CANADA
DEPARTMENT OF AGRICULTURE
EXPERIMENTAL FARMS SERVICE

DOMINION EXPERIMENTAL STATION

KAPUSKASING

ONTARIO

F. X. GOSSELIN, B.S.A., SUPERINTENDENT

PROGRESS REPORT
1941 - 1951

THE APIARY, EXPERIMENTAL STATION, KAPUSKASING, ONTARIO, HAS NECESSARY SHELTERBELT PROTECTION.

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CONTENTS

CONTENTS—Concluded

INTRODUCTION

The Experimental Station at Kapuskasing is situated in the Great Clay Belt of northern Ontario and conducts experimental work designed to serve the farmers of the surrounding districts. The area served by the Station comprises that part of Ontario extending from the North Bay area in the southeast to agricultural areas west and north of the town of Hearst. In Quebec the region served comprises the Temiskaming and Abitibi districts from Ville-Marie in the south, northwards to La Sarre and Senneterre and adjacent districts.

The last published progress report of this Station, issued in 1942, covered the years 1936-1940, inclusive, while the present report is for the years 1941-1951, inclusive. The experimental work covered includes many phases of livestock and diversified farming operations. Breeding, feeding, and management experiments are conducted with an Ayrshire dairy herd and a beef herd of Shorthorns. Yorkshire swine are kept for studies in pork and bacon production. Poultry experiments are conducted with the Barred Plymouth Rock breed. Experiments with cereals and forage crops include studies of soil fertility and of cultural and management practice. Horticultural work aims to determine the most suitable varieties of vegetables, flowers, shrubs, and trees and how to grow them. Information on honey production is obtained from an apiary maintained at the Station.

Administered from the Kapuskasing Experimental Station are one District Experiment Substation and nine Illustration Stations, all located on privately-owned farms. They bring to farmers in the outlying districts the practical findings of the Experimental Station and they serve as testing grounds for new varieties of farm crops, cultural methods, and soil treatments.

J. P. S. Ballantyne, former Superintendent, retired in 1945 and was succeeded by E. T. Goring, who resigned in 1949. F. X. Gosselin, previously in charge of Illustration Stations, was appointed Superintendent in the fall of 1949. A. E. Carlson, who assisted E. T. Goring in the field crop divisions, resigned in 1942. He was succeeded by M. R. Wiancko who later became Agronomist in charge of field crop divisions. J. U. Pilon, in charge of Animal Husbandry, resigned in 1948 and was succeeded by L. A. Charette in the same year. S. F. McGrath, former farm foreman, retired in 1945. He was succeeded in 1947 by W. Bellefeuille. K. G. Coates was appointed Gardener in 1948. P. J. Ede was appointed Clerk in 1948, replacing B. Roney who was transferred to the Experimental Station, Harrow, Ontario. In 1950, R. Bernier was appointed to take charge of Illustration Stations.

68351—2

METEOROLOGICAL RECORDS

M. R. Wiancko

Recording of precipitation and maximum and minimum temperature was started in 1918, with sunshine readings commencing in 1919. Data on evaporation were first recorded in 1937 by using the Piche evaporimeter and in 1945 supplemented by a free-water-surface open-tank method.

Seasonal Notes, 1941-1951

1941:—Seeding was early and soil conditions were satisfactory. The early summer period was hot and dry followed by high precipitation which made haying and harvesting difficult. As a result crops suffered in quality.

1942:—Spring heaving caused severe damage to legumes. Spring work was hampered by intermittent showers. An unusually dry June and July followed, greatly reducing hay yields. Grain straw was short and maturity delayed by a cool late summer and autumn.

1943:—Excessive spring moisture produced high hay yields but heavy summer precipitation made haying difficult. Grain crops were thin and stunted by a cool, wet spring, then suddenly forced into head by excessive heat during the second week of July. Straw was short and yields low but harvesting weather was good.

1944:—Seeding started on May 17, five days later than average. A dry spring coupled with severe damage by six degrees of frost on June 18 reduced hay yields below average. This frost gave grain a set-back and caused extensive damage to garden crops. Grain was harvested in good condition with above average yields.

1945:—Seeding was early and the ground worked up well. Rainfall was well distributed, resulting in good yields of high quality hay. A heavy rainfall on August 18 caused the worst grain lodging ever experienced but grain yields were the highest recorded on the Station.

1946:—Spring seeding, which started on May 18, was not completed until June 14 because of wet weather. This was followed by an exceptionally dry July and August and wet weather the first 10 days of September. Oat yields were good but most of the barley was frosted and cut green. Hay yields were good but a severe pasture and aftermath shortage developed after midsummer.

1947:—A cold wet spring delayed seeding until June 16, 33 days later than average. Forage growth was retarded and grazing started on June 19. Haying did not commence until August 1. Part of the oat crop did not mature and was cut green. Hay and barley yields were below average.

1948:—Warm dry weather in late April allowed seeding to start on May 1 but wet weather delayed final seeding until June 2. High rainfall in July and August produced good yields of hay but the quality was poor. Some hay fields were a total loss. Grain yields were high, with straw long and rank. Low rainfall in September gave excellent harvesting weather.

68351—2½

1949:—Low spring rainfall had a marked effect on reserve soil moisture and was mainly responsible for low yields of hay and grain. A severe infestation of army worm, which was at its maximum intensity from July 12 to 25, caused extensive damage to hay crops by defoliating the grasses and clovers and caused spotty damage in grain crops.

1950:—Winter-killing was severe on permanent pastures. The total precipitation for the spring months of April, May, and June was 4·38 inches greater than average. Seeding started on May 19 and was completed on June 15. Below normal temperatures for the spring, summer, and early fall and low precipitation in July, August, and September retarded the maturity of all grain crops. The first frost struck on August 18. Oat and barley crops produced low yields of frost-ripened, low grade seed.

1951:—An early spring permitted seeding to be started on May 2 and completed by May 15. Low precipitation in May and early June retarded germination of cereal crops and growth of forage plants. Well-distributed rain in late June and July produced high yields of grain and above average hay yields. Exceptionally low precipitation in August caused pasture production to drop in September and October.

Tables 1, 2, 3, and 4 give the meteorological records, 1918-51; annual precipitation, 1918-51; the occurrence of frost and frost-free periods, 1918-51; and dates of some farm operations, 1941-51.

TABLE 1.—AVERAGE MONTHLY METEOROLOGICAL RECORDS AT KAPUSKASING, ONT., 1918-51

Month	Temperature (34 Years) 1918-51			Precipitation (34 Years) 1918-51			Average bright sunshine (33 years) 1919-51	Evaporation Free water surface (7 years) 1945-51
	Highest	Lowest	Average mean	Average rain	Average snow	Average total		
	F.	F.	F.	in.	in.	in.	hr.	in.
January	47	−53	− 1·3	0·05	18·1	1·86	74·7	—
February	53	−52	2·6	0·07	13·0	1·36	102·4	—
March	67	−43	14·5	0·33	13·8	1·71	130·0	—
April	84	−23	31·4	0·88	8·6	1·74	169·0	—
May	92	9	46·1	1·94	2·2	2·16	204·6	—
June	96	20	57·4	2·66	—	2·66	212·8	2·66
July	101	31	62·5	3·20	—	3·20	234·1	3·36
August	95	25	60·3	3·04	—	3·04	199·7	2·76
September	89	20	51·4	3·17	0·3	3·20	133·3	1·47
October	82	3	40·0	1·86	3·3	2·19	88·0	—
November	68	−33	22·7	0·83	15·3	2·36	46·8	—
December	60	−49	6·8	0·22	18·2	2·05	51·1	—
Annual	101	−53	32·9	18·25	92·8	27·53	1,647·1	—

Average date last snowfall in the spring—May 18.
Average date first snowfall in the autumn—October 5.

TABLE 2.—PRECIPITATION RECORDS, DOMINION EXPERIMENTAL STATION, KAPUSKASING, ONT.

Monthly and Annual Precipitation Records (inches)

1941-51, inclusive with 34-year averages and monthly extremes for the same period

Year		Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total annual snow-fall	Total annual rain-fall	Total annual precipitation
1941		2·45	1·43	0·40	1·72	2·06	3·92	3·25	5·25	5·61	3·38	2·13	1·84	76·0	25·84	33·44
1942		1·20	1·30	3·55	0·91	2·88	1·13	4·09	2·00	5·19	3·52	1·49	1·55	94·5	19·36	28·81
1943		1·80	2·40	1·40	0·48	1·39	4·26	3·60	2·53	0·73	0·97	1·93	1·65	95·0	13·64	23·14
1944		1·26	1·65	2·09	0·95	2·07	2·27	2·76	2·80	2·85	2·30	1·02	2·09	80·5	16·06	24·11
1945		0·65	2·55	1·09	1·56	1·73	1·96	2·51	3·17	3·01	1·73	2·80	2·23	94·8	15·51	24·99
1946		1·20	0·92	0·84	2·53	3·80	2·73	1·81	2·94	3·61	2·46	2·32	2·00	60·5	21·11	27·16
1947		1·85	2·30	1·37	1·29	2·68	2·88	3·83	1·99	2·38	0·78	1·27	2·85	99·7	15·50	25·47
1948		0·55	0·65	2·38	2·31	3·03	1·56	4·75	5·72	1·02	1·66	3·65	2·01	100·6	19·26	29·32
1949		2·20	4·00	1·34	0·29	1·55	2·74	1·88	3·38	4·60	2·15	1·61	2·19	111·6	16·77	27·93
1950		3·66	1·36	2·01	2·03	3·81	5·10	1·80	0·95	1·29	1·64	5·71	1·68	150·0	16·04	31·04
1951		1·10	2·46	2·72	1·80	0·91	3·67	3·13	0·49	2·35	4·05	2·35	1·85	108·4	16·77	27·61
34-Year average		1·86	1·36	1·71	1·74	2·16	2·66	3·20	3·04	3·20	2·19	2·36	2·05	92·7	18·26	27·53
Extremes for the 34-year period 1918-51	Low	0·30	0·25	0·40	0·08	0·17	0·23	0·48	0·15	0·73	0·56	0·15	0·75	41·0	11·42	17·75
	Year	1923	1927	1941	1918	1926	1919	1919	1918	1943	1921	1939	1923	1920	1922	1918
	High	3·85	4·00	3·55	3·35	4·37	5·98	7·02	7·29	7·26	4·69	5·71	4·20	150·0	29·66	37·68
	Year	1935	1949	1942	1920	1940	1925	1921	1932	1921	1929	1950	1927	1950	1921	1921

Snow is converted to rain by the formula:—10 inches of snow equals 1 inch of rain.

TABLE 3.—FROST RECORDS, 1941-1951 AND 34-YEAR AVERAGE 1918-1951, DOMINION EXPERIMENTAL STATION, KAPUSKASING, ONT.

(Frost: 32° F. or lower, Killing frost: 28° F. or lower)

Year	Last frost in spring		First frost in fall		Number of frost-free days	Last killing frost in spring		First killing frost in fall		Number of crop days (above 28° F.)
	Date	Temp.	Date	Temp.		Date	Temp.	Date	Temp.	
		° F.		° F.			° F.		° F.	
1941	June 9	32	Sept. 8	32	90	May 17	28	Sept. 29	26	135
1942	June 14	30	Sept. 20	32	95	May 15	26	Sept. 23	26	131
1943	May 29	31	Sept. 11	26	105	May 15	28	Sept. 11	26	119
1944	June 18	26	Sept. 23	31	97	June 18	26	Sept. 26	28	100
1945	June 12	31	Sept. 13	32	92	June 3	25	Sept. 17	27	106
1946	June 18	32	Aug. 24	32	66	May 31	27	Sept. 30	27	122
1947	June 16	32	Sept. 22	26	98	June 3	27	Sept. 22	26	111
1948	June 18	32	Sept. 21	32	95	May 19	24	Oct. 2	27	136
1949	June 8	28	Sept. 25	31	108	June 8	28	Sept. 29	27	113
1950	June 17	31	Aug. 18	32	62	May 19	28	Sept. 2	28	106
1951	June 2	31	Sept. 1	27	90	May 23	27	Sept. 1	27	100
34-Year average	June 14	31	Sept. 5	30	82	May 27	26	Sept. 22	26	118
Shortest crop season 1921	July 20	31	Aug. 1	30	11	June 18	28	Aug. 11	28	54
Longest crop season 1938	May 24	30	Sept. 5	32	104	May 13	28	Oct. 23	24	163

Earliest and latest frost dates (32° F. or lower) 1918-51

Latest spring frost:—July 20, 1918—31° F., July 20, 1921—31° F.
Earliest last spring frost:—May 24, 1938—30° F., May 24, 1939—32° F.

Earliest fall frost:—August 1, 1921—30° F.
Latest first fall frost:—October 3, 1930—27° F.

Earliest and latest killing frost dates (28° F. or lower) 1918-51

Latest spring killing frost:—June 24, 1922—27° F.
Earliest last killing frost of spring:—May 8, 1940—27° F.

Earliest fall killing frost:—August 11, 1921—28° F.
Latest first killing frost of fall:—October 23, 1938—24° F.

TABLE 4.—DATES OF SOME FARM OPERATIONS AT KAPUSKASING, ONT., 1941-51

—	Earliest	Latest	Average
First seeding grain	April 25	June 6	May 12
First cutting grain	August 6	September 15	August 25
Starting hay harvest	July 4	August 1	July 14
Livestock put out on pasture	May 22	June 19	June 5
Livestock taken off pasture	October 15	November 13	November 2
Freeze-up	October 31	November 29	November 10

ANIMAL HUSBANDRY

L. A. Charette

Dairy Cattle

The Ayrshire herd at Kapuskasing was started in 1923 when purebreds were purchased from the Eastern Townships of Quebec. Other cows were brought in, but since 1928 no outside females have been introduced to the herd. However, some new blood came from the sires that were used. At the end of 1951, the herd, which is listed and accredited, comprised 33 head. The herd sires in use were Normandin Brae Night 2nd, 252455, and Ste-Anne Douglas 51st, 281897.

Record of Performance

All cows have been entered in the Canadian Record of Performance for purebred cattle. During the period covered by this report, 80 production records were completed. The average of 40 records in the 305-day division was 8,723 lb. milk, 358 lb. fat and 4·10 per cent fat. In the 365-day division, 40 records showed average production of 10,725 lb. milk, 439 lb. fat, and 4·09 per cent fat. Since the Ayrshire herd has been on R.O.P. control, a total of 193 records have been completed.

Production Records

Since 1941, several lifetime production records have been made in the Ayrshire herd. Eleven cows produced 50,000 lb. milk or more, five 75,000 lb. or more, and two 100,000 lb. or more. For the period 1932-51, the average production per cow based on 242 lactations was 9,349 lb. milk, 380 lb. fat, and 4·07 per cent fat. For the period covered by this report, the average production was 8,640 lb. milk, 349 lb. fat, and 4·04 per cent fat. This is below the 20-year average, but in the years 1938-41 many good producing cows had to be disposed of because they were affected with mastitis.

Feed Required to Rear Ayrshire Heifers

In the period, 1941-51, the feed consumption of heifers from birth to one year, from one to two years, and from two years to freshening was recorded. Table 5 sets forth the data.

TABLE 5.—FEED CONSUMPTION TO REAR AYRSHIRE HEIFERS

11-Year Average 1941-1951

Kind of feed	Birth to one year	One to two years	Two years to calving	Birth to calving
Number of animals	56	48	42	42
Whole milk lb.	655	—	—	628
Skim-milk lb.	2,137	—	—	2,194
Meal lb.	636	176	161	941
Hay lb.	1,603	2,700	1,965	6,143
Straw lb.	—	17	—	19
Silage lb.	1,122	3,562	2,399	6,959
Green feed lb.	40	25	29	48
Roots lb.	—	19	14	35
Pasture days	62	142	91	302

The heifers freshened at an average age of 31 months. Their weight taken one month after freshening averaged 996 pounds. It is possible to rear dairy heifers on less feed, but at this Station they are fed so that growth will not be retarded. An undersized animal does not indicate a good producer and such stock is difficult to sell.

From time to time, dairy cows must be replaced either by purchase or by raising heifers. An indication of the cost of raising herd replacements may be obtained by applying local prices to the feeds listed in table 5.

Silage Compared with Home-Grown Grain for Growing Heifers

Over a period of six years, an experiment was conducted on 68 one-year-old heifers to determine whether these could be raised satisfactorily without silage. A group of heifers received clover hay, O.P.V. (oats, peas, and vetch) silage, and minerals, while another group received clover hay and a grain mixture consisting of 65 per cent ground oats, 32 per cent ground barley, and 3 per cent minerals. The results are shown in table 6.

TABLE 6.—SILAGE VERSUS HOME-GROWN GRAIN FOR RAISING DAIRY HEIFERS

5-Year Average 1936-41

Items	Hay and home-grown grain	Hay and O.P.V. silage
Number of heifers	34	34
Average number of days on test	112	112
Average initial weight.....lb.	640·0	641·0
Average final weight.....lb.	760·9	738·2
Average total gain in weight.....lb.	120·9	97·2
Average initial height.....in.	45·1	44·5
Average final height.....in.	47·0	46·6
Average total gain in height.....in.	1·9	2·1
Meal consumed per heifer.....lb.	250·4	6·9*
Hay consumed per heifer.....lb.	1,781·7	1,042·8
Silage consumed per heifer.....lb.	—	2,227·2
Cost of meal.....$	4.25	0·13
Cost of hay.....$	8.83	5.20
Cost of silage.....$	—	3.67
Total cost of feed.....$	13.08	8.99
Feed cost for 100 lb. gain.....$	10.81	9.25

* Minerals only.

The results of this project indicate that the hay-grain ration produced greater gain in body weight but not in body growth, as measured by height. The hay-grain ration tends to be more fattening while the hay-silage ration may be cheaper, depending on the cost of producing silage.

Home-Grown Grains for Dairy Cows

An experiment was conducted to determine whether it was advisable for local farmers to use their own grains, only, or supplement these with such commercial feeds as oilcake and bran. The home-grown ration consisted of wheat, oats, barley, and peas, while the ration supplemented with commercial feeds consisted of barley, oats, bran, and oilcake. The rations fed were balanced as to total digestible nutrients, dry matter, and nutritive ratio.

During the four years of this experiment, there was no significant difference in the production of milk and butterfat, or in the maintenance of body weight. For heavy milkers requiring 10 to 12 lb. of meal or more, the home-grown ration was too heavy and some difficulty was encountered at the beginning in getting them to consume all the meal. However, with cows receiving a smaller quantity

of meal this was not noticed. It was also found that a cheaper balanced ration could be used in normal times by supplementing the home-grown grains with commercial feeds. Thus, the purchase of bran and oilcake would be advisable.

Dual-Purpose and Beef Cattle

Dual-purpose and beef Shorthorn cattle are raised at this Station. In the dual-purpose herd, milk and beef production are considered. At the end of 1951, this herd comprised seventeen head of cattle.

The commercial beef herd was started in 1939 when cows were transferred from the dual-purpose herd and a number of heifers came from the Central Experimental Farm. On December 31, 1951, it stood at sixty-one head of cattle. This herd was organized so that more extensive studies on beef cattle management in northern Ontario and northwestern Quebec could be made. The two present Shorthorn bulls, Indian Head Lavender Lad 5th, 266502, and Melfort Paymaster 17th, 310383, have been used since 1945 and 1951, respectively. Both sires are of the same blood lines as the majority of the Kapuskasing herd.

Dairy, Dual-Purpose, and Beef Cattle

To determine the most suitable type of cattle for this region, a study of the factors involved in the production of milk and beef has been made. For this purpose, dairy, dual-purpose, and beef herds were used. Factors under consideration were investment in buildings and equipment, labour, and feed requirements. This project was carried on for ten years and the results are presented in table 7. The term "animal unit" referred to in this comparison of the three herds is equivalent to one of the following: one cow, one bull over two years old, two 2-year-old heifers, three 1-year-old heifers, four 6-month-old calves, or five calves under 6 months.

TABLE 7.—DAIRY, DUAL-PURPOSE, AND BEEF CATTLE

Requirements and Returns per Animal Unit

Items	10-Year average 1939-49		
	Dairy	Dual-purpose	Beef
Average number, animal units kept yearly	22·42	14·17	27·96
Requirements per animal unit:—			
Labour, man hr.	165·6	164·7	23·2
Feed: Meal, lb.	2,367·3	1,422·8	370·8
Hay, lb.	5,042·9	4,999·5	4,869·8
Silage, lb.	4,715·8	4,765·9	2,414·4
Roots, lb.	100·5	128·7	44·7
Green feed, lb.	277·9	221·8	47·6
Straw, lb.	7·5	10·6	138·4
Regular pasture, acres	2·1	2·2	3·8
Supplemental pasture, acres	1·2	1·4	1·1
Capital invested, $	167·07	167·86	115·70
Production per animal unit:—			
Milk, lb.	5,339·1	3,823·9	—
Beef, lb.	411·0	505·9	578·1
Net returns per man hour, $	0.24	0.21	0.25

Having regard to the conditions under which the experiment was conducted, a number of observations were made:

Labour:—The labour required was practically the same for dairy and dual-purpose cattle, but this was seven times more than that for beef animals. The number of hours of man labour per year per animal unit amounted to 165·6 and 164·7 for the dairy and dual-purpose herds, respectively, while it was only 23·2 for the beef herd.

