops
IS-03·01—Control of weeds by cultural methods
IS-03·02—Control of weeds by chemicals
IS-04·04—Planning new farm buildings
IS-04·08—Whitewashing and painting of farm buildings
IS-05·02—Records of regional precipitation

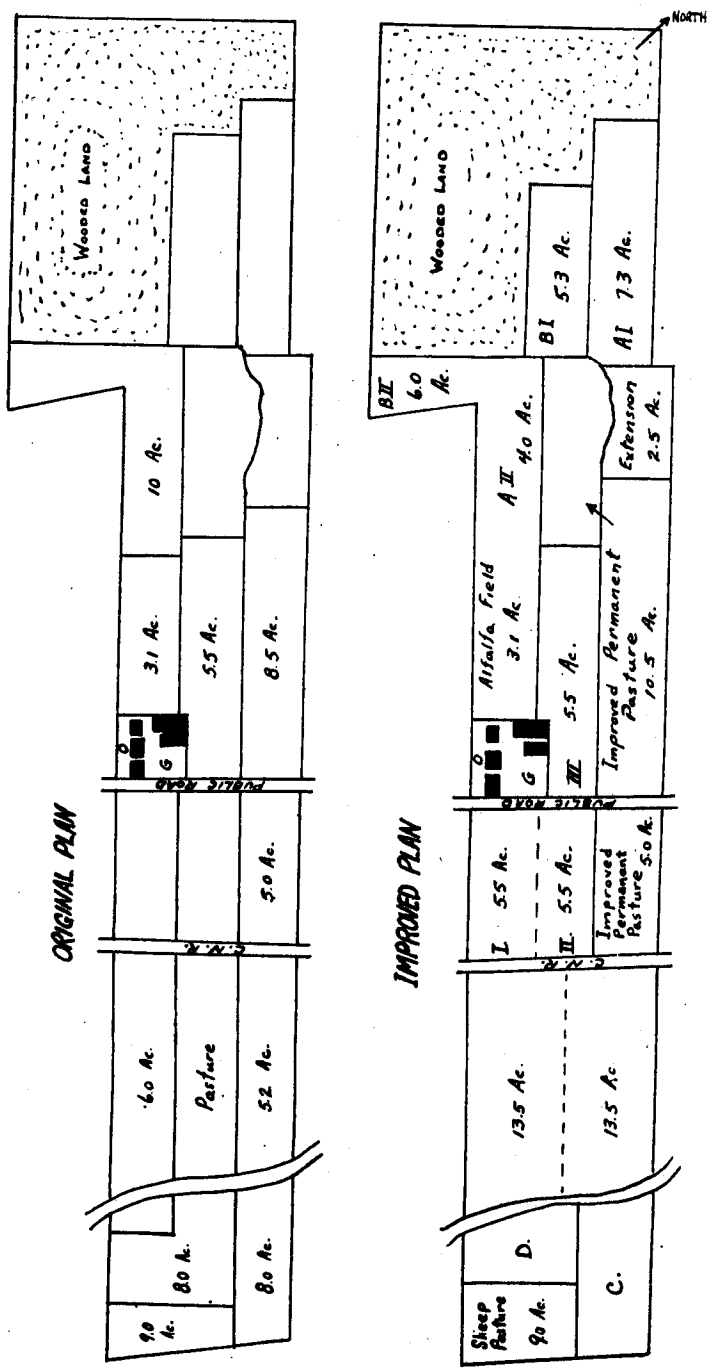
APPENDIX—Concluded

LIST OF EXPERIMENTAL PROJECTS CONDUCTED DURING THE TEN YEARS 1936-1945—*Concluded*

ILLUSTRATION STATIONS—*Concluded*

IS-06-04—Introducing suitable varieties of cereals
IS-07-01—Testing seed mixture for hay or pasture
IS-07-06—Variety test of legumes as a hay or pasture crop
IS-08-02—Chemical fertilizers for pasture, study of formulae
IS-09-01—Corn-growing for seed and forage
IS-09-02—Field corn variety test
IS-09-06—Method of controlling brown heart in turnips
IS-09-12—Turnip variety test
IS-10-01—Growing certified seed potatoes
IS-11-02—Stimulating interest in the development of the farm garden
IS-11-03—Establishment of a farm orchard
IS-11-14—Investigation and control of vegetable diseases
IS-11-17—Farm home beautification
IS-13-01—Dairy cattle production
IS-13-03—Animal pathological records
IS-13-05—Sales of livestock for breeding purposes
IS-13-08—Sheep production
IS-13-07—Swine production
IS-14-01—Poultry production
IS-14-04—Sale of hatching eggs, pullets and cockerels for reproduction
IS-17-02—Cost of producing milk
IS-17-03—Study of farm productivity and progress
IS-17-04—Study of farm business
IS-19-01—Field days
IS-19-02—Publications and presentation of results

ILLUSTRATION STATION OF ST-ARSÈNE



Legend: G—garden; O—orchard; I, II, III—three-year rotation; A, B, C, D—four-year rotation.