Feed requirements:—Although the dairy herd consumed the same amount of roughage and 944 lb. grain more than the dual-purpose herd, it produced approximately one and one-half times more milk and at less cost. It was noticed, however, that the dual-purpose cows required less grain for proper maintenance than the dairy cows. On the other hand, the beef cows required practically no meal and approximately 800 lb. roughage less per animal unit than the other two types, but this was counterbalanced by the fact that the herd remained on pasture longer. The pasture acreage per animal unit, as indicated in table 7, was much greater for the beef animals, but these had a longer pasture season and also made use of more unimproved pasture.

Returns:—Since all production factors were considered in this experiment, the net returns per man hour were low. As shown in table 7, the beef and dairy herds are more profitable, but the difference between the three herds is small.

Suitability of northern Ontario and northwestern Quebec:—In this northern area, dual-purpose cattle appear to be less profitable than beef and dairy cattle. Northern Ontario and northwestern Quebec produce more grass than grain and, since the grain is expensive and much of it has to be imported, beef cattle are recommended for many farms. However, before making a decision a farmer should consider (1) the amount of capital available, (2) the labour facilities, (3) the grain production in relation to the roughage-pasture area, (4) the buildings available, (5) the distance from markets and market requirements, and (6) personal preference.

In well-settled communities near towns and cities, where the land is cleared and creameries are available, dairy cattle will give satisfactory returns, except where labour is scarce. In the more recently settled communities where the buildings are inadequate, the pasture unimproved, and the milk and cream market limited, beef cattle are best suited. Since fewer man hours of labour are needed for beef cattle, sheep and poultry may be raised in addition. Beef cattle require little attention in summer, and more time may be devoted to increasing the production of field crops.

TABLE 8.—FEED REQUIREMENTS TO RAISE BEEF CATTLE

—	Cows and calves	Females			Steers	
	Weaning in fall to weaning next fall (13-year average) 1939-51	Weaning to 1½ years (11-year average) 1939-49	1½ to 2½ years (6-year average) 1940-45	2½ years to freshening (6-year average) 1940-45	Weaning to 1½ years (10-year average) 1939-48	1½ years to slaughter (9-year average) 1940-48
Number of cows bred	251	—	—	—	—	—
Number of calves weaned	209	—	—	—	—	—
Number of animals	—	60	16	25	68	40
Length of period.....days	372	350	365	155	350	77
Feed consumption per animal:—						
Hay.....lb.	4,328	2,263	2,973	2,103	2,398	979
Straw.....lb.	140	4	10	55	1	—
Silage.....lb.	1,606	1,552	2,791	2,157	1,790	677
Green feed.....lb.	41	—	—	4	61	4
Roots.....lb.	43	3	45	50	1	2
Grain.....lb.	42	413	156	1	478	357
Mineral.....lb.	16	5	2	9	8	4
Pasture.....days	146	146	154	8	143	13
Average weight of calves at weaning.....lb.	486	—	—	—	—	—
Average weight of animal at end of period.....lb.	—	837	985	—	889	1,060

Raising Shorthorn Beef Cattle

In order to determine the amount of feed required to maintain a cow and produce a calf, records are kept of the feeds consumed by the dams and the calves. By using the current market price of feed, and the feed requirements shown in table 8, the cost of rearing beef cattle may be estimated. The cost will depend on the amount of roughage and concentrate produced on the farm.

As shown in table 8, small amounts of straw, roots, green feed, and grain were used, the reason being that straw and roots were fed in only one year, while green feed was given only in the fall of two years. Grain was supplied only when the animals were in low flesh. The object was to keep the grain consumption to a minimum while maintaining the health and growth of the animal.

Swine

The original foundation for the Yorkshire herd, the only breed maintained at this Station, dates back to 1918 when a boar and a sow were on hand. At the end of 1951 the herd comprised 110 animals. In the period 1941-51, seven boars were used. One of these was bred by this Station, three came from the Central Experimental Farm, while the remainder were from the Brandon Experimental Farm, the Lacombe Experimental Station, and the New Liskeard Demonstration Farm. At present, the herd is headed by the boars, Ottawa Grove 95C, 358371, and Lacombe Beau 211E, 393314. Since 1941, a total of 186 sows farrowed. The average number of pigs born per litter was 11·9, with 8·5 reaching 21 days of age and 8·4 alive at weaning age.

Feed Required to Rear Suckling Pigs

A record is kept of the feed consumed by each sow from the time one litter is weaned until the next is weaned. Average figures for the 11-year period under review are presented in table 9.

By applying the current prices of feed to these data, the cost of rearing suckling pigs may be calculated. However, this cost will be affected by the number of litters a sow produces each year, the number of pigs born in each litter, and the percentage of pigs that reach weaning age.

TABLE 9.—FEED REQUIRED TO REAR SUCKLING PIGS

Items		11-Year average 1941-51
From weaning to farrowing:		
Sows kept	No.	17·2
Length of period	days	132·5
Grain consumed per sow	lb.	933·5
Skim-milk consumed per sow	lb.	454·0
Roughage fed per sow	lb.	1·9
Pasture per sow	months	1·6
From farrowing to weaning:		
Sows kept	No.	16·7
Pigs born per sow	No.	12·0
Pigs weaned per sow	No.	8·4
Length of period	days	50·7
Grain consumed per sow	lb.	472·0
Skim-milk consumed per sow	lb.	536·5
Roughage fed per sow	lb.	23·6

Bacon and Shop Hogs

An experiment was undertaken to compare the cost of producing bacon and shop hogs and to investigate the suitability of certain feed mixtures. The bacon hogs were marketed at 200 pounds and the shop hogs at 160 pounds. A mineral supplement was fed at the rate of 2 per cent of the meal mixture. Table 10 sets forth the 6-year results (1939-45), and the meal mixtures were as follows:—

		From weaning to 100 lb.	From 100 lb. to finish
Feed mixture A	Oats	200 lb.	100 lb.
	Barley	100 lb.	100 lb.
	Tankage	30 lb.	10 lb.
Feed mixture B	Oats	100 lb.	100 lb.
	Barley	100 lb.	200 lb.
	Tankage	20 lb.	15 lb.

There is no difference in the profit per pound of pork over feed costs between bacon and shop hogs. However, in this district, the majority of hogs are sold locally and the market preference is for shop hogs. These have more suitable cuts and less waste than the bacon hogs.

TABLE 10.—BACON VERSUS SHOP HOGS, 6-YEAR AVERAGE 1939-45

	Mixture "A"		Mixture "B"	
	Bacon hogs	Shop hogs	Bacon hogs	Shop hogs
Number of pigs.....No.	54·0	55·0	54·0	55·0
Average number of days on test.....days	132·7	105·5	133·6	103·3
Average initial weight.....lb.	40·3	40·0	40·1	40·6
Average final weight.....lb.	200·4	160·8	200·0	160·5
Average total gain.....lb.	160·1	120·8	159·9	119·9
Average daily gain.....lb.	1·21	1·15	1·20	1·16
Average carcass weight.....lb.	149·5	117·7	149·6	117·6
Dressing percentage.....%	79·8	78·5	79·8	78·6
Total feed consumed per pig.....lb.	607·5	436·7	631·6	432·3
Daily feed consumed per pig.....lb.	4·58	4·14	4·73	4·19
Feed consumed per 100 lb. live weight gain.....lb.	379·7	361·4	394·8	360·6
Cost of feed during test..... $	12·02	8·67	12·40	8·53
Cost of feed to start of test..... $	3·75	3·75	3·75	3·75
Cost of feed per 100 lb. gain during test..... $	7·51	7·18	7·75	7·12
Returns per pig at slaughter..... $	25·56	20·13	25·58	20·11
Profit over cost of feed per pig..... $	9·79	7·71	9·43	7·83
Profit over cost of feed per pound of pork..... $	0·065	0·066	0·063	0·067
Profit per $100 capital invested as feed..... $	62·41	62·03	58·73	63·86

Control of Anaemia

Iron deficiency occurs when the suckling pigs are confined to pens with concrete or wood floors. Since this is a nutritional disease appearing between the age of five days and five weeks, special precaution must be taken when the pigs are young. It was shown that the mortality in young pigs was 8·1 per cent when the sows were out on pasture during pregnancy, but when they were inside, mortality increased to 12·5 per cent. A project to determine the relative efficiency of certain iron compounds in the control of anaemia was started in 1946. The compounds used were reduced iron and iron sulphate. The brood sows and the suckling pigs both received various treatments. The treatments to the brood sows were home-mixed minerals fed to sows indoors; sods fortified with iron sulphate fed to sows indoors; home-mixed minerals fed to sows on pasture; and a commercial mineral mixture fed to sows indoors. With the suckling pigs, the treatments given were reduced iron, iron sulphate, and sods fortified with iron sulphate.

From the results obtained, the reduced iron compound proved to be the most advantageous treatment, while sods sprinkled with a solution containing iron sulphate also proved satisfactory. However, for early spring litters, the sods have to be gathered in the fall, stored all winter, sprinkled before being used, and replaced every second or third day. A further disadvantage is that the young pigs will not touch these sods before they are a week old, and in severe cases of anaemia, this would be too late. The feeding of iron sulphate proved less effective than reduced iron and sods. Since sods require too much labour and iron sulphate is not so satisfactory, the treatment recommended is 3 grains of reduced iron, starting the second day after birth and repeated at weekly intervals for three weeks. By treating the suckling pigs individually, every pig is assured of the treatment.

APICULTURE

M. J. Rowland

Honeybees have been kept at this Station continuously since September, 1919, with the object of obtaining reliable information on beekeeping and honey production. Results are based on experiments conducted with Italian bees. Table 11 shows average dates of significance to beekeeping in this district. The period covered ranges from twenty to thirty years.

TABLE 11.—AVERAGE DATES

First day of general bee flights	April 22
Cellar wintered colonies taken to yard	April 18
First pollen taken into hives	April 28
Top packing taken from outside wintered colonies	April 30
Supply of stores within the hives checked	May 1
Last of winter snow in apiary melts	May 3
Dandelions commence blooming	May 31
Colonies taken out of winter cases	June 15
Main honey flow commences	July 1
Main honey flow ends	August 19
Colonies put into winter cases	September 22
Feeding for winter commenced	September 24
Feeding for winter completed	October 5
Last general flying by bees	October 15
Colonies put into cellar	November 14

The actual date of occurrence ranges from approximately ten days before to ten days after the average date.

Honey Production

Fifteen colonies were used each year for honey production in nine consecutive years to ascertain the approximate potential yield in the district. Table 12 shows the average production per colony and the amount of sugar given for winter stores.

TABLE 12.—AVERAGE COLONY PRODUCTION AND WINTER FEED, 1941-49

Season	Honey yield	Wax from cappings	New combs drawn	Sugar fed for preceding winter
	lb.	lb.	No.	lb.
1941	239·0	3·2	3	34·0
1942	105·1	1·6	0	35·0
1943	79·5	1·1	2	34·5
1944	112·9	1·4	3	39·0
1945	109·5	1·3	3	41·5
1946	84·9	1·1	0	31·5
1947	116·7	1·4	0	45·0
1948	207·5	1·9	2	33·5
1949	163·0	1·7	1	42·5
9-Year average	135·5	1·6	1·5	37·4

The honey graded No. 1, Extra White or No. 1, Water White.

Honey Flows

Colonies have been kept on scales throughout the active seasons since 1920 for the purpose of studying the time, length, density, and source of local honey flows and the weather conditions affecting them. The colonies were weighed each morning before the bees commenced flying. The time and the quantity of honey from the various sources were determined from the daily gain or loss in weight so recorded. The average change in weight made by the hives on scales during each month of the 11-year period is shown in table 13.

TABLE 13.—GAIN IN WEIGHT OF COLONY ON SCALES

11-Year Average 1941-51

	Early flows		Clovers	
	May	June	July	August
Change in weight.....lb.	+6·3	+22·1	+135·7	+11·8
Per cent.....%	3·6	12·5	77·2	6·7

Results of this project showed that approximately 90 per cent of the honey crop was harvested from clover during the latter part of June and throughout July. The flow tapers off gradually early in August. The earliest date on which the main flow commenced was June 19. Prior to 1930 the honey yield from clover was comparatively low. A large part of the honey crop was then harvested from fireweed during the latter part of August and early September. The late honey flow has been reduced by the disappearance of fireweed within flying distance from this apiary but the loss has been largely offset by heavier crops from clover during June, July, and early August.

Methods of Adding Honey Supers

The purpose of this experiment was to determine which of two methods of adding supers was the more efficient. Two groups of colonies of approximately equal strength were selected each year. Supers were added as follows:

Group 1: Each additional super was placed immediately on the brood chamber and beneath all previously added supers. When a new super was added, the weight of those removed was recorded.

Group 2: Each additional super was placed on top of all previously added supers.

Results are tabulated in table 14.

TABLE 14.—COMPARISON OF SUPERING METHODS, 1941-49

Year	Number of colonies in each group	Bottom supering		Top supering	
		Total production	Colony average	Total production	Colony average
	No.	lb.	lb.	lb.	lb.
1941	4	941·5	235·5	968·0	242·0
1942	4	444·0	111·0	396·5	99·1
1943	4	521·0	130·2	433·0	108·3
1944	7	829·0	118·4	758·5	108·4
1945	7	666·0	95·1	605·5	86·5
1946	7	600·0	85·7	588·0	84·0
1947	7	887·0	126·7	875·0	125·0
1948	7	1,454·0	207·7	1,409·0	201·3
1949	7	1,177·5	168·2	1,114·5	159·2
Nine years	54	7,520·0	139·3	7,148·0	132·4

The fifty-four colonies of the bottom-supered group yielded an average of 6·9 pounds of extracted honey more than did those of the top-supered group. This increase is more or less offset by the time and labour involved in lifting off and replacing the partly filled supers.

FIG. 1.—Top left: A comb of high viability brood showing typical elliptical form of brood area surrounded by pollen, with capped honey in the upper corners. Top right: A well-filled and capped Langstroth comb of honey. Middle left: Entrances to most of the wintering cases are covered with snow. Arrows point to holes melted through the snow by warmth from the bees. Middle right: A closer view of the vent above a completely covered hive. Lower left: Wintering cases with no insulating material under the hives are completely covered with snow. The mounds are on top of them. Lower right: Snow is sometimes swirled away from the cases by draughts caused by buildings, gaps in hedge or fence, or by wide eaves to the roof.

Detecting Preparations for Swarming

The object of this experiment is to ascertain whether preparation for swarming can be detected by tipping the upper part of a double brood chamber and looking for queen cells along the bottom bars of the frames.

Of the 336 colonies used for this project since it was begun, 88 of them built the multiplicity of queen cells usually associated with swarming. Of the latter number, 82 built the first queen cells along the bottom bars of the upper brood chamber where they were readily seen when that section was tilted. A little smoke was usually blown across the bottom bars to drive the bees from them and thus leave a clear view. More thorough examinations were made of the colonies up to the time of appearance of open brood in the upper brood chamber.

The remaining six colonies built the queen cells in the bottom brood chamber, only. In some instances, the top brood chamber had not been added early enough for the brood nest to be extended into it before the desire to swarm was developed. In other colonies the queen had been crowded from the upper brood chamber by honey from early flows before the first cells were built.

The results indicate that this is a quick and reliable means of detecting swarm preparations, if the necessary precautions are taken. The upper brood chamber must be added early enough for the bees to incorporate it as a part of the brood nest before swarm preparations commence and there must be sufficient supers on the hive for all surplus honey.

No swarming occurred where only one queen cell appeared in any one hive. In most of those instances the old queen was superseded by a young one. In the remainder the cell was destroyed by the bees. The number of cases of this normal supersedure of old queens during the main honey flow has increased in recent years thus greatly simplifying the requeening of the colonies.

Swarm Control

Three methods of swarm control have been tested. The procedure in each is outlined below:—

(a) "Dequeening and Requeening."—The procedure in this method is to remove the queen and all queen cells when larvae are first seen in the queen cells. The colony is left queenless for nine or ten days, then all queen cells are again destroyed and a young laying queen is introduced.

(b) "Separation of Queen and Brood."—With this method, all combs containing eggs and brood, with adhering bees, are put above the queen-excluder when larvae are first seen in queen cells. The queen is left below on a set of empty combs with a few bees shaken from the comb on which she was found. All queen cells are destroyed at the time of this manipulation and again in eight or nine days.

(c) "Raising Brood and Dequeening and Requeening."—The procedure in this method is to remove the queen when swarm preparations are first noticed. All combs of brood, except one, with the adhering bees are raised above the queen excluder. A young, laying queen is introduced on the one brood comb left in the brood chamber. The brood chamber is then filled out with empty combs. Queen cells are destroyed at the time of this manipulation and again eight or nine days later.

Details of the results are tabulated in table 15.

TABLE 15.—NUMBER OF COLONIES USED IN SWARM CONTROL AND RESULTS OF THE THREE METHODS USED

Method	Total number of years	Total number of colonies	Per cent stopped swarm preparation	Honey yield per colony
			%	lb.
Dequeening and requeening	1929-49 21	64	98	141·0
Separating queen and brood	1929-49 21	37	62	130·5
Raising brood and requeening	1940-49 10	11	92	89·6

The "Dequeening and Requeening" method has been the most successful from the viewpoint of both swarm prevention and honey production. It has also been the most satisfactory way of requeening the colonies.

In the "Separation of Queen and Brood" method the old queens disappeared from 51 per cent of the colonies shortly after the manipulation, and supersedure cells were built. Considerable trouble was experienced in inducing the bees to accept another queen. Honey production was slightly less than under the first-mentioned system.

The "Raising Brood and Requeening" method was first used in this apiary in 1940. Honey production from colonies treated by this method was low. Only 54 per cent of the colonies accepted the first queen given them. The remainder accepted other queens but laying workers developed in one colony. It was united to a queen-right colony.

Wintering Surplus Queens

The purpose of this project was to find a suitable method by which surplus queens may be carried through the winter for early use in spring. Each fall a tight-fitting division board was put in the centre of standard 10-frame hives. Entrances to the compartments were made at opposite ends. The bees, brood, and queen from mating boxes or other weak colonies were put into these divided hives.

During the period 1941-51, 118 queens were put into winter quarters in these divided hives. Of these, 113 survived the winters in good condition and were used to requeen queenless colonies, replace failing queens, or were left with their own colony and used for honey production. The colonies used for honey production were transferred to standard hives and allowed to build up in a normal way. They yielded an average of 91·5 pounds of extracted honey compared with an average of 135·5 pounds produced by colonies wintered in standard hives. The honey yield of the small colonies was comparatively high probably because queens and bees were younger when put into winter quarters.

Wintering

Wintering of bees is given special consideration because of the long winter and the comparatively short period between early spring and the main honey flow. Some 320 colonies were used in methods-of-wintering experiments, during the period covered by this report.

Cellar wintering:—Four colonies in standard 10-frame hives were put into the cellar each winter. Colonies to be wintered in the cellar were put into small cases in the yard when other colonies were put into their wintering cases. They remained there until put into the cellar. The colonies were returned to the cases when taken from the cellar in spring and left there until mid-June.

Statistics covering this experiment are given in table 16.

TABLE 16.—DATA PERTAINING TO CELLAR WINTERING

9-Year Average 1941-49

Average annual date bees put into cellar	November 14
Average annual date bees taken from cellar	April 18
Average annual number of days in cellar	155
Average maximum temperature of cellar	48·3 deg. F.
Average minimum temperature of cellar	31·6 deg. F.
Mean monthly temperature of cellar	40·0 deg. F.
Average monthly relative humidity	68·0 per cent
Average weekly loss in weight of one colony each winter	1·2 pounds
Average loss in weight by all colonies while in cellar	28·3 pounds

Outside wintering:—Bees were wintered in the yard in six different sizes of wintering cases, all provided with bottom entrances. The group number and details of each type of case are given in table 17.

TABLE 17.—GROUP NUMBERS AND DETAILS OF WINTERING CASES

Group number	Type of case	Thickness of insulation material
1	—	In cellar
2	4-colony	Six inches beneath hives and 6 inches at sides
3	2-colony	Six inches beneath hives and 6 inches at sides
4	1-colony	Six inches beneath hives and 6 inches at sides
5	1-colony	None beneath hives and 6 inches at sides
6	1-colony	None beneath hives and 3 inches at sides
7	1-colony	None beneath hives and 2 inches at sides

All wintering cases allowed 10 inches of insulating material and a well-ventilated air-space above the hives. Thoroughly dried planer shavings were used throughout.

The difference in colony survival between groups was not significant but there was a wide difference between individual colonies within each group every year. It ranged from strong (colonies with bees covering nine or ten combs), through medium strength to weak (two combs of bees or less), or an occasional complete loss. This would indicate that some factors other than the tested methods of wintering exert an influence on the ability of the bees to withstand the winter.

There was a tendency, in the four-colony and two-colony cases, for the bees to drift from the weaker to the more active of two colonies that were side by side. In former years this drifting caused the loss of some colonies. It was prevented during the period covered in this report by taking the hives from the case as soon as drifting was noticed. Each colony would then build up slowly. They did not strengthen as rapidly as those in one-colony cases that had the protection of wintering-cases until a later date. The average date of putting colonies into the cases in the autumn and removing them in the spring was September 22 and June 15. All colonies were provided with bottom entrances.

Queen Rearing

The purpose of queen rearing has been to develop an acclimatized and generally improved strain of bees. The Gilman system of line-breeding[1] and the Doolittle method of queen rearing are used, and during the past 21 years, 2,328 queens were successfully mated. Of these, 1,465 were sent to other Experimental Farms and Stations and 863 were used at this Station. Progress is indicated by the gradual improvement in the spring condition of the bee colonies, the smaller number of colonies making swarm preparations, and the increase in honey yields.

During the period 1929-1935, 53 colonies, or 22·0 per cent out of a total of 241, made swarm preparations. In the next 7 years, 1936-1942, 45 colonies out of 248 or 18·1 per cent prepared to swarm. During the years 1943-1949, the number of colonies dropped to 12·8 per cent, with 40 out of 312 colonies building queen cells. No swarm control manipulations were applied to any colony until after preparations to swarm were indicated by the appearance of larvae in queen cells.

[1] Gilman, A., "Practical Bee Breeding", G. P. Putnam's Sons, London and New York.

Unfortunately, the honey yield of the whole season cannot be fairly used as a criterion because of the disappearance of fireweed from this vicinity about 1934. Prior to that year approximately 50 per cent of the honey crop was gathered in August and early September from that source. During the period 1936 to 1949, only 9 per cent of the total crop was gathered in those months. Plants supplying honey in the spring and summer have remained the same and afford a more reliable gauge.

The figures recorded during the past 28 years have been divided into four groups of seven years each. The net monthly gain or loss in weight of the colonies on scales has been grouped accordingly and the results are presented in table 18. The figures were obtained by recording the weight of colonies on scales each morning during the active season. The gain or loss in weight indicates the amount of honey gathered or the stores consumed during the previous day. The natural increase in the number of bees in the hive would account for a small fraction of some of the changes in weight.

TABLE 18.—AVERAGE ANNUAL CHANGE IN WEIGHT OF COLONIES ON SCALES FOR FOUR PERIODS

1922-49 (28 Years)

Period	Change in weight of hives on scales					Three-month honey production		Average annual honey yield	Per cent of honey gathered	
	May	June	July	Aug.	Sept.	May, June, July, total	Gain over first period		May, June, July	Aug. and Sept.
	lb.	lb.	lb.	lb.	lb.	lb.	%	lb.	%	%
1922-1928.....	−8·7	1·0	68·9	48·2	14·3	61·1	—	123·6	48·3	51·7
1929-1935.....	−2·5	14·1	110·9	96·7	0·2	122·7	100·8	219·3	51·4	48·6
1936-1942.....	3·2	19·0	114·7	26·9	−4·2	136·9	124·1	159·6	86·0	14·0
1943-1949.....	1·5	16·1	139·1	12·5	−4·2	156·4	156·0	164·7	95·1	4·9

NOTE:—Minus sign indicates loss in weight.

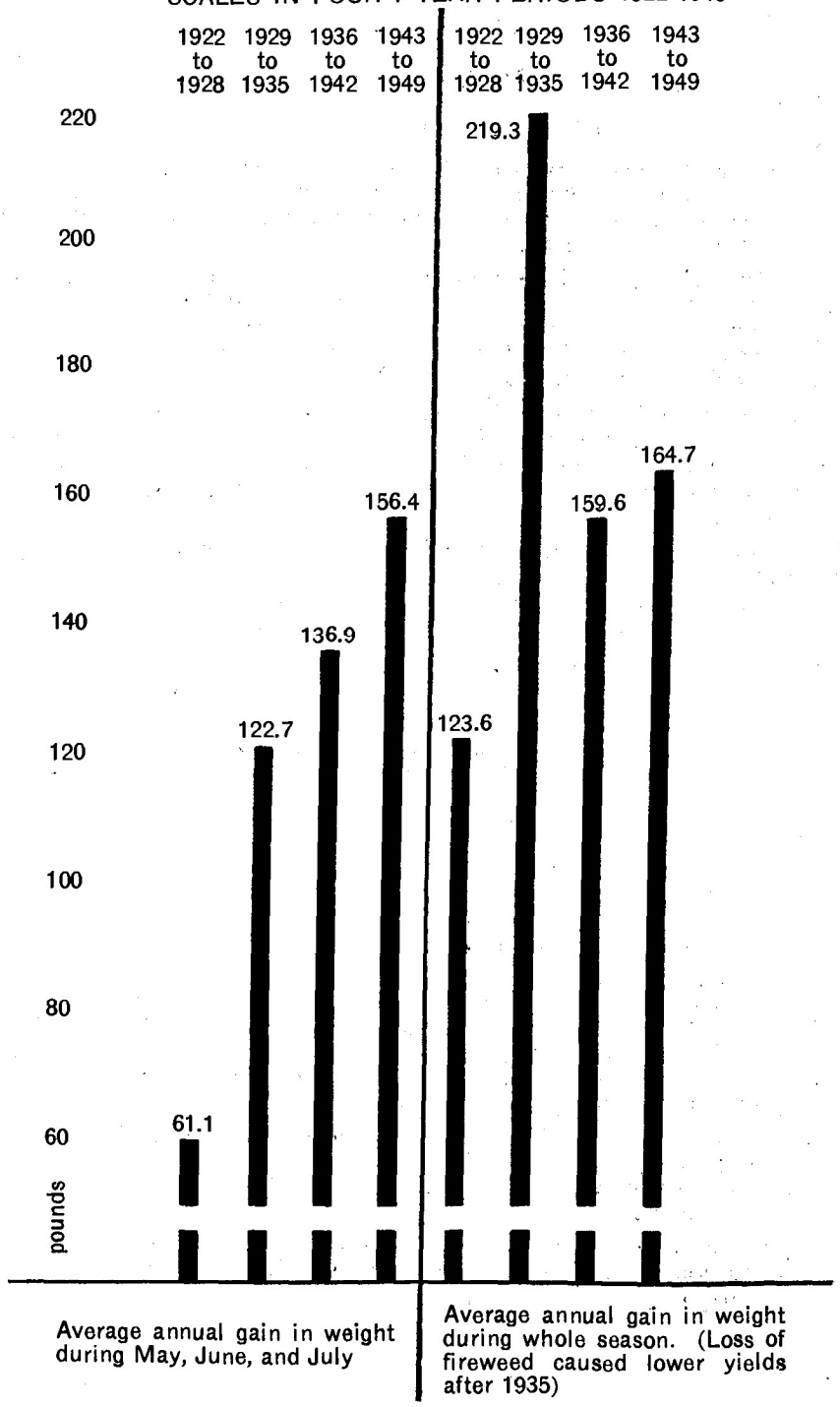
The figures in the table show that the amount of honey gathered during May, June, and July increased in each succeeding period and, in the last period, equalled 156 per cent of that of the first period.

Figures in column 10, table 18, show the effect of the disappearance of fireweed at the end of the second period. The average annual production of 164·7 pounds during the last seven years when compared with 123·6 pounds in the first period indicates that the loss of the fireweed has been more than offset by larger crops gathered during the early part of each season.

Much higher honey production could have been expected in recent years if the source of the autumn flows had remained the same. The gradual swing of the main honey flows from the later to the earlier part of the season is illustrated by the percentage of the honey gathered in those two periods as shown in the last two columns of table 18. The increase in honey yield is clearly shown in Chart 1.

Results to date indicate that some benefit is to be gained by rearing queens from selected stock in the locality where the queens are to be used.

CHART 1.—SHOWING GAIN IN WEIGHT OF COLONIES ON SCALES IN FOUR 7-YEAR PERIODS 1922-1949



CEREALS

M. R. Wiancko

Tests of Varieties and Strains

The testing of cereal varieties and strains to determine the most suitable for the area served by this Station has been conducted continuously since 1924. During the period 1941-51 the tests included spring wheat, oats, barley, field peas, winter rye, and field beans.

All variety testing was done in rod-row plots. Each plot consisted of four rows 18½ feet long, spaced 9 inches apart. Four to six replicates were used and the plots were randomized within each block. At harvest time, one foot was cut from the ends of each row and discarded. The two centre rows of each plot were cut for yield determinations.

During each season accurate data were recorded on the following:—date of seeding, date of emergence, date of heading or flowering, date ripe, length of straw or vine, resistance to lodging, yield per acre, weight per bushel, weight per 1,000 kernels, and the occurrence of diseases, such as leaf rust, stem rust, smut, ergot, root-rots, etc.

The cereal test plots were grown in the experimental plot field using a 4-year rotation as follows:—

First year:— Cereal test plots. An application of 2-12-6 fertilizer at 300 pounds per acre was drilled in previous to seeding.

Second year:—Barley seeded to red clover at 12 pounds per acre.

Third year:— Red clover cut for hay, aftermath ploughed and sown to winter rye at 2 bushels per acre.

Fourth year:—Winter rye ploughed down in early heading. Ground disked and 100 pounds of sulphate of ammonia applied per acre. Land was summerfallowed for remainder of the season.

Spring Wheat

Twelve varieties have been under test each year and a total of forty-seven varieties have been tested during the period 1941-51. Table 19 lists the named varieties under test each year and includes data on the average yield per acre, and the number of days to maturity.

In addition to this replicated variety test, single-plot observation tests of spring wheat have been conducted to test new strains. This observation test consisted of ten new strains plus two standard varieties as checks. On the average, no difficulty was experienced from lodging in spring wheat. Care must be taken to sow an early maturing variety. Spring wheat should be the first grain crop sown in the spring if a mature crop is to be harvested.

Regent 975·11 is a good yielding, medium early variety. It has strong straw of medium length and is resistant to stem rust. This is the recommended variety for the district giving an average yield of 38·7 bushels per acre and maturing in 112 days.

Coronation 11 has yielded well. It has a medium length, strong straw, and is resistant to stem rust. It is too late in maturity for this district.

Huron Ott. 3 has no rust resistance and is much too late for the district.

TABLE 19.—VARIETY TEST SPRING WHEAT

(Average Results 1941-1951, inclusive)

Variety	Years tested	Average yield per acre for years stated	Average number of days to mature for years stated
		bu.	days
Regent 975-1	1941–42	44·7	109·3
Coronation 11	1941–46	39·4	116·6
Huron Ott. 3	1941–42	42·8	116·9
Garnet 652	1941–42	38·6	99·0
Rival	1941–42	47·9	118·8
Regent 975-11	1943–51	38·7	112·3
Thatcher	1943–51	37·8	118·0
Saunders	1944–51	36·0	109·6
Cascade	1946–51	45·1	122·5
Redman	1948–51	41·1	121·8
Acadia	1942–51	43·7	118·5

FIG. 2.—A general view of the cereal testing plots 1945. Cereal testing has been conducted at the Station since 1924, and usually good stands are obtained.

Garnet 652 has low yielding ability, and no resistance to rust, making it unsuitable despite the fact that it is early maturing.

Thatcher is slightly lower yielding than Regent over a period of eight years and is 2 to 6 days later maturing.

Saunders has the same maturity as Regent and is resistant to stem rust. Over a 6-year period its average yield has been 4 bushels per acre less than Regent.

Cascade is a semi-hard, white wheat, higher in yield than Regent, resistant to stem rust, but too late in maturity for the district.

Redman is higher yielding than Regent but slightly later in maturing. It is a new variety licensed in 1946 and requires further testing to determine its possibilities.

Acadia is a new variety licensed in 1951. While it is higher yielding than Regent it is too late in maturity for this district.

Oats

During the period 1941-51, ninety-seven varieties and strains of oats were tested in the replicated variety test. In addition to the variety test, replicated preliminary trials were also conducted. The purpose of these is to test the suitability of new strains and selections made here or elsewhere before entering them in the variety test.

Table 20 lists the twenty-one named varieties tested, the yield per acre, the number of days to mature and the resistance to lodging, on a 1 to 9 basis with "1" indicating that plants have very good resistance and "9" that they have very poor resistance.

Strains of crosses 2806, 2797, and 3003, were also tested and discarded because of late maturity, low yields, weakness of straw, or susceptibility to disease such as crown or stem rust.

TABLE 20.—VARIETY TEST OATS

(Average Results 1941-1951, inclusive)

Variety	Years tested	Average yield per acre for years stated	Average number of days to mature for years stated	Average resistance to lodging for years stated
		bu.	days	1-9
Dasix	1941-43	66·6	107·4	3·6
Erban	1941-47	67·9	102·5	3·9
Mabel	1941-45	68·1	97·7	4·3
Alaska	1941-43	55·6	99·1	3·2
Cartier	1941-48	64·4	97·5	3·3
Ajax	1941-51	72·1	101·5	3·2
Beacon	1943-47	75·5	101·5	3·1
Beaver	1943-47	72·3	99·4	4·7
Valor	1944-45	62·2	87·3	5·4
Garry	1946-48	68·1	108·8	7·1
Clinton	1946-51	60·5	105·1	1·9
Larain	1946-48	71·7	102·1	3·3
Mohawk	1948-50	52·0	107·1	2·4
Zephyr	1949-51	72·0	110·4	2·3
Fortune	1949-51	80·4	108·2	1·9
Andrew	1949-51	73·4	103·4	1·9
Mindo	1949-50	48·2	100·5	1·2
Bonda	1949-50	47·1	101·4	2·3
Shelby	1949-51	73·0	110·0	2·1
Advance	1949-51	68·9	105·3	2·7
Lanark	1948-51	65·3	109·3	2·7

Important considerations in the choice of a variety of oats, to be grown in northern Ontario, are: good yielding ability, early maturity, resistance to diseases such as stem rust and crown rust, strength of straw and sufficient straw length to provide bedding for the long stabling period.

Ajax is a good yielding, early maturing variety, semi-resistant to stem rust, mid-tall with a medium to strong straw. Over an 11-year period, this variety has given an average yield of 72·1 bushels per acre and matured in 102 days. Ajax is the recommended variety for the district.

Beacon is a medium short, strong strawed, high yielding variety but is usually later maturing than Ajax. This variety has fair resistance to stem and crown rust but is very susceptible to Victoria blight disease.

Beaver yields about the same as Ajax, but is slightly weaker in the straw. It is semi-resistant to stem rust and moderately resistant to stem and crown rust.

Cartier over an 8-year period has been 3 days earlier than Ajax but has yielded 8·6 bushels per acre less than Ajax. It is also very susceptible to stem and crown rust.

Clinton has good resistance to the rusts, has a short, stiff straw and about the same maturity as Ajax. The yield, however, is far below Ajax.

Erban is 1 to 10 days later in maturity than Ajax, has no resistance to stem rust, but is moderately resistant to crown rust.

Dasix is early maturing but lacks rust resistance and is weak in the straw.

Mabel is a light brown to buff coloured oat, early maturing, a good yielder but has only moderate resistance to crown rust.

Alaska is an early maturing oat and for many years was one of the recommended varieties for northern Ontario. It is very susceptible to crown and stem rust and in comparative years yielded 8·3 bushels per acre less than Ajax.

Banner is much too late for northern Ontario conditions. It is inclined to be weak in the straw and very susceptible to rust.

Lanark is a new variety licensed in 1950. It is lower yielding than Ajax and too late in maturity for this district.

Barley

Barley adapts itself to northern Ontario conditions and is a good producer of total digestible nutrients. Forty-five varieties were tested in replicated rod-row plots during the period 1941-51. In addition to these, numerous selections were tested in single-plot observation trials.

Over a 3-year period a large number of varieties from the world barley collection were tested in single-plot trials as follows: 1945, 201 varieties; 1946, 203 varieties; and 1948, 186 varieties. Nothing of particular interest was discovered among these 590 varieties tested.

Table 21 lists the named varieties under test each year in the regular plots together with data on yield, maturity, and resistance to lodging.

TABLE 21.—VARIETY TEST BARLEY

(Average Results 1941-1951, inclusive)

Variety	Years tested	Average yield per acre for years stated	Average number of days to mature for years stated	Average resistance to lodging for years stated
		bu.	days	1-9
Byng	1941–51	69·0	104·3	5·1
Nobarb	1941–44	54·0	106·2	3·4
Velvet	1941–51	58·0	104·0	4·1
Olli	1941–49	57·8	94·3	3·6
O.A.C. 21	1941–51	58·5	100·6	3·7
O.A.C. 34-1-0	1941–43	58·8	106·4	3·8
Oxford	1941–44	53·0	108·9	4·3
Galore	1944–46	61·5	106·5	5·7
Montcalm	1944–51	60·4	105·4	3·6
Peatland	1944–46	48·6	105·4	1·8

Barley as a general rule reaches maturity 2 to 7 days earlier than oats, and one to two weeks earlier than spring wheat in this district. As a result, varieties classified from early to mid-season can be grown successfully. Where earliness can be combined with other desirable agronomic characteristics, the value of the variety is increased. To merit serious consideration in northern Ontario, a barley variety must have good strength of straw, preferably a medium length of straw, and smooth or semi-smooth awns. No appreciable damage has been caused by disease up to 1951.

Montcalm is a mid-season variety with moderately strong straw of good length. It has good yielding ability and has a semi-smooth awn. This is now the recommended variety for the district. Over an 8-year period it has yielded 60·4 bushels per acre and matured in 105 days.

Byng is one of the highest yielding varieties tested but lodges seriously under northern Ontario conditions. The awns are semi-smooth and the kernels are large. It matures in the same number of days as Montcalm.

O.A.C. 21 until 1948 was the recommended variety and is still grown extensively in the district. It is 5 days earlier in maturing than Montcalm and produced 3·3 bushels per acre less over a comparative 8-year period. It has the disadvantage of being rough awned and slightly weaker in the straw than Montcalm.

FIG. 3.—Severe lodging among varieties of the World Barley Collection in 1945. This lodging followed a heavy rainfall in a year of good grain yield.

Olli is a rough awned, early maturing variety ripening 6 to 10 days earlier than O.A.C. 21. Its short straw often makes it difficult to harvest with a binder. In yielding ability it compares favourably with O.A.C. 21. This variety has the characteristic of dropping most of its awns at maturity.

Velvet is a smooth awned variety of the same maturity as Montcalm but yielded 5·6 bushels per acre less over an 8-year period. It is also weaker in the straw than Montcalm.

Field Peas

The production of field peas is limited in the area served by this Experimental Station, being confined mainly to the Matheson region of northern Ontario and the Temiskaming district of Quebec. Part of the crop is used for human consumption, the remainder going for stock feed.

Several of the varieties tested during 1941-51 are listed in table 22 together with data on yield per acre, number of days to mature, and length of vine. Data were not recorded on field peas for the following years: 1943, complete crop failure; 1944, insufficient seed available; 1946, crop failure; 1947, spring seeding too late, not sown; and 1950, plots damaged by crows, no yield recorded.

TABLE 22.—VARIETY TEST FIELD PEAS, 1941-51

Variety	Yield per acre						Number of days to mature						Length of vine					
	1941	1942	1945	1948	1949	1951	1941	1942	1945	1948	1949	1951	1941	1942	1945	1948	1949	1951
	bu.	bu.	bu.	bu.	bu.	bu.	days	days	days	days	days	days	in.	in.	in.	in.	in.	in.
Chancellor	60·3	50·2	54·9	70·2	33·7	82·5	121·3	127·3	109·0	133·5	103·5	126·2	54·3	45·0	33·0	55·0	39·8	48·0
Early Blue	75·4	67·8	42·0	78·4	—	—	103·5	112·0	103·0	120·8	—	—	31·3	25·3	22·5	32·0	—	—
Thursday	56·4	56·2	—	—	—	—	121·3	127·3	—	—	—	—	53·7	45·7	—	—	—	—
Polish 31-3	—	—	—	—	41·6	65·4	—	—	—	—	100·8	124·0	—	—	—	—	38·3	43·5
Valley	—	—	—	—	37·3	64·3	—	—	—	—	108·5	130·8	—	—	—	—	41·0	50·2
Kap. 3880-4	—	—	—	—	28·3	68·7	—	—	—	—	96·5	117·0	—	—	—	—	39·0	37·0
Kap. 3880-5	—	—	—	—	27·9	77·4	—	—	—	—	96·5	124·0	—	—	—	—	32·0	40·8
Kap. 3880-2	—	—	—	—	26·6	70·9	—	—	—	—	96·5	116·5	—	—	—	—	35·0	44·2

Field peas in this district require a long period, varying from 105 to 120 days on the average, to mature. The variety most commonly grown in the district is Chancellor. This is a high yielding, small seeded, white pea, with a good length of vine, but is unfortunately too late in maturity for this area. Early Blue is an irregular shaped, blue coloured variety. It is early maturing and high yielding, but too short in the vine for easy harvesting. It is also unpopular because of its colour and shape. Several other promising varieties have been tested but since they are susceptible to pea blight, leaf and pod spot, and pea wilt they are not recommended for the district.

Field Beans

The testing of field beans, begun in 1923, was continued until 1942. No interest has been shown by the farming public in the growing of this crop. Although earlier in maturity than field peas, 102 days for a 6-year average, field beans are readily damaged by late spring or early fall frosts. Brown Norwegian and Grey appear to be the most suitable varieties, with Grey showing a slight superiority. Yields are usually low in northern Ontario, the 7-year average for Brown Norwegian and Grey being 12·0 and 13·7 bushels per acre, respectively.

Winter Rye

The growing of winter rye for a seed crop has never been undertaken to any extent in northern Ontario. As a result variety testing, begun in 1922, was discontinued in 1942.

Yields of rye varied considerably from year to year, largely because of winter-killing. The 6-year average yield of the varieties Crown, Dakold, and Advance, was 36·5, 34·9, and 32·0 bushels per acre, respectively. Winter-killing on these varieties during the same period, was 23·3, 25·3, and 27·4 per cent, respectively. Of the thirteen varieties tested for the period 1937-42 the most promising are Horton and Crown.

Cereal Plant Breeding

In 1945 a program of cereal plant breeding by selection was started for oats, barley, and field peas. Selection work on spring wheat was added to this in 1946. The object of this selection work was to develop an early maturing, high yielding variety, with strong straw of medium height. In addition to this, the selection should have disease resistance and in the case of barley, have a smooth or semi-smooth awn.

None of the spring wheat selections showed promise. Most of the original oat selections were discarded, but several that have fair rust resistance and good resistance to Victoria blight remain. These merit further testing. The most promising results have been obtained from barley selections. Several of these, originating from single-head selections made in 1945, show superiority over such varieties as Montcalm, Byng, and O.A.C. 21. Several selections of field peas that show sufficient promise to merit further testing remain.

Elite and Registered Seed Production

The lack of growers of registered seed in the district has led this Experimental Station to produce elite and registered seed of spring wheat, oats, and barley. This has facilitated the introduction of recommended varieties to the district by making available limited supplies of good seed.

Cereal Research

This Station co-operates with the Cereal Division at Ottawa on two problems of basic cereal research, inheritance studies of physiological characters in spring wheat, such as frost resistance; and root studies in relation to lodging resistance of oats, barley, and spring wheat.

FIELD HUSBANDRY

M. R. Wiancko

Cost of Producing Farm Crops in Northern Ontario

Records were kept from 1926 to 1942 on the cost of producing six main farm crops grown on this Station and in the district. These were oats, spring wheat, barley, mixed hay, sunflowers, and a mixture of oats, peas, and vetch for ensilage. Similar records were kept on potatoes for the period 1926-41.

The varieties used were as follows: oats—Cartier, and Alaska; spring wheat—Reward, Garnet, and Regent; barley—O.A.C. 21; potatoes—Irish Cobbler; sunflowers for silage—Mammoth Russian. The mixture used for silage was oats, 3 bushels; peas, ¾ bushel; and vetch, ½ bushel. In later years vetch was dropped from the mixture. On low-lying land the hay mixture was red clover, 8 pounds; timothy, 8 pounds; and alsike, 2 pounds per acre, while on well-drained land 6 pounds of alfalfa were added and the red clover and timothy reduced to 6 pounds each.

Local wage scales were used to determine the cost of manual labour. The cost of seed and fertilizer was governed by the local market. Costs for rent, threshing or ensiling conformed with costs in the district. The values for horse and tractor labour, and machinery costs were based on figures compiled by the Agricultural Engineering section of the Field Husbandry Division, Central Experimental Farm, Ottawa. The return values were based on the current market prices under local conditions for all crops that were marketable.

TABLE 23.—COST OF PRODUCING CROPS AT KAPUSKASING, ONT.

Crop	17-Year average 1926-42		
	Yield per acre	Cost per acre	Cost per bushel or ton
	bu.	$	$
Spring Wheat	23·0	21.93	0.86
Oats	32·2	22.27	0.61
Barley	25·8	20.95	0.72
Potatoes*	186·7	79.45	0.42
	tons		
Hay	1·28	13.23	10.34
Sunflowers	8·67	42·71	4.93
Oats and Peas (for silage)	4·46	28.59	6.41

* 16-Year average (1926-41).

The large amount of work involved and the comparatively low yields obtained from the two silage crops, sunflowers, and oats and peas, have raised the cost of production above the value of the crop. Since they are not economical to produce they are not recommended for northern Ontario.

Experiments have shown that where alfalfa is added to a hay mixture on well-drained land, yields are increased thus reducing the cost of production per ton.

Sequence of Crops

A project was started in 1936 to determine the influence of certain commonly grown field crops upon the yields of succeeding crops. Ten preceding crops, alfalfa, sweet clover, red clover, timothy, barley, oats, oats, peas and vetch for silage, potatoes, sunflowers, and summerfallow each received 12 tons of manure per acre once every three years. Two preceding crops, red clover and timothy, did not receive any manure. These twelve preceding crops were followed by four crops, namely: oats; barley; oats, peas, and vetch for silage; and potatoes. The average yields obtained of the four succeeding crops are presented in table 24.

TABLE 24.—SEQUENCE OF CROPS

Average Yield of Succeeding Crops

Preceding crop	Manure applied	Average yield per acre 1938-1951			
		Oats, 10-year average grain	Barley, 11-year average grain	Oats, peas, and vetch, 11-year average dry matter	Potatoes, 9-year average marketable
		bu.	bu.	tons	bu.
Alfalfa	12 tons per acre	70·3	58·8	3·02	227·0
Sweet Clover	12 tons per acre	68·7	59·6	2·90	237·9
Red Clover	12 tons per acre	73·1	59·9	3·01	242·1
Timothy	12 tons per acre	57·0	47·5	2·68	237·4
Barley	12 tons per acre	53·4	38·4	2·56	202·3
Oats	12 tons per acre	47·9	41·6	2·44	201·2
Oats, Peas and Vetch	12 tons per acre	55·8	44·5	2·66	193·0
Potatoes	12 tons per acre	66·7	52·6	2·85	166·2
Sunflowers	12 tons per acre	62·0	49·7	2·72	182·7
Summerfallow	12 tons per acre	65·7	55·8	2·78	183·2
Red Clover	No manure	67·7	53·5	2·84	213·8
Timothy	No manure	51·9	43·9	2·42	212·8

During the period 1938-51, it was found that oats, barley, potatoes, and the silage mixture of oats, peas, and vetch, produced the highest yield when following legume crops of alfalfa, red clover, and sweet clover. Timothy as a preceding crop for potatoes appeared to be as beneficial as the legumes. When oats or barley followed such crops as silage, hoed crops, or grains, the yield was less than when they were grown after summerfallow. The silage crop (O.P.V.) gave the highest yields following legume crops but showed little variation when following grains, hoed crops, or summerfallow. Results would indicate that it is poor cultural practice to follow a grain crop with a grain crop, particularly a species following itself; and that potatoes should follow a sod crop in preference to summerfallow, grain, or a hoed crop.

Soil Fertility Investigations

Manure and commercial fertilizer for the production of hay and grain:—The effect of applications of manure and commercial fertilizer was studied over the period 1926 to 1948. The materials were applied to an oats, peas, vetch (O.P.V.) crop in a 4-year rotation of O.P.V., barley, clover, and timothy to 1936. At that time, the plan of the experiment was revised to include heavier rates of treatment and, in some cases, applications of the materials at different times in the rotation.

The fertility treatments applied and the average yields recorded on the four crops in the rotation are presented in table 25.

TABLE 25.—MANURE AND FERTILIZERS FOR HAY AND GRAIN

Average Yields per Acre

Treatments per acre applied for O.P.V. crop	O.P.V. (dry matter)			Barley (grain)			Clover* (dry matter)			Timothy** (dry matter)		
	1926-35	1936-45	1926-46	1927-36	1937-46	1927-46	1928-37	1938-46	1928-46	1929-38	1939-46	1929-46
	lb.	lb.	lb.	bu.	bu.	bu.	lb.	lb.	lb.	lb.	lb.	lb.
Check (no manure or fertilizer)	3,080	2,173	2,605	22·4	20·3	21·5	1,261	1,419	1,331	990	1,580	1,248
Nitrate of Soda, 100 lb.	3,337	2,428	2,890	22·0	20·0	21·1	1,214	1,406	1,299	978	1,536	1,222
Superphosphate, 250 lb.	3,687	2,849	3,248	23·4	24·8	24·1	1,852	2,579	2,175	1,339	2,392	1,800
Nitrate of Soda, 100 lb.; Muriate of Potash, 50 lb.	3,314	2,567	2,923	21·9	22·4	22·1	1,154	1,480	1,299	965	1,621	1,252
Nitrate of Soda, 100 lb.; Superphosphate, 250 lb.	4,269	2,989	3,599	25·6	26·9	26·2	1,878	2,738	2,260	1,427	2,285	1,803
Superphosphate, 250 lb.; Muriate of Potash, 50 lb.	3,967	2,867	3,331	25·4	26·7	26·0	1,896	2,738	2,271	1,403	2,400	1,839
Nitrate of Soda, 100 lb.; Superphosphate, 250 lb.; Muriate of Potash, 50 lb.	4,249	2,973	3,580	26·4	28·8	27·5	1,811	2,778	2,241	1,539	2,497	1,958
Manure, 8 tons	3,713	2,996	3,338	25·3	30·4	27·5	1,697	3,235	2,381	1,351	3,062	2,100
Basic slag, 500 lb.	3,851	2,764	3,281	23·2	29·6	26·0	2,194	3,174	2,630	1,444	2,982	2,117
Manure, 16 tons; Superphosphate, 250 lb.; (1926-35, Manure, 8 tons)	—	3,460	—	—	32·7	—	—	4,066	—	—	4,075	—
Manure, 16 tons; Superphosphate, 500 lb. (1926-35, Check)	—	3,515	—	—	32·4	—	—	4,303	—	—	3,880	—
Manure, 16 tons (1926-35, Check)	—	3,378	—	—	32·1	—	—	3,750	—	—	3,137	—
Superphosphate, 500 lb. (1926-35, Superphosphate, 250 lb.)	—	2,984	—	—	25·6	—	—	3,278	—	—	2,909	—
Nitrate of Soda, 200 lb.; Superphosphate, 500 lb.; Muriate of Potash, 100 lb. (1926-35, N.P.K at half this rate)	—	3,800	—	—	29·9	—	—	3,455	—	—	3,156	—

* No yields of barley or clover in 1943 or barley in 1946

** No yields of timothy in 1938 or 1944.

Nitrogen brought about some increase in the O.P.V. yields, but otherwise nitrogen and potash had little effect on the crop yields. Superphosphate at 250 pounds per acre and manure at 8 tons per acre each gave substantial increases in the yield of all crops in the rotation. Further yield increases were obtained by increasing the superphosphate rate to 500 pounds and the manure rate to 16 tons per acre. The best yields were obtained from a combination of manure and superphosphate.

Over the period of the experiment, the pH values of the surface soil increased and the organic-matter content decreased.

Similar results were recorded in an experiment to evaluate the effect of farmyard manure alone, commercial fertilizer alone, and the combination of manure and superphosphate, as compared with a check rotation without either manure or fertilizer. This experiment involved a 4-year rotation of oats, barley, clover, and timothy with each crop in the rotation occupying one acre of land. Crop yields were doubled over the check by the use of manure for three of the four crops in the rotation and cash returns per acre were 50 per cent greater. The use of commercial fertilizer or manure plus superphosphate also resulted in decided increases in yield and cash returns.

Manure and commercial fertilizer combinations for potatoes on clay soil:— Nineteen different fertility treatments were applied to potatoes on clay soil as follows: three combinations of manure and commercial fertilizer, two rates of manure alone, one check plot receiving neither manure nor fertilizer, and thirteen commercial fertilizer applications. Such fertilizer analyses as 2-12-4, 2-12-6, 4-8-0, 4-8-4, 4-8-6, 4-8-8, 4-12-4, 4-12-6, 6-8-8, and 6-8-10 were applied in the row, with the exception of one broadcast application, at the rate of 500 pounds per acre. The 4-8-4 analysis was applied at 250, 500, and 750 pounds per acre. The potatoes were grown in a 4-year rotation of potatoes, wheat, clover hay, and timothy hay. The 9-year average yields per acre for the period 1934-42 are presented in table 26.

TABLE 26.—POTATOES ON CLAY SOIL

Average Yield per Acre 1934-42

Fertility treatments (rate per acre)	Marketable potatoes
	bu.
Check	140·6
Manure, 16 tons	209·9
Manure, 32 tons	222·7
Manure, 16 tons; 4-8-4, 250 lb.	232·9
Manure, 16 tons; 4-8-4, 500 lb.	255·4
Manure, 16 tons; 2-12-6, 500 lb.	236·4
4-8-0, 500 lb.	202·3
4-8-4, 250 lb.	165·1
4-8-4, 500 lb.	228·9
4-8-4, 750 lb.	259·0
4-8-6, 500 lb.	233·1
4-8-8, 500 lb.	222·7
6-8-8, 500 lb.	237·1
6-8-10, 500 lb.	238·1
2-12-4, 500 lb.	195·4
4-12-4, 500 lb.	242·9
2-12-6, 500 lb.	222·6
4-12-6, 500 lb.	237·1
4-8-4, 500 lb. (Broadcast)	187·1

The unfertilized area produced a yield of 140·6 bushels per acre. The application of 16 tons of manure per acre increased the yield to 209·9 bushels while 32 tons gave a yield of 222·7 bushels per acre. The 4-8-0, 4-8-4, 4-8-6, and 4-8-8 fertilizers applied at 500 pounds per acre gave yields of 202·3, 228·9, 233·1, and 222·7 bushels per acre, respectively. The 2-12-6 fertilizer treatment resulted in higher yields than the 2-12-4 treatment by 27·2 bushels, the actual yields being 222·6 and 195·4 bushels, respectively. The highest yields, from commercial fertilizer alone, namely 259·0 and 242·9 bushels per acre, were produced by using 750 pounds of 4-8-4 and 500 pounds of 4-12-4.

FIG. 4.—Typical drought cracks in northern Ontario clay soil caused by a lack of organic matter in the soil.

The addition of 16 tons of manure to 250 pounds of 4-8-4 increased the yield by 67·8 bushels. Where farmyard manure is available, a definite increase in yield can be obtained by its use. When 500 pounds of 4-8-4 was applied in the row it resulted in a 41·8 bushel increase over the same application of fertilizer applied broadcast.

Green manure experiments:—The object of these experiments was fourfold: to determine the value of green manure as compared with farm manure and to compare both with a check rotation that received neither manure nor fertilizer; to determine the value of green manure as compared with the green manure crop cut for hay; to determine to what extent sweet clover as green manure will supply nitrogen to the soil; and to compare sweet clover and red clover as green manure crops. The crops included in each rotation, the average yield per acre for the period 1935-45, and the average net cash returns per acre are presented in table 27.

Farm manure (rotation 2) gave a considerably higher yield than the check rotation (rotation 1) and a greater yield than sweet clover cut for hay or ploughed

TABLE 27.—GREEN MANURE EXPERIMENTS

Average Yields per Acre of Crops in the Rotation 1935-45

Rotation No.	Treatments (Total amounts of farm manure and commercial fertilizer used per acre during entire rotation indicated)	Oats	Sweet clover (cured hay)	Barley	Clover hay (cured hay)	Timothy hay (cured hay)	Average value of crops per acre after deducting cost of farm manure and/or commercial fertilizer
		bu.	tons	bu.	tons	tons	$
1	Check, no manure, no fertilizer	21·1	—	13·4	0·93	0·78	11·81
2	Farm manure, 16 tons	37·8	—	29·7	2·01	1·94	19·48
3	Sweet clover as green manure (no fertilizer) Sweet clover cut for hay	26·0	0·93	21·2	1·13	1·06	15.45
4	Sweet clover ploughed in as green manure	25·0	—	20·3	1·06	1·03	12.22
5	Sweet clover as green manure (fertilizer added) Sweet clover cut for hay plus nitrate of soda, 300 lb.; superphosphate, 300 lb.; and muriate of potash, 75 lb	37·5	1·11	37·6	1·71	1·65	20.06
6	Sweet clover cut for hay plus superphosphate, 300 lb.; muriate of potash, 75 lb	33·4	1·14	29·1	1·61	1·54	19.20
7	Sweet clover ploughed in as green manure plus nitrate of soda, 300 lb.; superphosphate, 300 lb.; and muriate of potash, 75 lb	35·7	—	34·8	1·72	1·58	16.46
8	Sweet clover ploughed in as green manure plus superphosphate, 300 lb.; and muriate of potash, 75 lb	34·3	—	27·8	1·63	1·48	16.12
9	Sweet clover versus red clover as green manure Sweet clover ploughed in	25·5	—	19·3	0·73	—	11.07
10	Red clover ploughed in	22·0	—	18·0	0·59	—	9.69

in (rotations 3 and 4). When commercial fertilizer was added to a sweet clover green manure rotation (rotations 5, 6, 7 and 8) the yields were increased above the rotation with no commercial fertilizer (rotations 3 and 4). The addition of 300 pounds of nitrate of soda to rotations 5 and 7 did not give any appreciable increase in yield over rotations 6 and 8 where nitrate of soda was not used.

Sweet clover ploughed in as green manure gave a slight increase in yield over red clover ploughed in. The value of the sweet clover when cut for hay was partly responsible for the higher net cash returns per acre over the rotations in which sweet clover was ploughed under. It would appear that ploughing in sweet clover as green manure (rotation 3) gives a slight increase in yield over the check (rotation 1) but no noticeable difference was noted in the net cash returns per acre.

Pasture Investigations

A large grazing experiment was laid out in 1946 to determine the most suitable fertilizer formulae to use on permanent pastures and on cultivated pastures. Five acres of a rough, uncultivated, virgin area had the brush removed and three acres of this were fertilized. The remaining two acres were left

unfertilized as a check. The cultivated pasture area was sown in 1948 and fertilizer was applied for the entire experiment at the same time. A second application of fertilizer was applied on the entire experiment again in 1951.

The pasture mixture sown on the cultivated pasture in 1948 and the rate per acre in pounds was as follows: timothy 4, creeping red fescue 4, Kentucky blue 3, red top 1, early red clover 2, late red clover 2, alfalfa 5, alsike 1, and white Dutch clover 1.

The experiment is being conducted on three-acre fields. Yields are recorded by clippings from cages one yard square located on the grazed areas. Records are also kept of the number of grazing days and the gain in live weight of steers used to graze the pasture. For purposes of this experiment an animal unit is considered as a steer weighing 600 pounds at the start of the pasture season and 930 pounds after 150 days on pasture.

TABLE 28.—COMMERCIAL FERTILIZER FOR PASTURES

Data on a per Acre Basis

Field No.	Treatment	Type of pasture	Number of years in averages	Yield of dry matter	Carrying capacity animal units	Return over cost of fertilization
			yr.	lb.	No.	$
1	Check, no fertilizer	Permanent	4	1,616	0·48	35.49
2	Superphosphate 600 lb. every 3 years	Permanent	4	2,620	0·74	56.82
3	Superphosphate 600 lb. every 3 years; potash 100 lb. every 3 years	Permanent	4	3,021	0·74	54.12
4	Superphosphate 600 lb. every 3 years; sulphate of ammonia 100 lb. annually	Permanent	4	2,970	0·81	57.37
5	Superphosphate 600 lb. every 3 years; potash 100 lb. every 3 years; sulphate of ammonia 100 lb. annually	Permanent	4	3,237	0·79	54.98
6	Superphosphate 600 lb. annually; potash 100 lb. annually; sulphate of ammonia 100 lb. annually	Permanent	4	3,159	0·79	45.17
7	Manure 10 tons every 3 years	Permanent	4	1,541	0·57	35.19
8	Check, no fertilizer	Cultivated	2	1,835	0·54	47.64
9	Superphosphate 600 lb. every 3 years	Cultivated	2	3,393	0·85	76.43
10	Superphosphate 600 lb. every 3 years; potash 100 lb. every 3 years	Cultivated	2	3,479	0·76	63.98
11	Superphosphate 600 lb. every 3 years; sulphate of ammonia 100 lb. annually	Cultivated	2	3,227	0·74	62.12
12	Manure 10 tons every 3 years	Cultivated	2	1,791	0·64	51.94
13	Superphosphate 600 lb. annually; potash 100 lb. annually; sulphate of ammonia 100 lb. annually	Cultivated	2	3,883	0·88	61.88
14	Superphosphate 600 lb. every 3 years; potash 100 lb. every 3 years; sulphate of ammonia 100 lb. annually	Cultivated	2	2,957	0·72	60.04
18	Superphosphate 600 lb. every 3 years; potash 100 lb. every 3 years; sulphate of ammonia 100 lb. annually	Virgin	3	2,466	0·67	44.07
19	Check, no fertilizer	Virgin	3	1,401	0·45	33.51

Shown in table 28 are the fertilizer treatments applied on the old pasture sward, fields 1 to 7, and the 4-year average results for the period 1948 to 1951. Also included are the fertilizer treatments applied to the cultivated pasture, fields 8 to 14, with the 2-year average results for the period 1950 to 1951, and the

fertilizer treatment on the virgin area fields 18 and 19, with the 3-year average results for the period 1949 to 1951.

A combination fertilizer treatment of 600 pounds of superphosphate per acre applied once every three years and 100 pounds of sulphate of ammonia per acre applied annually gave the highest carrying capacity and the best cash return per acre on the old pasture sward. The greatest cash returns per acre on the cultivated pasture were derived from the application of 600 pounds of superphosphate per acre applied once every three years. When unimproved virgin areas were fertilized, as was field 18, the cash returns per acre were much lower than the improved and cultivated pasture such as fields 5 and 14. The unfertilized fields all gave low cash returns per acre.

Weed Eradication

Cultural weed control:—The spread of perennial sowthistle through northern Ontario has long been a problem and has now reached alarming proportions. To determine the possibility of controlling this weed by cultural methods an experiment using small plots was established in 1935.

Nine treatments, listed in table 29, were tried on an area infested with sowthistle. Treatments Nos. 1 to 7 and No. 9 were conducted in a 4-year rotation consisting of oats; a mixture of oats, peas and vetch, for ensilage; barley; and hay. Treatment 8 was a continuous-cropping method of control, using the following four crops: oats, peas and vetch (O.P.V.) for ensilage; barley; sunflower for ensilage; and buckwheat.

Treatment No. 1 was fall ploughed with no further work and serves as a check plot with which to compare the other treatments. After haying, treatments 2, 3, 4, 5, 7, and 9, were ploughed 4 inches to 5 inches deep and the sod worked down by disking. The barley was not seeded down in treatment 6 and was followed by summerfallow. Additional treatments are given in table 29. The oat crop was harvested to determine the effect of treatment on yield.

TABLE 29.—CONTROL OF PERENNIAL SOWTHISTLE BY CULTURAL METHODS

Treatment	Stand of weeds per square yard (9-year average) 1938-46		Percentage kill	Yield of oats per acre (9-year average) 1938-46	
	Before treatment	After treatment		Grain	Straw
	No.	No.	%	bu.	tons
1. Check, fall ploughed	101·2	76·9	24·0	40·4	0·96
2. After hay cultivate every three days for remainder of season	83·4	3·4	95·6	52·0	1·30
3. After hay cultivate every week for remainder of season	96·2	7·7	92·0	48·3	1·25
4. After hay cultivate every week then plough again in the fall	117·9	5·6	95·3	42·4	1·07
5. Cultivate every week after hay, plough again in fall. Plough after oats and cultivate every week, plough again in the fall	111·9	4·4	96.1	42·5	1·13
6. Cultivate summerfallow every three days weather permitting	67·8	1·1	98.4	46·3	1·17
				Green tons (8-year average) 1938-46	
7. Sunflowers replaced oats: cultivate every week after hay is ploughed	62·8	7·4	88.2	15·56	—
8. Same as No. 4 except not re-infested after initial infestation	119·9	11·3	90·6	45·8	1·15

All plots that were ploughed and cultivated after the hay was removed showed a high percentage kill. There appeared to be no significant difference in percentage kill between any of these treatments. The introduction of a hoed crop to the rotation gave a lower percentage kill.

Comparing treatments Nos. 3 and 4, the reploughing in the fall (treatment 4) gave a 3·3 per cent greater kill which cannot be considered significant. On the other hand the yield of the subsequent crop, both in grain and straw, was greater with treatment No. 3. This was the case not only on the average but consistently throughout the nine years. It would appear therefore that reploughing in the fall has given no greater control of sowthistle and has decreased the yield of the subsequent grain crop. The additional cultivation in treatments Nos. 2 and 5, does not appear to have given a greater control of weeds.

Within the limits of the experiment the treatments were uniformly successful in reducing the stand of sowthistle but no treatment gave absolute eradication such as is given by 2,4-D treatment, see table 31. It would appear that the growth of surviving weeds would rapidly bring the stand back to serious infestation. Grain yields following treatments were all greater than on the check plots but reploughing in the late fall resulted in a probably significant reduction in yields.

In the continuous-cropping method, where one crop is grown on the same area year after year (treatment 8) the A and B sections were cultivated every week after the crop was removed and fall ploughed. The C and D sections were fall ploughed after the crop was removed. Additional treatments and results are given in table 30.

TABLE 30.—CONTROL OF PERENNIAL SOWTHISTLE BY CONTINUOUS CROPPING

No.	Treatment	Stand of weeds per square yard (8-year average) 1938-46		Percentage kill	Yield per acre 8-year average 1938-46	
		Before treatment	After treatment		Grain or green matter	Straw
		No.	No.	%		tons
8 A	Continuous, Oats, Peas, Vetch	280·0	198·1	29·3	2.41 tons	—
8 B	Continuous, Barley	271·2	244·3	9·9	15·6 bu.	0·47
8 C	Continuous, Sunflowers	44·4	24·0	45·9	8·52 tons	—
8 D	Continuous, Buckwheat, cultivated in spring 2 or 3 times before seeding	171·8	96·1	44·1	6·1 bu.	—

None of these treatments is in any way effective in the control of sowthistle. Downy mildew reduced the yield of sunflowers for several years and for two years caused a crop failure. Yields of all other crops were very poor. For the last three years the O.P.V. crop was so heavily infested with sowthistle that no yield determinations could be made. The growth of buckwheat was poor in every season. Climatic conditions do not promote the rank and luxurious growth that is necessary if buckwheat is to be effective as a smoother crop. The three smoother crops, O.P.V., barley, and buckwheat, and the hoed crop sunflowers, proved ineffective in the eradication of sowthistle.

Control of perennial sowthistle and couch grass with sodium chlorate:—Concentrations of sodium chlorate of 5, 10, 15, and 20 per cent solutions were applied to perennial sowthistle and couch grass during the period 1935-46, at rates of

75, 100, 200, and 300 gallons per acre during the months of May to September. A 10 per cent solution of Atlacide at 100 gallons per acre was also used. Kills of 50 to 95 per cent were recorded for perennial sowthistle and 65 to 95 per cent for couch grass on a 6-year average.

Sodium chlorate, 5 per cent solution at 200 gallons per acre, applied in July, August, and September gave the best results for couch grass and sodium chlorate, 10 per cent solution at 100 gallons per acre, applied in May, June, and July was most effective for sowthistle. Atlacide was less effective than sodium chlorate. Sodium chlorate had a more lasting effect when applied in solution than when used as a dry powder. Three applications per year were preferable to one or two applications, even when the material applied in the one or two applications was equal in quantity to the total of the three applications.

Oats were planted for the first and second years after treatment to determine the sterilizing effect on the soil. In the first year after treatment yields varied from low to a crop failure. By the second year, yields were almost back to normal.

Sodium chlorate will control perennial sowthistle and couch grass, but it is not recommended because of its soil-sterilizing action.

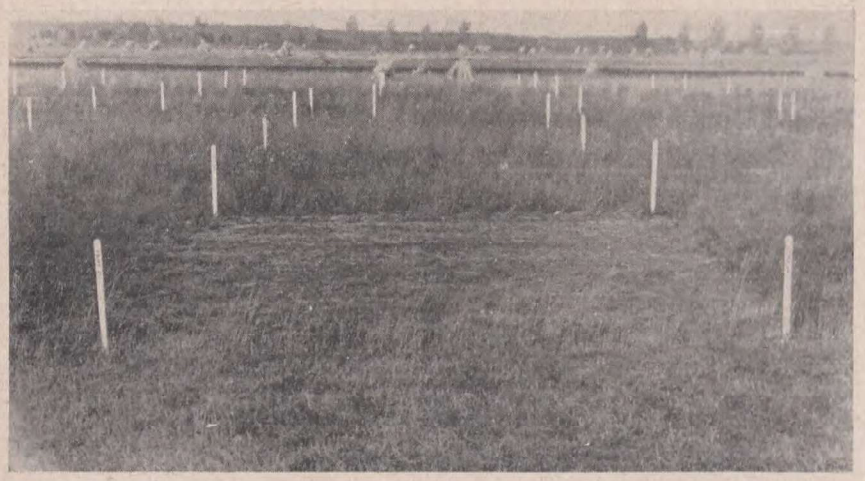


FIG. 5.—Sodium chlorate when applied to perennial sowthistle kills out all vegetation.

The control of perennial sowthistle with 2,4-D:—A test to ascertain the effect of time, concentration, and rate of application of different types of 2,4-D formulations on perennial sowthistle was started in 1946 and completed in 1948. The plots sprayed were located on a clover-timothy sod and contained a reasonably uniform stand of perennial sowthistle. Percentage stands of weeds, both before and after treatment, were determined by actual counts.

The various concentrations, rates of application, formulations, and stages of growth at which the sowthistle was sprayed, and the results recorded, are presented in table 31.

An increase in concentrations, except with the ester, tended to increase the kill in the full-emergence stage of growth while little or no significant difference occurred in the first-bud and full-bloom stages. Concentrations of 2 pounds of acid per acre, and over, gave very satisfactory kills at the first-bud and full-bloom stages. Fall-rosette treatments gave a lower percentage kill, and results were particularly erratic in 1946. Results from ethyl and butyl esters were practically

TABLE 31.—RESULTS OF 2,4-D TREATMENT ON PERENNIAL SOWTHISTLE 1946 AND 1947

Chemical used	Concentration in pounds acid per acre	Rate in gallons per square rod	Percentage of treated tops killed after original treatment						
			Full emergence		First bud		Full bloom	Fall rosette	
			1946	1947	1946	1947	1947	1946	1947
	lb.	gal.	%	%	%	%	%	%	%
Sodium Salt	½	¾	33·9	—	58·9	—	—	0·0	—
	1	¾	60·4	—	34·5	—	—	9·6	—
	1½	¾	43·9	—	74·1	—	—	0·0	—
	2	¾	71·9	—	91·4	—	—	26·0	—
	1	1½	58·3	—	95·5	—	—	9·5	—
	2	1½	70·3	69·6	97·7	90·3	98·1	25·5	75·8
	3	1½	78·1	76·9	97·7	94·1	97·5	0·0	52·8
	4	1½	96·7	81·9	97·5	93·5	96·4	27·5	75·6
Amine Salt	1	1½	80·5	—	95·1	—	—	0·0	—
	2	1½	92·9	47·4	97·8	83·8	98·2	0·0	76·9
	3	1½	93·3	76·9	97·3	93·9	96·9	0·0	85·3
	4	1½	99·0	85·3	83·8	99·3	99·3	23·9	84·3
Ethyl Ester	1	1½	89·7	—	91·1	—	—	0·0	—
	2	1½	95·6	87·1	92·3	97·7	95·6	16·3	74·1
	3	1½	94·6	86·9	93·9	98·3	80·6	0·0	80·7
	4	1½	97·1	88·7	78·9	98·9	79·7	14·1	81·1
Butyl Ester	1	1½	97·3	—	81·6	—	—	3·5	—
	2	1½	99·1	—	80·9	—	—	18·9	—
	3	1½	92·9	—	63·3	—	—	0·0	—
	4	1½	97·0	—	42·3	—	—	20·6	—
Sodium Salt	2	1	94·7	—	85·3	—	—	0·0	—
Amine Salt	2	1	95·5	—	93·9	—	—	28·9	—
Ethyl Ester	2	1	99·7	—	87·9	—	—	0·0	—
Butyl Ester	2	1	99·7	—	88·5	—	—	0·0	—

equal. The esters and sodium salt killed all legumes at all concentrations, while with the amine salt complete kill of legumes resulted only from the heaviest concentrations.

The results of this experiment indicate that 2 pounds of acid per acre in the ester form applied at the first-bud stage of growth would provide the best control of perennial sowthistle.

To ascertain the effect of retreatment with 2,4-D the 1946 plots were again sprayed in 1947 at the same concentrations and rates of application as used in 1946. All concentrations of esters, amine salts, and the three highest concentrations of sodium salt gave effective control of perennial sowthistle. Retreatment at any stage of growth appeared equally effective.

These experiments indicate that perennial sowthistle can be eradicated with 2,4-D. To obtain complete eradication, treatments should be repeated the year following the original treatment. Early and mid-season treatments are preferable to fall applications. Red clover and alfalfa appeared to suffer less damage from an amine salt than from sodium salts or esters.

Controlling weeds in potatoes with 2,4-D:—To test the possibility of controlling weeds in potatoes by means of chemicals, concentrations of $\frac{1}{8}$ and $\frac{1}{4}$ pounds of 2,4-D acid per acre in the sodium, amine, and ester forms, were applied to five varieties of potatoes in 1948. Two sets of plots were treated at different stages of growth; the first at full emergence of the potatoes and the second one week after full emergence. The $\frac{1}{8}$ and $\frac{1}{4}$ rates of application had no apparent effect on the potatoes and they had little or no effect on the weed growth.

In 1949 the concentrations were increased to $\frac{1}{2}$ and $\frac{3}{4}$ pounds of 2,4-D acid per acre. These concentrations caused damage to the potato tops and the yields

of the treated plots were below the untreated. The results indicated that spraying at the full-emergence stage of growth was more detrimental to yields than the later spraying.

Control appeared to be obtained on the following weeds in the plots: perennial sowthistle, dandelion, curled dock, and groundsel. The most severe injury from treatment was suffered by Green Mountain followed by Warba, Irish Cobbler, Chippewa, and Katahdin varieties in that order.

The spraying of potatoes with 2,4-D for weed control is not recommended.

Chemical control of couch grass:—Two new chemicals isopropyl-N phenyl carbonate (I.P.C.) and sodium trichloroacetate (T.C.A.) were given preliminary trials in 1948-50. The I.P.C. was applied at 10 and 80 pounds per acre on both old and new sod of couch grass. Only a slight temporary setback was noted at each rate and the plots had completely recovered in 1949 from the 1948 treatment. T.C.A. applied on an old sod infested with couch grass at 25, 50, 75, and 100 pounds per acre in solution gave kills from 93 to 100 per cent. This chemical is recommended for spot treatment at the rate of 50 to 100 pounds per acre.

If tillage is practised prior to applying the chemical the rate can be reduced. When the couch grass sod was ploughed then sprayed; ploughed, sprayed then disked; or ploughed, disked then sprayed only half as much chemical was needed.

Drainage Experiments

Tile drainage:—In 1921 half of a twenty-acre field was tile-drained and the remainder left as a check with only surface drainage. The tile-drained area gave a slight increase in yield for all the crops grown. These increases per acre over the undrained area were as follows: Oats, 5·3 bushels; O.P.V. for silage, 1·42 green tons; clover, 0·01 tons; and timothy, 0·08 tons. The oat and O.P.V. crops received the most benefit from under-drainage. In terms of average net cash returns per acre, the tile-drained area gave $19.19, and the undrained area $15.98, an increase of $3.21 in favour of tile drainage.

These small increases in yield and cash returns attributed to tile drainage are undoubtedly related to the following factors. In heavy clay areas it is difficult for water to penetrate the soil to reach the drains, thus reducing their effectiveness. In muck soil areas the tiles often settle thus forming pockets in which the water lies. This water freezes during the winter, often breaking the tile or obstructing the flow of water till long after spring seeding.

Under the conditions of this experiment tile drainage failed to give worthwhile increases in yields.

Surface drainage:—Drainage is such a problem on the flat heavy clay areas of the district, that the Richard system of ploughing, using permanent dead furrows, was established in the first few years of the Station's operation. In 1922 an experiment was started to compare the results obtained by spacing the furrows 18, 24, 36, and 48 feet apart. The average results indicated that the 48-foot lands were consistently superior throughout.

FORAGE CROPS

M. R. Wiancko

Variety Testing

Alfalfa

Of the older varieties that have been under test for a considerable period of time, little or no variation exists between Ontario Variegated, Grimm, and Cossack. Yields of Ladak on first- and second-year meadows compare favourably with the above varieties but its great susceptibility to winter-killing often lowers the yield in the third year. The 7-year average yields of these varieties in tons of hay per acre were: Ontario Variegated 2·16, Grimm 2·31, Ladak 2·12, and Cossack 2·04.

A newer variety, Viking, yields well but lacks the ability to produce good aftermath for second-cut hay or pasture. Ladak has the same fault to a certain extent. Several new varieties Canauto, Rhizoma, Buffalo, Ranger, and Ferax have recently been tested. Of these varieties, Rhizoma is the only one that will compete favourably with Grimm, Cossack, or Ontario Variegated. Ferax is definitely a low yielder, and fall frosts yellow the top growth much sooner than the other varieties.

The recommended variety for this district is Grimm.

Red Clover

Several varieties of single- and double-cut types have been under test. The average hay yields of some of these varieties over a 5- and 11-year period are presented in table 32.

TABLE 32.—AVERAGE YIELDS OF RED CLOVER VARIETIES AT KAPUSKASING, 1940-51

Variety	Yield of hay per acre					
	5-Year average 1946-51			11-Year average 1940-51		
	First cut	Second cut	Total cut	First cut	Second cut	Total cut
	tons	tons	tons	tons	tons	tons
Single-cut Type—						
Altaswede	2·03	—	2·03	2·62	—	2·62
Manhardy	2·05	—	2·05	2·42	—	2·42
Leon	1·53	—	1·53	—	—	—
Double-cut Type—						
Commercial	1·32	0·81	2·13	1·25	1·08	2·33
Ottawa Early	1·29	0·81	2·10	1·30	1·12	2·42
Redon	1·71	0·27	1·98	—	—	—

Altaswede and Manhardy of the single-cut varieties both produce excellent yields. Two other single-cuts, Mammoth and Graham, were tested and discontinued because of low yielding ability.

Altaswede and Manhardy produce about the same amount of hay in one cut as the double-cuts do in two cuts per year. These two varieties also produce well as second-year meadows. On second-year meadows the 4-year average of Altaswede and Manhardy was 1·88 and 1·84 tons of hay per acre, respectively, while Ottawa Early and Commercial gave 0·77 and 0·74 tons, respectively.

Ottawa Early over the long-time average, gave the best yield of the double-cut varieties. Redon, while showing good yield in the first cut, produced a second cut only twice in the five years it has been under test. In northern Ontario, Redon behaves more like an early single-cut variety.

Sweet Clover

Biennial sweet clover, compared with an annual sweet clover, cut once for hay, consistently gave a higher yield. The 6-year average yield per acre of hay was as follows: White Blossom, 2·85 tons; Yellow Blossom, 2·55 tons; and Hubam (annual), 1·80 tons. When this same test was cut twice a year, for hay, the spread in yield was even greater in favour of the biennial types.

Eight varieties of sweet clover have been tested. Common Biennial White, which is the ordinary commercial variety, has been the heaviest yielder; but it is coarser in the stem and less leafy than the other varieties. Of the heavier yielding varieties, Grundy County White and Erector are the best. Alpha No. 1 and Brandon Dwarf are finer and leafier but yield less. The latter two varieties have the advantageous characteristic of being prostrate in growth the first year. Since they do not grow up into the grain to the same extent, they interfere less with harvesting the nurse crop.

While Common White has outyielded all others, it is coarser, less leafy, and makes poorer hay than Brandon Dwarf or Alpha No. 1, which are much finer in the stem and are very leafy. Alpha No. 1 has shown itself to be more susceptible to disease than the others.

As a crop for northern Ontario, sweet clover has proved unreliable, especially when seeded with a nurse crop.

Timothy

During the period 1941-47 a total of twenty-five varieties of timothy were tested. In the years 1943, 1944, and 1945 the test failed to produce a satisfactory stand because of patchy growth and the infestation of volunteer alsike clover. Broadcast plots were used for testing in 1941-42. In 1946-47 an individual plant test was used, with each variety being grown in a 34-foot row with plants spaced 1 foot apart in the row. Six plots were grown of each variety in a randomized design. The named varieties tested during 1941-47 and the dry matter yields obtained are presented in table 33.

TABLE 33.—VARIETY TEST TIMOTHY

(Average Results 1941-47, inclusive)

Variety	Broadcast test		Individual plant test	
	Period tested	Average dry matter yield per acre	Period tested	Average dry matter yield per acre
		tons		tons
Boon	1941–42	1·20	1946–47	1·10
Swallow	1941–42	1·19	1946–47	1·21
Milton	1941–42	1·36	1946–47	1·32
Drummond	—	—	1946–47	1·32
Ott. 1956-13 (Climax)	—	—	1946–47	1·25
Cornell 1777	1941–42	1·27	1946–47	1·28
Cornell 4059	1941–42	1·33	1946–47	1·03
Dural	—	—	1946–47	1·14
Nappan	—	—	1946–47	1·21
Medon	—	—	1946–47	1·50
Lorain	—	—	1946–47	1·10
Commercial	1941–42	1·38	—	—

This test failed to show any consistent superiority of one variety over another or over commercial seed. Such varieties as Medon, Milton, Boon, and Drummond showed more leafiness than Commercial but did not necessarily produce more hay per acre. This added leafiness, however, does produce hay of higher quality. The varieties Medon and Drummond showed slightly better aftermath production.

Timothy, as a hay grass, is well adapted to the district and produces as well or better than other hay grasses tested. It is the recommended grass to be included in all hay or hay-pasture mixtures. It should be grown in combination with legumes such as alfalfa, red clover, and alsike clover.

White Clover

In pure stands of white clover, ladino shows a slight superiority in yield over the varieties white Dutch, Pathfinder, and New Zealand. The 4-year average yield of dry matter produced per acre per year during the period 1946-51 was as follows: Ladino, 2,270 pounds; White Dutch, 2,049 pounds; New Zealand, 1,412 pounds; and Pathfinder, 1,533 pounds. New Zealand is a low yielder and is less winter hardy than the other varieties.

Ladino, when used to replace red clover and alsike in a pasture mixture, gives the same dry matter yield per acre. Either ladino or white Dutch clover should be included in pasture mixtures.

Hybrid Corn

To determine the possibility of growing early maturing varieties of hybrid corn in the Great Clay Belt, tests were sown in 1945, 1946, 1948, and 1949.

Over this period the following hybrid strains were tried:—

Canada 240	Canbred 150
Canada 255	Canbred 250
Canada 275	Wisconsin 255
Canada 279	Wisconsin 335
Canada 355	Wisconsin 416
Canada 531	

At no time during the 4-year period did the corn make sufficient growth, or reach a stage of growth, where it could be cut as an ensilage crop. Growth was

FIG. 6.—Typical growth of hybrid corn, at the end of August, Experimental Station, Kapuskasing. Ensilage corn is not a reliable crop in the district.

so poor that no apparent difference was noted between varieties. These tests indicate that hybrid corn cannot be grown successfully for ensilage in the district.

Field Carrots

Over a 16-year period varieties and strains of field carrots were grown in test plots. Yields on the average were low. For ten varieties the average green yields varied from 6·03 tons to 3·62 tons per acre. The Improved Short White variety was the highest yielder and has the added advantage of being less difficult to harvest because of its shorter length.

Swede Turnips

Varieties and strains of swede turnips were tested during a 20-year period. Average green yields per acre varied from 12·99 to 9·15 tons. These yields are not particularly attractive considering the work involved in producing the crop. Variations in yields are small between varieties particularly on a dry-matter basis. The best varieties appear to be Hall's Westbury, Bangholm, Corning's Green Top, Ditmars Bronze, Purple Top, and Improved Yellow.

Mangels

Mangels were under test for 17 years and the types tested included the globe, intermediate, long, tankard, and half-sugar. Globe proved to be the most satisfactory. It is the easiest to pull, cleans readily, and gave the highest yields of the types tested. Yields were inclined to be low. Twenty-three varieties gave an average yield of between 8·98 and 6·48 tons of green feed per acre. Giant Yellow Globe was the best variety grown.

Fall Turnips

The variety testing of fall turnips was conducted over a 16-year period during which twenty-five varieties were tested. Purple Top Mammoth, Devonshire Greystone, and Improved Greystone appeared to be the most promising varieties. Fall turnips produced the greatest yield of green tonnage of the four field root crops but did not necessarily produce more dry matter per acre than mangels. Turnips can be stored only for two or three months in the fall.

Field roots have not been grown to any extent in northern Ontario for several reasons. A large amount of manual labour is required to grow the crop. Yields are inclined to be low and uncertain. Harvesting on the average is made difficult by cold, wet autumn weather with snow often falling before and during the harvest period.

Annual Hay Crops

This experiment was established to determine the relative suitability of oats, and millet as annual hay crops.

Oats

Thirteen varieties of oats, which included nine late and four early varieties, were tested as annual hays and cut at the following stages of growth: in bloom, when turning, and early ripe.

The 6-year average yields of cured hay per acre for the early and late varieties at the different growth stages were as follows:—In bloom, the late varieties varied from 1·74 tons to 2·15 tons per acre, while the early varieties yielded 1·54 tons to 1·64 tons per acre. When turning, the late varieties averaged 2·08 to 2·33 tons per acre and the early varieties 1·52 to 1·90 tons per acre. At the early ripe stage of growth, the yields of the late varieties were 1·94 to 2·23 tons per acre and of the early varieties 1·58 to 1·86 tons per acre.

The yields obtained from the late varieties were somewhat above the early varieties. Victory appears superior among the late varieties, while O.A.C. No. 3

is the best of the early varieties. From the standpoint of quality, the early varieties are superior to the others because of finer straw.

It would appear that for best results oats used for a hay crop should be cut when 10 to 20 per cent have turned. The greatest weight of dry matter is obtained at this stage and the palatability is also good.

As a general rule hay crops produce well in the district and there is little need for an annual hay crop. If a late-sown oat crop fails to mature, well cured oat hay makes satisfactory feed and is relished by livestock, especially cattle.

Millet

Four varieties of millet have been tested, Japanese, Siberian, Hungarian, and Common. These varieties produced the following yields of hay per acre: Japanese, 2·38 tons; Siberian, 2·48 tons; Hungarian, 2·49 tons; and Common, 2·39 tons.

As the seed of this crop must be purchased each year and is not readily procurable, and since the hay is not suitable for horse feed, millet cannot be recommended for use in this district.

Hay Mixtures

This test was begun in 1940 to determine the most suitable mixture of alfalfa, red clover, timothy, and alsike for hay purposes. Yields are taken on first-, second-, and third-year meadows. The average results obtained over a 10-year period are presented in table 34.

TABLE 34.—HAY MIXTURE TEST

(10-Year Average 1941-51)

Mixture No.	Mixture in pounds per acre	Yield of hay per acre
		tons
1	Early red clover 8, timothy 8, alsike 2	2·09
2	Late red clover 8, timothy 8, alsike 2	2·52
3	Alfalfa 5, early red clover 4, timothy 8, alsike 2	2·64
4	Alfalfa 5, early red clover 2, late red clover 2, timothy 8, alsike 1	2·64
5	Alfalfa 5, late red clover 4, timothy 8, alsike 1	2·80
6	Alfalfa 2½, late red clover 2, timothy 4, alsike ½	2·73
7	Alfalfa 5, late red clover 4, timothy 4, alsike 1	2·72
8	Alfalfa 2½, late red clover 4, timothy 8, alsike 1	2·65
9	Alfalfa 5, timothy 8, alsike 1	2·85
10	Alfalfa 10	2·35

The use of late red clover (Altaswede variety) in preference to early red clover (Commercial variety) increased the yield of mixture 2 over mixture 1 by more than one-half ton per acre. Similarly mixture 5 gave one-quarter ton per acre more than mixture 3. The rate of seeding of mixture 6 was only half that of mixture 5, yet the yield was only slightly reduced. This reduction in yield usually occurs in the first-year meadows.

On well-drained land, where alfalfa can be grown, it is definitely profitable to add it to the mixture. The recommended mixture for the district on well-drained land is alfalfa 5, late red clover 4, timothy 8, and alsike 1 pound per acre; and for poorly drained land, late red clover 8, timothy 8, and alsike 2 pounds per acre.

Hay-Pasture Mixtures

Twelve different grass and legume mixtures were sown in 1945, and again in 1948. From this test it was hoped to find an adaptable mixture for hay and pasture purposes. Hay was cut the first and second years, with the aftermath used as pasture, and in the third year the mixtures were used for pasture exclusively. The mixtures under test and the results obtained are presented in table 35.

The use of late red clover increased the hay yield considerably but produced less aftermath growth for pasture when compared with early red clover. The addition of alfalfa to a mixture increased the aftermath yield. Replacing part of the timothy by brome and meadow fescue decreased the hay cut but gave the same total dry matter yield. The addition of bottom grasses such as Kentucky blue, red top, and creeping red fescue increased the total dry-matter yield on a 6-year average over the standard hay mixture by 9·2 and 13·0 per cent as indicated by mixtures 11 and 12.

Pasture Mixtures

In a test of pasture mixtures the same twelve grass and legume combinations mentioned in table 35 were sown in 1945 and again in 1948. These mixtures were used for pasture only, during the period 1946-51.

The absence of alfalfa in the mixture lowered the yield, particularly during the late summer and early autumn. When ladino clover replaced the alsike, a drop in yield of 401 pounds of dry matter per acre was recorded on the 6-year average. Bottom grasses in the mixture appeared to give a more uniform yield over the season but did not increase the total yield.

Adequate rainfall during the growing season usually maintains pasture growth. Proper fertilization and an adapted grass and legume mixture can greatly increase the total yield of pasture per acre. In many cases carrying capacity can be doubled by ploughing up and reseeding old pasture areas.

Species Testing

Four tall-growing grasses combined with a basic mixture of alfalfa, late red clover, and alsike, also four bottom-grass types combined with white Dutch clover, are under test to determine the relative value of these different species of grass for pasture purposes. Only slight differences in yield have been noted between timothy, brome, and meadow fescue, but reed canary yielded 1,000 to 1,200 pounds less dry matter per acre than the above three. Reed canary, when grown from seed, is slow to establish itself, which may explain this low yield. Of the bottom grasses, red top yielded from one-half to two-thirds of a ton more dry matter per acre than Canada blue, creeping red fescue, and Kentucky blue.

Perennial Introduction Nursery

A perennial nursery was first sown in 1936 to test, in a small way, the plant introductions and new varieties of grasses, legumes, and miscellaneous plants that become available from time to time. A large addition was made to the nursery in 1945 and again in 1948, and well over one hundred species have been tested. Observations are made on hardiness, longevity, seeding habits, and the suitability and practical value of many species, varieties, and strains. Difficulty has been experienced in establishing some introductions by seed, especially some of the small-seeded grasses. Within their groups, Kansas brome, Mefon meadow fescue, Oron orchard grass, and Chieftain Canada blue grass, appear to be the most suitable.

Turf Grass Experiments

This project was established in 1949 to test the suitability and adaptability of certain lawn grasses and lawn mixtures for private lawns, school grounds, play grounds, parks, and golf courses in northern Ontario.

TABLE 35.—GRASS AND LEGUME MIXTURES FOR HAY-PASTURE PURPOSES

Mixture No.	Mixture in pounds per acre													Total yield of dry matter per acre (6-year average) 1946-51	Percent yield of Mixture No. 4
	Timothy	Brome	Meadow fescue	Red top	Reed canary	Kentucky blue	Alfalfa	Early red clover	Late red clover	Alsike	White Dutch clover	Ladino	Creeping red fescue		
														lb.	%
1	10	—	—	—	—	—	—	—	8	2	—	—	—	2,775	87·9
2	10	—	—	—	—	—	—	8	—	2	—	—	—	2,281	72·3
3	8	—	—	—	—	—	5	4	—	1	—	—	—	3,223	102·1
4	8	—	—	—	—	—	5	—	4	1	—	—	—	3,157	100·0
5	8	—	—	—	—	—	5	—	4	—	—	2	—	3,244	102·7
6	8	—	—	—	—	—	5	2	2	1	—	—	—	3,143	99·5
7	5	10	—	—	—	—	5	2	2	1	—	—	—	3,299	104·5
8	5	—	6	—	—	—	5	2	2	1	—	—	—	3,152	99·8
9	4	5	3	—	—	—	5	2	2	1	—	—	—	3,342	105·9
10	4	5	3	1	—	3	3	2	2	1	2	—	—	3,014	95·5
11	4	—	—	1	4	3	5	2	2	1	—	—	—	3,448	109·2
12	4	—	—	1	—	3	5	2	2	1	—	—	4	3,567	113·0

Mixture No. 4 is the recommended standard hay mixture for the district.

In the pure species of grasses, New Brunswick creeping bent shows the most aggressiveness in its ability to keep out volunteer white clover and weeds. This grass is superior in aggressiveness, texture, and density to Prince Edward Island Colonial bent and Velvet bent. Chewing's fescue lacks the aggressiveness of New Brunswick creeping bent but has the same density with slightly coarser texture. Kentucky blue grass is superior to Canada blue grass in rapidity of ground coverage, density, and texture but lacks the aggressiveness of Canada blue. Creeping red fescue is less aggressive than Chewing's fescue, being less dense and coarser in texture. Alta fescue shows a decided lack of aggressiveness and is coarse in texture. Red top, while having almost the same aggressivness as the bent grass, gives a coarse, open turf.

FIG. 7.—A section of the turf grass experiment with the Station office in the centre background. The test includes nine pure species and twenty-two mixtures.

In northern Ontario, volunteer white clover rapidly invades a lawn mixture composed of grasses only. Lawn grass mixtures sown in 1948 had 35 to 85 per cent of the ground coverage occupied by volunteer white clover in the fall of 1951. The grass mixture that appeared to be the most aggressive was composed of 30 per cent Kentucky blue, 30 per cent Prince Edward Island Colonial bent, and 40 per cent creeping red fescue by weight, and was sown at the rate of 5 pounds per 1,000 square feet. This mixture is also fine in texture and has good density.

When 5 per cent white Dutch clover was added to a grass mixture an increase in density occurred but the texture of the turf was coarser. Clover in the mixture also helps to maintain green colour during drought periods. Alta fescue in the mixture also increases drought resistance but gives a coarse, open turf.

If white clover is desired in a mixture a suitable combination appears to be 30 per cent Kentucky blue, 30 per cent Prince Edward Island Colonial bent, 35 per cent *Poa trivialis*, and 5 per cent white Dutch clover by weight, sown at the rate of 5 pounds per 1,000 square feet. This mixture starts growth early in the spring, has good density, is not so coarse as some other mixtures, and maintains its colour well in dry periods.

HORTICULTURE

K. G. Coates

Experiments during 1941-51 covered vegetable crops, fruits, ornamentals, and flowers. New introductions of fruit and vegetables were compared continually with the standard varieties. Extensive trials were carried out with tomato, corn, and cucumber varieties. The introduction of hardy ornamentals to the district is of great importance. Shrubs from northern latitudes are being planted to record their ability to winter. Because of the importance of perennial flowers to landscaping, the list of varieties is constantly being improved upon.

Windbreaks

Experience has shown the necessity of windbreak areas for carrying on horticultural work. If no protection is provided the soil will be slow to warm

FIG. 8.—Difference in growth of corn grown within spruce compounds (top) and in the open (bottom).

up in the spring and taller crops will be damaged in storms. To show the value of shelter, yields from the tomato variety Victor were recorded in a very adverse year as follows: yield from protected plot 1·7 pound ripe fruit, 26·9 pounds green, and from an unprotected plot no ripe fruit and 2·9 pounds green.

Any natural shelter-belt that already exists should be utilized and extended around the entire farm buildings. Double plantings in the northwest make a proportionate contribution. In this district they can be expected to collect a considerable depth of snow, and so should be planted 60 to 75 feet away from driveways.

The materials most extensively used have been laurel leaf willow (*Salix pentandra*) planted in the spring, as hardwood cuttings 3 feet apart; and native spruce in 2- and 3-row plantations 6 feet apart.

Tree Fruits

In the 1940 report, the crabapples Columbia, Florence, and Bedford were noted as varieties that might live in the north. During the past 9 years all have died, along with additional plots containing 18 varieties of third-cross apples. Native wild plum seedlings planted in 1936 have had no greater success. A few wintered above the snow line but no fruit matured. Since the first plantings in 1917, this Station has tried over 160 varieties of tree fruits; none have proved to be adaptable.

FIG. 9.—Heavy yields of currants are obtained at Kapuskasing.

Small Fruits

Currant:—Currants thrive on clay soil and have never failed as a crop. When the bushes were in bud or bloom, late spring frosts sometimes reduced the number of blossoms by half. On such occasions the fruits were proportionately larger. An average yield from a mature bush has been 15 quarts. The present plantation consists of eleven varieties spaced 6 by 6 feet. There is some

indication that wider planting would be an aid in cultivation. The recommended varieties are:—

Black — Boskoop Giant, Mite Free, Topsy.
White — White Dutch.
Red — Red Cross, Stephens No. 9.

Blueberry:—The wild, low-growing blueberry is native in this area, and this suggested the possibility of adapting the high-bush type at this Station. A small group of a maritime strain, Kengrape, was received from the Kentville Experimental Station and planted out in 1949. These made a clean growth to a height of 11 inches by fall. During the first winter (1950) 50 per cent were lost and the remainder in the plot were killed the second winter (1951). This variety lacks the initial requirement of winter hardiness for at no time were the bushes above the snow during severe weather.

Gooseberry:—Like currants, this fruit prefers cool moist growing conditions to prevent the bloom from developing too early, thus protecting them from late spring frost damage. Records kept of a plantation containing eight varieties planted in 1938, showed that Pixwell and Abundance commenced to crop at an earlier age and gave more pounds of fruit each season. Unfortunately they are both small, round-fruited types. Gooseberry experiments are being continued with selections that are almost thornless. If successful, they may bring this fruit into greater favour.

Raspberry:—The hardiest raspberry in this district has been the Herbert. Results of recent experiments, however, recommend the variety Latham. It often outyields others in spite of 12 to 15 inches of winter-kill.

Strawberry:—In 1948 a new plantation containing the varieties Tupper, Elgin, Sparkle, Louise, Valentine, and Premier was laid out. No results are available. For the present, Senator Dunlap remains the recommended variety.

Vegetables

Well grown fresh and storage vegetables are in great demand in urban as well as rural homes. The successful production of non-perishable vegetables and many of the salad crops has been demonstrated at this Station, although this does not apply to tender crops such as pepper, eggplant, and melon. The climate has often prevented the maturing of corn, tomatoes, and vine crops.

New introductions both from the Experimental Farms and private seed houses are sown in 30-foot rows to compare them with varieties considered best for this district. The varieties recommended on the basis of these tests are listed below.

Asparagus:—Mary Washington is the variety at present recommended. Three other varieties, Eden, Paradise, and Vineland 35 are now under trial.

Bean:—Only from the broad bean can a crop be assured if summer frosts are experienced. Broad Windsor seems to be the favourite. Of the bush varieties, Tendergreen and Logan will, if moist weather prevails, give a green stringless pod. Pencil Pod Kidney Wax and Cherokee Wax are the most popular varieties of their type. Pole beans seldom mature, but of these Kentucky Wonder is the most promising.

Beet:—The variety Detroit Dark Red has, over the past eleven years, given the greatest yield. Early bunching varieties have never matured more than 7 days earlier and were always quick to turn woody during dry periods.

Broccoli:—Three varieties have been under test, each representing a different type of this vegetable: Walcheren, white; Green Sprouting, green; and Early

Purple Cape, blue. All three have done well when started indoors to lengthen the season. Walcheren is the most attractive, but it has not outyielded the others nor was it superior in flavour.

Brussels Sprouts:—The season in Kapuskasing is not long enough for these to produce a full crop. For those who enjoy growing their own, the Long Island variety has given the highest yield.

Cabbage:—Eleven cabbage varieties have been under trial. The following are recommended:

Early — Golden Acre
Late — Copenhagen Market
Savoy — Chieftain
Storage — Danish Ballhead
Pickling — Red Acre

Carrots:—For a smooth coreless carrot the variety Nantes, with a 5-year average yield of 23 pounds per 30-foot row, has had no rival. Imperator develops a medium-long, heavy shouldered root that keeps well in storage.

Celery:—Celery should be grown only where additional water is available. Blanching with tile gives a more tender stalk, but a higher yield can be had when the row is hilled up with garden soil. Celery will be easily frozen on low muckland. The varieties Golden Plume for blanching and Utah with green stalks are recommended.

Chard:—Swiss chard makes an excellent substitute for spinach, continuing to grow until freeze-up. The green type, Lucullus, and the red stemmed, Rhubarb, have given identical yields.

Corn.—Corn varieties, in the past, with their small and poorly filled ears, have been grown only by the hobbyist. The recent hybrid introductions Seneca 60 and Seneca 60·C13, are great improvements.

Cucumber:—Cucumber is most successfully grown when sown inside a cold frame enclosure. The glass cover is removed as the growth develops, allowing the vines to tumble out over the edge. Straight Eight and Green Pack are the best varieties for slicing. Early Russian, grown for pickling, will crop in adverse weather but its fruit is not so smooth as the commercial strains, Heinz or Boston Pickling.

Endive:—Excellent yields of endive can be expected from the variety Green Curled.

Kale:—Satisfactory yields of kale can be had from the variety Scotch Green Curled.

Leek:—The two leek varieties Musselburgh and Elephant, named in order of merit, will give good yields if sown indoors and transplanted out as soon as the ground is ready.

Lettuce:—While head lettuce is little grown, good heads of Cosberg, New York 12, and Imperial 456 mature in 59 days. Black Seeded Simpson is the best of the leaf varieties.

Parsley:—Moss Curled parsley has produced consistently each season.

Onion:—To have firm bulbs weighing one pound for winter storage, the preferred varieties Yellow Globe Danvers and Riverside Sweet Spanish should be sown under glass in February or early March and transplanted to the garden in spring. Seed of White Portugal sown in drills will reach a good size for the pickling season.

Parsnip:—If sown early, parsnips will grow only medium sized roots by fall. The 11-year average yield of the better varieties has been Guernsey 45·3 pounds and Hollow Crown 41·2 pounds per 30-foot row.

Pea:—Garden peas grow well on the heavy clay of the district. Unfortunately, when the soil turns dry and cracks open, the vines fail in a few days. For the early crop, Laxall will give good results. Laxton Progress seems to stand the late summer conditions best.

FIG. 10.—(Left to right) Imperial 456, Cosberg, Black Seeded Simpson.

Potato:—Three potato varieties grown on heavy clay for four years gave the following average yield: Chippewa 371 bushels, Warba 320 bushels, and Irish Cobbler 320 bushels per acre.

Radish:—Success with radish will depend upon the weather. When sudden warm weather was experienced it was not unusual for 20 per cent of the crop to seed prematurely; in other seasons good radish was pulled in 30 days. Of eight varieties on trial Sparkler proved to be the most satisfactory. The White Icicle variety has always been damaged by root maggot.

Rhubarb:—Ruby and Valentine rhubarb were the two varieties tested. Ruby retains its high colour after canning, while Valentine is a little more robust and not so sweet.

Squash and Marrow:—The varieties White Bush Scallop (squash) and Long White Bush (marrow) will give earlier yields than the trailing vine types like Hubbard, which require a longer growing season.

Tomato:—Tomatoes have long been grown for green fruit only. With the introduction of hybrids and determinate types, some hope for ripe fruit is warranted. The Early Chatham, Victor, and Bounty varieties, if transplanted in a sheltered location, give the most promise.

Turnip:—The summer turnip Milan does well even on the heavy clay of the district, with individual roots weighing up to 2 pounds. Fall maturing rutabaga or swede types are often severely stunted by dry periods in August. Of the six varieties grown, Laurentian has developed the smoothest root and given the highest yields.

Hedges

Hedges are used in landscaping for perimeter or screen planting, as boundaries to lawns, and to divide one area from another. The type chosen is governed partly by personal taste, but chiefly by the purpose for which the hedge is intended. Different heights may be achieved first by choice of species planted, and later by clipping. The texture of the foliage should also be considered when planting. Species with fine leaves and needles should be planted in the foreground where they can be appreciated, while broad coarse leaves can be located some distance away. Hardy varieties and their uses may be found in table 36.

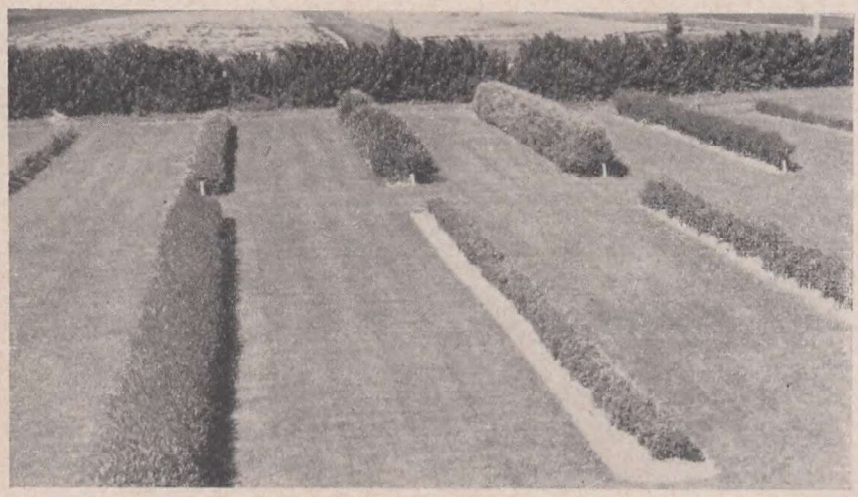


FIG. 11.—Hardy hedges are important in northern Ontario.

Ornamental Trees, Shrubs and Climbers

The list of recommended woody ornamentals has increased from year to year. Many of these varieties are planted on the Station grounds, for experimental purposes as well as to display fitting arrangements to the public. Failures in planting trees are often the result of not securing hardy stock. Specimens should not be lifted from a sandy soil in a warmer climate and expected to thrive in the clay of northern Ontario. Hardy nursery stock should come from a local grower or from an area of similar climate.

Trees that recently have proved hardy in northern Ontario are silver maple (*Acer saccharinium*) ash (*Fraxinus*), Colorado spruce (*Picea pungens*), burr oak (*Quercus macrocarpa*), European basswood (*Tilia cordata*), and Chinese elm Manchurian strain (*Ulmus pumila manchu*). Approximately 130 kinds of bushes and low evergreens are under test at this Station. The failures have been many and only a small percentage have been found suitable in this climate. Those suitable are divided into groups according to their height at maturity as follows:

Tall, tree-like shrubs:

Amur maple—(*Acer ginnala*) small red leaf.

Hawthorn—(*Crataegus rotundifolia*) thorny, fruit attracts birds.

Lilac—(*Syringa villosa*) (*S. vulgaris*) (*S. josikaea*) very hardy, flowers range in colour from white to pink, mauve, and blue.

Japanese lilac—(*Syringa japonica*) non-suckering, late white flowering.

European basswood—(*Tilia cordata*) makes a tidy round shrub in this district.

Chinese elm—Manchurian strain (*Ulmus pumila manchu*) rank growing dwarf elm.

TABLE 36.—HEDGES RECOMMENDED FOR NORTHERN ONTARIO

Common name	Botanical name	Height	Colour of foliage	Remarks
Alpine Currant	Ribes alpinum	2′–4′	Medium green	Small leaf, good low hedge
Cedar	Thuja occidentalis	3′ up	Medium green	Best year round hedge
Chinese Elm (Manchurian strain)	Ulmus pumila manchu	5′–9′	Medium green	Rank grower
Dogwood	Cornus stolonifera	3′–5′	Dark green	Large leaf, red bark in winter
Honeysuckle	Lonicera tatarica	3′–7′	Blue green	Best not clipped
Lilac	Syringa	5′–9′	Medium green	Best not clipped
Mountain Pine (dwarf)	Pinus mugo mughus	1′–3′	Dark green	Very dense, requires little clipping
Saskatoonberry	Amelanchier canadensis	4′–7′	Medium green	Upright habit, silvery foliage in spring
Siberian Pea-tree	Caragana arborescens	5′–8′	Light green	Rapid grower, stands drought
Siberian Pea-shrub	Caragana frutescens	2′–3′	Light green	Small barbs, requires little clipping
Siberian Pea (pygmy)	Caragana pygmaea	1′–2′	Dark green	Fine foliage, very dwarf formal hedge
Spirea	Spirea media	1′–2′	Medium green	White flower when not clipped
Spruce	Picea glauca	4′–6′	Dark green	Good native hedging material
Wayfaring Tree	Viburnum lantana	3′–5′	Silver grey	Large leaf, no clipping required
Willow (orange-twig)	Salix vitellina britzensis	3′–5′	Dull green	Fine leaf, orange wood in winter

Shrubs 6 to 10 feet:

Siberian pea-tree—(*Caragana arborescens*) small leaf, small yellow to rust coloured flower.

Russian olive—(*Elaeagnus angustifolia*) grey green foliage, black bark.

Honeysuckle—(*Lonicera tatarica*) widely planted, orange to red fruit, attracts birds.

Honeysuckle—(*L. korolkowii*) purple leaf, red fruit.

Elderberry—(*Sambucus racemosus tenuifolia*) cut-leaf elder, showy white heads of bloom, black fruit.

Elderberry—(*S. pubens*) red fruit.

High-bush cranberry—(*Viburnum trilobum*) white flower, orange-red fruit in fall.

Shrubs 3 to 6 feet:

Siberian pea-shrub—(*Caragana frutescens*) small leaf, rust flowers, small barbs.

Siberian pea-shrub—(*Caragana pygmaea*) very fine leaf, fernlike foliage, rust flowers.

Cotoneaster—(*Cotoneaster acutifolia*) dark green foliage, very hardy, black fruit.

Rose—(*Rosa rugosa*) ornamental foliage, deep pink flowers, hardy.

Spirea—(*Spirea media*) slightly cascading, many white flowers.

Spirea—(*S. billiardii*) upright, pink plumed flowers.

Bearberry—(*Lonicera involucrata*) broad leaf, yellow flower, two-lobed red fruit, attractive.

Dogwood (*Cornus stolonifera*) broad leaf, red bark.

Dogwood—(*C. stolonifera flaviramea*) yellow bark.

Dogwood—(*C. alba siberica*) dull red bark.

Dogwood—(*C. alba argenteo-marginata*) variegated leaf.

False spirea—(*Sorbaria sorbifolia*) fern leaf, white plume flower, dies to the ground each year.

Snowberry—(*Symphoricarpos albus*) open foliage, small pink flower, white berry clings well through the winter.

Nannyberry—(*Viburnum lantana*) large grey leaf, dense growth, black fruit.

Mountain pine—(*Pinus mugo*) irregular shrub, coarse needles.

Moose maple—(*Acer pennsylvanicum*) light green leaf which turns yellow-orange in autumn, requires shade.

Shrubs less than 3 feet:

Alpine currant—(*Ribes alpinum*) small leaf, upright habit, small yellow flower, grows well in shade or sunshine.

Missouri currant—(*Ribes aureum*) open foliage turning deep red in autumn, fruit yellow-orange.

European currant—(*Ribes vulverwellii*) medium green leaf, hairy, few red fruit.

Dwarf mountain pine—(*Pinus mugo mughus*) compact pine, no leader, coarse needles.

Shrubby cinquefoil—(*Potentilla fruticosa*) fine foliage, continuous small single yellow flowers.

Shrubby cinquefoil—(*P. dahurica* (*P. dahurica friedrichsenii*)). Potentilla varieties; have flowers which vary from white to yellow.

The following willows and dogwoods have coloured bark during the winter and will give a bright effect if planted near foundations or in front of evergreens.

Variety	Colour of bark
Salix purpurea	Purple-black
S. alba chermesina	Yellow
S. vitellina britzensis	Orange
Cornus stolonifera	Red
C. stolonifera flaviramea	Yellow
C. alba siberica	Dark red

In this area few of the clinging creepers so popular in the south can be grown. The following woody vines are adapted from the native vegetation.

Riverbank Grape (*Vitis vulpina*) grows wild as far west as Manitoba, making rapid tumbling growth. It has large leaves, sweet scented flowers andneeds wire or an arbour for support. No fruit will set unless both male and female plants are present.

Virginia Creeper (*Parthenocissus quinquefolia*) is a widely grown native climber with large leaves turning many shades of red in the autumn. It will not cling to a smooth wall but is best adapted to stucco or shingle siding and will grow 30 feet high.

A few herbaceous plants can be used for covering stumps or foundations. Generally, the height is limited because of their annual growth.

Perennial pea (*Lathyrus latifolius*) has fine grey foliage, and clings best to a wire trellis. It grows to a height of 4 feet with flowers ranging from white to deep mauve-red.

Scarlet runner is an annual pole bean (*Phaseolus coccineus*), which makes rapid growth but will cling only to a string or wire. It will attain a height of 10 feet with scarlet flowers, and maturing pods that are edible when young.

Climbing nasturtium (*Tropaeolum peltophorum*), annual, will grow to 4 feet in height in a warm location; flowers range from orange to yellow-red.

Floriculture

In spite of late spring frosts and prolonged dry or wet periods, a surprising range of flowers can be produced in sheltered areas at this Station. Plants like gladiolus and dahlia, requiring long seasons, must first be sprouted indoors; only a few annuals will develop from seeding in the open. In the perennial flower group, much of the work has been rewarding. The continuous snow blanket from early November till May protects many varieties that otherwise would not be hardy.

Because of the short growing season, annual flowers are not recommended for mass planting, but have been most satisfactory in supplementing perennial and shrubbery beds. If strong plants of aster, alyssum, antirrhinum, celosia, clarkia, cosmos, lobelia, marigold, petunia, poppy, scabiosa, tagetes or verbena are transplanted in the open during mid-June, they will throw bloom from July 20 until frost. Sweet peas sown in the open during early May normally grow well.

Plantings of tulips, narcissus, daffodil, and crocus have been made in favourable positions, in flower as well as shrubbery beds throughout the Station property, the object being to find the number of years that varieties can be expected to continue flowering before the bloom depreciates in size. Results so far have shown that tulips have to be replaced after 4 or 5 years, narcissus and daffodils after 2 or 3 years, while crocus varieties have continued to flower indefinitely.

Perennials, besides including some of the most popular flowers, are also the most practical for this climate. Ordinary care, in a location with a southern exposure, will give bloom from June till freeze-up. By growing plants in an exposed position for several years and recording their behaviour, it is now possible to recommend a considerable number of hardy perennials that can be grown successfully in most areas of northern Ontario. A list of these, together with their growth characteristics, is presented in table 37.

TABLE 37.—HARDY PERENNIAL FLOWERS FOR NORTHERN ONTARIO

Botanical name	Common name	Height	Commence to flower	Colour	Suitable for
		(inches)			
Achillea millefolium roseum	Yarrow	22	July 9	Rose-red	Perennial border, cut flower
A. ptarmica	Sneezewort	22	July 10	White	Perennial border
Allium schoenoprasum	Chives	9	Aug. 2	Pink	Border
Alyssum saxatile	Madwort	7	June 20	Yellow	Rockery
Aquilegia alpina	Columbine	19	July 6	White-blue	Perennial border
A. long spurred hybrids	Columbine	28	July 15	White pink blue	Perennial border, cut flower
Aubrieta	Many named varieties	5	June 7	Rose-blue	Border, rockery
Baptisita australis	False Indigo	21	July 10	Blue	Perennial border
Centaurea montana	Bluet	9	June 1	Blue	Perennial border
Cephalaria tatarica	—	72	July 9	Yellow	Perennial border, cut flower
Chrysanthemum maximum	Shasta Daisy	43	July 26	White	Perennial border, cut flower
Convallaria majalis	Lily of the Valley	11	June 17	White	Shade
Delphinium hybrids	Many named varieties	60	July 2	White-blue	Perennial border, cut flower
D. chinensis	Perennial Larkspur	14	Aug. 2	White	Border, cut flower
D. nudicale	Perennial Larkspur	11	July 8	Scarlet	Border
Dianthus deltoides	Pink	9	June 17	Rose	Border rockery
D. plumaris	—	12	July 4	Mauve-pink	Perennial border, cut flower
Gaillardia	—	20	July 2	Orange	Perennial border, cut flower
Hemorcallis	Many named varieties	25	July 15	Yellow-orange	Perennial border, cut flower
Heuchera sanguinea	Alum-root	17	June 24	Pink-red	Border, rockery
Iberis sempervirens	Candytuft	5	June 3	White	Border, rockery
Iris germanica	German Iris	24	July 5	White yellow blue	Perennial border, cut flower
I. japonica	Japanese Iris	19	July 27	White yellow blue	Perennial border
I. pumila	—	7	June 27	White yellow blue	Border
I. dichotoma	Rockery Iris	30	Aug. 12	Blue-bronze	Perennial border, rockery
Liatris spicata	Blazing Star	27	Aug. 26	Pink	Perennial border
Ligularia clivorum	—	20	Aug. 12	Yellow	Perennial border
Lupinus polyphyllus	Lupine	38	July 7	Mauve-white	Perennial border, cut flower
L. russell	Lupine	34	July 5	Bi-colour	Perennial border, cut flower
Lychnis arkwrightii	—	19	July 15	Pink-red	Perennial border
L. coronaria agrostemma	Agrostemma	25	July 21	Magenta-red	Perennial border
L. chalcedonica	Fiery Cross	37	July 22	Scarlet	Perennial border, cut flower
L. haageana	—	19	July 19	Pink-red	Perennial border
L. viscaria	—	12	June 30	Pink	Border, rockery
Mertensia virginica	Bluebell	10	June 2	Blue	Perennial border
Oenothera missouriensis	—	8	July 8	Yellow	Border
Paeonia	Peony	30	July 5	White-red	Perennial border, cut flower
Papaver nudicaule	Iceland Poppy	14	June 9	White yellow orange	Rockery
P. orientale	Oriental Poppy	23	July 6	White pink red	Perennial border
Phlox paniculata	Many named varieties	30	July 10	White red mauve	Perennial border
P. subulata	Many named varieties	6	June 3	Pink mauve	Border, rockery

TABLE 37.—HARDY PERENNIAL FLOWERS FOR NORTHERN ONTARIO—*Concluded*

Botanical name	Common name	Height	Commence to flower	Colour	Suitable for
		(inches)			
Physostegia virginiana	False Dragonhead	35	Aug. 17	Pink mauve	Perennial border, cut flower
Polemonium caerulium tanguticum	—	29	July 11	Blue	Perennial border, cut flower
P. caeruleum tangaticum alba	—	27	July 16	White	Perennial border, cut flower
P. richardsonii	—	11	May 30	Blue	Border
Potentilla warrensii	Cinquefoil	23	July 29	Yellow	Perennial border
Primula denticulata	Primrose	6	June 15	Blue	Border, rockery
P. veris macrocalyx	Primrose	7	May 10	Yellow	Border, rockery
Pyrethrum	Gay Feather	25	June 30	White red	Perennial border, cut flower
Rudbeckia laciniata	Golden Glow	70	Aug. 16	Yellow	Perennial border, cut flower
R. purpurea	Coneflower	35	Aug. 5	Mauve-pink	Perennial border
Scabiosa fischerii	Scabious	15	Oct. 10	Blue	Perennial border, cut flower
Sempervivum tectorum	Houseleek	3	Nil	—	Rockery
Stachys jamiana	Betony	17	July 20	Mauve	Perennial border
Trollius europaeus loddigesii	—	20	July 15	Orange	Perennial border, cut flower
T. ledebouri	—	16	July 18	Yellow	Perennial border, cut flower
Veronica gentianoides	Speedwell	5	July 11	Blue	Border
V. spicata and others	Speedwell	20	July 19	Blue	Perennial border, cut flower

POULTRY

J. L. Tessier

A flock of Barred Plymouth Rocks was established at this Station in 1921. This breed is well suited to the climate, is the most popular in the district, and it meets the requirements of the market. The flock comprises annually 400 hens and 70 breeding males. Approximately 300 pullets are used for experimental work in breeding, feeding, and housing. The remaining 100 hens are kept for breeding purposes only. All the layers are trap-nested.

Blood Test for Bacillus Pullorum

The birds have been blood tested annually and have shown no reactors since 1944. The control of Pullorum disease has greatly contributed to the general improvement of the flock in fertility, hatchability, mortality, and egg production.

Hatching Results from Different Dates of Setting

Hatching results have been recorded at this Station for the past eleven years to determine whether the date of setting would affect either fertility, hatchability, or mortality of chicks during the first three weeks after hatching. Chicks hatched in February had lower mortality rates than those hatched in April. In addition the early-hatched chicks were stronger.

Cost of Rearing Chickens

The object of this experiment was to determine the cost of rearing Barred Plymouth Rock mixed chicks from hatching date to maturity. The chicks were placed in a coal-heated brooder house and then transferred to colony houses. As soon as the weather permitted, they were moved to an alfalfa range. During the rearing period, some cockerels were sold as broilers and roasters and the surplus pullets were sold at culling or at housing time. The results show that the sale of cockerels as broilers and roasters pays all the feed costs for both cockerels and pullets.

Pedigree Breeding for Egg Production

The breeding work at this Station, for egg size and egg production, is centered about the sire progeny test in which "superior" males are selected. To qualify as a superior male, the average egg production of the progeny of a sire must exceed, by a significant amount, the average production of the progeny of all other sires tested. However, all birds (males and females) are carefully selected for type, colour, size, and family performance (egg production, egg size, viability, broodiness, etc.). The results are given in table 38.

Records of the progeny tests conducted at Kapuskasing during the period under review showed that the high egg production was maintained. The eggs laid by some pullets were too large and therefore selection toward smaller eggs is being practised.

Feed Cost of Egg Production

To determine the feed cost of producing eggs, some 265 pullets were kept annually for a period of nine years. Records were kept of the quantity and cost of feed consumed, mortality, egg production, and returns from sales. No culling was done on the flock until after September 4.

TABLE 38.—PEDIGREE BREEDING FOR EGG PRODUCTION 1942-51

Year	Number of sires	Number of dams	All daughters			Daughters on which progeny test based			
			Number at start	Number at finish	Percentage of mortality	Number	Egg production	Egg weight	Body weight per bird
	No.	No.	No.	No.	%	No.	No.	gm.	lb.
1942	8	52	280	244	12·9	239	213	59·9	6·2
1943	9	52	294	256	12·9	232	206	58·6	6·9
1944	8	39	300	254	15·3	137	210	63·1	6·3
1945	8	46	300	251	16·3	245	232	64·0	6·6
1946	9	39	300	278	7·3	261	227	61·0	6·3
1947	8	56	300	273	9·0	259	221	61·0	6·2
1948	8	66	300	281	6·3	269	229	64·0	6·5
1949	8	66	300	272	9·3	268	233	63·0	6·1
1950	8	60	300	282	6·0	277	232	62·2	6·4
1951	8	58	288	255	11·5	246	213	57·7	5·8
Total	82	534	2,962	2,646	—	2,433	2,216	614·5	63·3
10-Year average	8·2	53·4	296·2	264·6	10·7	243·3	221·6	61·4	6·3

Table 39 shows that poultry production is a profitable enterprise in this region. The average cost of the feed consumed during the period 1943-51, was 21c. per dozen while the profit over cost of feed was 30c. per dozen or an annual profit of $5.51 per bird.

TABLE 39.—FEED COST OF EGG PRODUCTION 1943-51

Year	Number of pullets	Percentage mortality	Per bird			Per dozen		
			Eggs laid	Feed cost	Value of eggs	Feed cost	Price of eggs	Profit over feed cost
	No.	%	No.	$	$	$	$	$
1943	266·3	18·9	210·0	2.61	6.65	0.17	0.42	0.25
1944	188·2	19·7	216·6	3.08	7.45	0.17	0.41	0.24
1945	301·0	18·3	205·4	2.75	7.06	0.16	0.41	0.25
1946	274·8	12·1	222·4	3.26	7.78	0.18	0.42	0.24
1947	280·8	11·4	209·1	3.08	8.71	0.18	0.50	0.32
1948	272·8	6·7	226·9	4.76	10.40	0.25	0.55	0.30
1949	271·3	9·3	236·2	4.55	11.81	0.23	0.60	0.37
1950	265·0	6·3	235·9	4.97	11.80	0.25	0.60	0.35
1951	263·2	11·7	210·1	5.45	12.26	0.31	0.70	0.39
9-Year average	264·8	12·0	216·7	3.84	9.35	0.21	0.51	0.30

During this period (1943-51), an average of 265 pullets laid a yearly average of 216·7 eggs. The average feed consumed annually per pullet was 137·1 lb., which consisted of 60·4 lb. of grain, 56·7 lb. of mash, 4·7 lb. of oyster shell, 1·9 lb. of green feed, 0·1 lb. of cod-liver oil, and 13·3 lb. of skim-milk.

Improving Poultry in the District

During the years 1942 to 1951, inclusive, in addition to chicks hatched for the Station flock, 40,057 baby chicks were sold in small lots at nominal prices to Illustration Station operators, farmers, and poultry raisers in the area served by this Station. Also during this period, 9,676 hatching eggs were sold to a commercial hatchery. Other sales included 4,421 six-week-old cockerels, 2,115 breeding pullets, 1,900 breeding hens and 25 males, Barred Plymouth Rocks. Table 40 gives the number of hatching eggs and breeding stock sold annually.

TABLE 40.—HATCHING EGGS AND BREEDING BIRDS SOLD, 1942-51

Year	Hatching eggs	Baby chicks	6-Week-old cockerels	Pullets	Hens	Roosters
	No.	No.	No.	No.	No.	No.
1942	352	6,906	222	76	189	—
1943	—	3,134	132	10	175	—
1944	—	5,649	205	159	107	1
1945	—	4,439	415	150	188	—
1946	—	6,725	344	169	174	—
1947	48	3,435	653	248	143	3
1948	—	2,930	580	286	100	3
1949	3,852	3,335	660	364	169	15
1950	24	1,706	505	310	119	1
1951	5,400	1,798	705	343	536	2
Total	9,676	40,057	4,421	2,115	1,900	25

Relation of Specific Gravity of the Egg to Its Hatching Power

In 1942, work was conducted to determine whether the hatching power of fresh eggs could be measured by a specific gravity test. Eggs having a specific gravity of 1·078 and over as determined by immersion in a brine solution, were set and hatched separately from those of lower specific gravity. The results are given in table 41.

TABLE 41.—RELATION OF SPECIFIC GRAVITY OF THE EGG TO ITS HATCHING POWER, 1942

—	Number of eggs tested	Eggs with specific gravity greater than 1·078				Eggs with specific gravity less than 1·078			
		Number of eggs	Percentage of eggs	Number of chicks hatched	Percentage of chicks hatched	Number of eggs	Percentage of eggs	Number of chicks hatched	Percentage of chicks hatched
Hens	2,340	2,025	86·5	1,379	68·1	315	13·5	188	59·7
Pullets	6,150	4,765	77·5	3,415	71·7	1,385	22·5	869	62·7
Total	8,490	6,790	80·0	4,794	70·6	1,700	20·0	1,057	62·2

The data show that the hatchability of the eggs with a specific gravity less than 1·078 was 62·2 per cent, and for the eggs with a specific gravity greater than 1·078 was 70·6 per cent or an increase in hatchability of 8·4 per cent.

Hatching Results

During the past ten years, an average of 2,201 eggs were set annually for breeding and experimental work. The average fertility of eggs set was 93·5 per cent. Sixty-six and one-half per cent of all eggs set or 71·1 per cent of fertile eggs hatched an average of 1,425 chicks. For the first three weeks after hatching, losses averaged 2·6 per cent. The average hatching season lasts from February 20 to May 10. All chicks are hatched from fully qualified males and females (yearling and older). The hatching results for the ten years on eggs set for the Station flock are given in table 42.

TABLE 42.—HATCHING SUMMARY, 1942-51

Year	Total eggs set	Number fertile	Per cent fertile	Number of chicks	Per cent total eggs hatched	Per cent fertile eggs hatched	Number chicks alive at 3 weeks	Per cent chicks hatched alive at 3 weeks	Total eggs required for one chick hatched	Total fertile eggs for one chick hatched	Total eggs required for one chick at 3 weeks
	No.	No.	%	No.	%	%	No.	%	No.	No.	No.
1942.....	2,125	1,972	92·8	1,538	72·4	78·0	1,505	97·9	1·38	1·28	1·41
1943.....	2,140	2,022	94·5	1,391	65·0	68·8	1,350	97·1	1·54	1·45	1·59
1944.....	2,690	2,301	85·5	1,302	48·4	56·6	1,251	96·1	2·07	1·77	2·15
1945.....	2,298	2,144	93·3	1,265	55·1	59·0	1,209	95·6	1·82	1·69	1·90
1946.....	2,200	2,080	94·5	1,434	65·2	68·9	1,376	95·9	1·53	1·45	1·60
1947.....	1,833	1,736	94·7	1,501	81·9	86·5	1,481	98·7	1·22	1·16	1·24
1948.....	2,351	2,213	94·1	1,437	61·1	64·9	1,380	96·0	1·64	1·54	1·70
1949.....	1,850	1,756	94·9	1,502	81·2	85·5	1,493	99·4	1·23	1·17	1·24
1950.....	2,510	2,399	95·6	1,772	70·6	73·9	1,738	98·1	1·42	1·35	1·44
1951.....	2,009	1,959	97·5	1,492	74·3	76·2	1,473	98·7	1·35	1·31	1·36
Total...	22,006	20,582	—	14,634	—	—	14,256	—	—	—	—
10-Year average	2,201	2,058	93·5	1,463	66·5	71·1	1,426	97·4	1·50	1·41	1·54

Relation Between Annual Production and Date First Egg Laid

Work was undertaken to determine the relationship between the date the first egg is laid and the annual egg production of pullets. Data were kept over a 6-year period, 1940-45, inclusive. The egg production was recorded up to September 4, for each year. Records were kept for three lots of pullets that started to lay at different ages, 185 days or less, from 195 to 210 days, and after 220 days. The 844 pullets that started to lay at the age of 185 days or less laid an average of 206·3 eggs. The 336 pullets that started to lay between 195 to 210 days had an average production of 194·2 eggs. The last group, which started laying after the age of 220 days, recorded an average production of 161·2 eggs. The experiment shows that the highest egg production was obtained from pullets that started to lay at an early age.

ILLUSTRATION STATIONS

F. Gosselin and R. Bernier

Makamik District Experiment Substation

The District Experiment Substation at Makamik, in the Abitibi district of northern Quebec, was established on the farm of Mr. Remi Auger in the fall of 1936. It is situated on the main highway about two miles from the town of Makamik, and comprises an area of 100 acres of heavy clay land that is typical of the district. Up to 1947, the cropping system of the farm was a 5-year rotation of two years in grain and three years in hay. In 1948, for the purpose of experimental work, this rotation was changed to a 4-year grain-hay rotation, leaving the fifth field for the study of two 5-year rotations, one with hoed crops, grain and hay, and the other with two years in grain and three years in hay. Close to the buildings, a 19-acre pasture was laid down two years before the establishment of the Substation, and fertilized at regular intervals. In addition, a 7-acre field along the highway is used for intensive experimental plot work. The object of these experiments is to test different forage crops seeded alone and in mixtures, cereals in rod rows, and root crops, to determine their adaptability to the climatic and soil conditions of the district, and also to determine the fertilizer requirements of the soil. This report is a brief summary of the work conducted at the Substation and the associated Illustration Station farms.

Associated Illustration Station Farms

In the Kapuskasing supervisory district at the close of 1951 there were ten Illustration Station farms operated on privately owned properties under a co-operative agreement between the owner and the Experimental Farms Service. Six are located in northwestern Quebec and four in northern Ontario. At these stations, the operator is directed in developing his farm on a systematic basis; and a cropping plan is prepared for each station to meet local conditions. The location of each station farm with the name of the co-operating farmer is listed below.

Location	Co-operating Farm Owner	Established
Amos, Que.	Leonel Cossette	1949
Champcoeur, Que.	Paul Beliveau	1937
Cloutier, Que.	Ovide Gauvin	1949
Earlton, Ont.	Albert Rivard	1942
Genier, Ont.	Albert Tousignant	1948
Launay, Que.	Adolphe Lord	1937
Laverlochere, Que.	Alberic Trudel	1932
Makamik, Que.	Remi Auger	1937
Matheson, Ont.	Gerald Scratch	1948
Ramore, Ont.	Albert Boucher	1931

Some forty-five projects, including meteorological studies, crop rotations, soil fertility, cereals, forage crop, pasture investigations, horticulture, and livestock are now active at Makamik and on the other associated Illustration Station farms. The results obtained over a number of years have proved to be useful to the farming population of the district.

Meteorological Report

Farming operations are intimately associated with weather conditions, and the kind of crop that may be grown depends largely upon temperature ranges and rainfall. During the past ten years, great variations in climatic conditions have occurred, but in no season has there been a total crop failure. While hampered sometimes by excessive rainfall and cloudy weather, seeding and harvesting operations have always been completed without undue delay and the fall work has been finished before winter set in.

Dates of seeding and harvesting were recorded yearly, and results show that on the average, seeding was started on May 27, haying on July 19, and harvesting on August 27. By using early maturing grain varieties, it has always been possible to produce reasonably good crops. The last spring frost as well as the first killing frost were recorded by the operators. The average results for fourteen years, show that the last spring frost occurred on June 10, and the first killing frost on September 7, leaving a frost-free period of 88 days.

On seven different stations, the rainfall is recorded by means of a standard rain gauge. Snowfall is also recorded, ten inches of snow equalling one inch of rain. The following table gives the monthly and annual precipitation on Stations where these records are kept.

TABLE 43.—RECORDS OF REGIONAL PRECIPITATION—AVERAGE, 1938-51

Stations	Fall and winter	Growing season—Average						Total	Number of years
		May	June	July	Aug.	Sept.	Oct.		
	in.	in.	in.	in.	in.	in.	in.	in.	
Amos, Que.	16·22	1·91	4·64	2·34	2·64	2·87	3·38	33·98	1949–51
Cloutier, Que.	13·31	1·30	3·81	2·63	2·17	3·73	3·09	30·04	1949–51
Launay, Que.	13·29	1·79	3·90	3·29	2·51	2·60	2·78	30·16	1949–51
Laverlochere, Que.	8·80	1·95	3·42	3·03	3·02	3·12	2·53	25·87	1939–51
Makamik, Que.	8·57	2·23	3·73	3·69	3·52	4·05	2·74	28·53	1939–51
Montbeillard, Que.	11·13	3·27	3·80	3·89	3·35	4·03	2·69	32·16	1938–48
Senneterre, Que.	10·71	2·42	2·78	2·87	2·92	3·60	2·13	27·43	1940–48
Genier, Ont.	10·36	1·96	5·97	3·22	1·56	2·67	2·70	28·44	1949–51
Ramore, Ont.	13·31	1·30	4·72	2·28	2·23	2·62	2·30	28·76	1949–51

These figures indicate that drought is not a problem in this district. Since June is usually a wet month, it is obvious that seeding becomes a real problem if it is not completed by the end of May. Records kept at the Makamik Experiment Substation over a 12-year period indicate that the rainfall is well distributed throughout the growing season.

In 1948, the Senneterre and Montbeillard Stations were closed, and were replaced by Cloutier and Amos Stations, respectively. At Launay and Ramore, no records of precipitation were kept before 1948. The rainfall for the growing season is approximately 17·07 inches at Laverlochere, and 19·96 inches at Makamik.

Crop Rotations

In order to obtain definite information regarding suitable cropping plans to meet local conditions, various types of rotations are under study at the Makamik Experiment Substation, as well as on the other Illustration Station farms of the district. These are listed below.

3-Year Rotation—

First Year — Hoed crop
Second Year — Cereal (seeded)
Third Year — Clover hay, the aftermath is fall ploughed, manure 10 tons per acre.

This rotation is under study at Makamik, and may be used on a small farm where a cash crop such as potatoes or turnips is grown or where land suitable for this purpose is found.

4-Year Rotation—

First Year — Potatoes
Second Year — Cereal (seeded)
Third Year — Clover
Fourth Year — Timothy, fall ploughed, manure 12 tons per acre.

This rotation is under study at Launay on four one-acre fields suitable for potato production. The first cycle is now completed but the results, one crop in each field, cannot be conclusive and the rotation merits further study.

4-Year Rotation—

First Year — Cereal (seeded)
Second Year — Clover hay, manure at 10 tons per acre following first hay crop.
Third Year — Timothy hay
Fourth Year — Timothy hay

This rotation is under study at Makamik, Cloutier, Amos, Launay, Laverlochere, Genier, and Matheson. It is becoming more popular with the introduction of the fertilized permanent pasture. Because the dairy herd is steadily increasing on every station, more pasture has to be provided outside the rotation fields.

5-Year Rotation—

First Year — Potatoes
Second Year — Cereal (seeded)
Third Year — Clover
Fourth Year — Mixed hay
Fifth Year — Mixed hay or pasture, fall ploughed, manure 10 tons per acre.

This 5-year cycle now under study in five fields of one acre each was laid down at Makamik in 1947 and at Genier in 1949. No practical results are yet available.

5-Year Rotation—

First Year — Cereal
Second Year — Cereal (seeded)
Third Year — Clover hay, manure at 10 tons per acre following first hay crop.
Fourth Year — Mixed hay
Fifth Year — Mixed hay or pasture, fall ploughed

This was the rotation used on Illustration Station farms for years. It is still the most practical for a great number of farmers, particularly those whose farm layout does not include a fertilized permanent pasture field. In the first year of the rotation, such crops as potatoes or turnips for home consumption or even for a cash crop, or a mixture of O.P.V. may be grown, while the remainder of the same field is in grain (wheat, oats, or barley) not seeded down. Farm manure may be used on these crops but it is preferable to spread it on the sod after the first year hay crop has been removed. The second year of the rotation is in grain seeded down with 8 pounds of timothy, 5 pounds of late red clover, 5 pounds of alfalfa, and 2 pounds of alsike clover per acre. The third year meadow is either cut for hay or used as pasture. The results obtained for a period of years appear in table 44.

TABLE 44.—AVERAGE YIELDS OF CROPS FROM A 5-YEAR ROTATION

Stations	Oats		Barley		Wheat		Clover hay		Mixed hay	
	Number of years	Average yield	Number of years	Average yield	Number of years	Average yield	Number of years	Average yield	Number of years	Average yield
		bu.		bu.		bu.		tons		tons
Makamik, Que.	1937-49	42·1	1941-48	25·9	1941-49	22·3	1937-49	1·73	1937-49	1·51
Launay, Que.	1938-49	23·3	1948-49	6·0	1944-45	12·1	1938-49	1·04	1939-49	0·91
Laverlochere, Que.	1934-49	52·5	1935-41	25·0	1937-46	21·8	1934-49	1·64	1932-49	1·54
Champcoeur, Que.	1938-49	29·9	1939-46	16·3	1939-46	16·1	1939-49	1·27	1937-49	1·07
Earlton, Ont.	1942-49	45·0	1943-48	29·2	1943-45	19·7	1942-49	1·40	1942-49	1·20
Ramore, Ont.	1934-49	44·6	1943-49	33·1	1938-49	22·1	1934-49	1·66	1934-49	1·46
Senneterre, Que.	1937-48	34·6	1937-48	19·7	—	—	1938-48	1·34	1936-49	1·44

When the Experiment Substation was established at Makamik in 1937, the average yield per acre for oats was 32 bushels, and for hay, 1·0 ton per acre. At Laverlochere, when the Illustration Station was established in 1932, the average yield per acre was 35·5 bushels for oats, and 0·75 ton for hay. As noted in table 44, these yields have been substantially increased. The increase in oat yields has been made possible by the use of early, more productive varieties while the increased hay yields result from the addition of alfalfa and Altaswede red clover to the hay mixture.

Soil Fertility

Because the supply of farmyard manure is inadequate to provide the necessary plant food for maximum growth of farm crops, soil fertility is a major problem on many of the Illustration Station farms. For several years the value of chemical fertilizer, as a supplement to farm manure and lime, has been under study. This study involves the use of commercial fertilizer, farm manure plus commercial fertilizer and lime, and the rates of application for fertilizer and lime. The salient points of experimental work on fertilizers on these stations follow.

Effect of different chemical fertilizers on field crops:—The object of this experiment, under study at Makamik, is to determine the effect on following crops, of a combination of manure, limestone, and chemical fertilizers using turnips as an indicator crop. The experiment is conducted on a 5-year rotation, including a hoed crop, cereal crop seeded down, and three years in hay. The area is divided into twelve plots, one of which is used as a check, receiving no manure or fertilizer. The three others in the same series receive only chemical fertilizer; one plot being given 500 pounds of superphosphate 20 per cent per acre, the second 100 pounds of muriate of potash per acre, and the third, a mixture of superphosphate 20 per cent and muriate of potash at 500 pounds and 100 pounds, respectively. The second series of four plots receives an application of 15 tons of manure per acre supplemented with chemical fertilizers in the same proportions as mentioned above. The third series is given an application of ground limestone at the rate of 2 tons per acre, in addition to manure and fertilizer. Chemical fertilizers and lime are applied broadcast prior to planting the turnip crop. The cereal used is Ajax oats seeded to a mixture of 8 pounds timothy, 5 pounds Altaswede red clover, 5 pounds alfalfa, and 2 pounds alsike clover. Treatments and yields are shown in table 45.

Table 45 shows that superphosphate is the more useful of the two fertilizers used. However, it is apparent especially on the hoed crop, that when superphosphate is combined with potash, the response is greater than when

TABLE 45.—EFFECT OF DIFFERENT CHEMICAL FERTILIZERS AND MANURE ON FIELD CROPS—AVERAGE, MAKAMIK EXPERIMENT SUBSTATION

Plot No.	Treatment per acre	Turnips	Oats	Clover hay	Mixed hay	Mixed hay
		Average yield per acre 1944-51 (8 years)	Average yield per acre 1946-51 (6 years)	Average yield per acre 1946-51 (6 years)	Average yield per acre 1948-51 (4 years)	Average yield per acre 1949-51 (3 years)
		tons	bu.	tons	tons	tons
1	Check	1·42	36·1	0·84	1·10	0·83
2	Superphosphate 20 per cent 500 lb.	4·86	43·9	1·06	1·44	1·15
3	Muriate of potash, 100 lb.	3·29	41·9	1·03	1·30	1·08
4	Superphosphate 500 lb., potash 100 lb.	6·70	45·0	1·07	1·55	1·1
5	Manure 15 tons	5·20	45·8	1·46	1·68	1·31
6	Manure 15 tons, superphosphate 500 lb.	9·25	60·7	1·64	1·98	1·40
7	Manure 15 tons, potash 100 lb.	7·94	56·0	1·47	2·02	1·33
8	Manure 15 tons, superphosphate 500 lb., potash 100 lb.	11·21	61·6	1·60	2·03	1·58
9	Manure 15 tons, lime 2 tons	5·73	50·9	2·02	2·52	2·26
10	Manure 15 tons, lime 2 tons, superphosphate 500 lb.	8·89	58·6	2·41	2·92	2·51
11	Manure 15 tons, lime 2 tors, potash 100 lb.	8·12	59·2	2·18	2·78	2·47
12	Manure 15 tons, lime 2 tons, superphosphate 500 lb., potash 100 lb.	10·38	60·6	2·17	2·90	2·42

superphosphate is used alone. The effect of lime does not appear the year it is applied. Its value is apparent in the production of hay, since alfalfa grows successfully on the limed area. On plots 1 to 4 where chemical fertilizer is used alone, the alfalfa stand is 8 per cent; on plots 5 to 8 with manure and chemical fertilizer, 20 per cent; on plots 9 to 12 with lime added, 60 per cent. By comparing plots 1 and 5, it is apparent that manure is of great value for hay crops on this soil.

FIG. 12.—Turnip crop at Makamik, Que., 1948. Yields were (left to right) 26·28 tons using manure, superphosphate 20 per cent and potash; 17·42 tons using manure and lime; 12·56 tons using manure only; and 4·50 tons using no treatment.

Inoculation versus non-inoculation of alfalfa:—This experiment, under study at Makamik, is designed to determine the necessity of inoculating alfalfa seed before sowing. For this test, alfalfa was sown alone at the rate of 12 pounds per acre without any nurse crop. The treatments and results obtained after five years are presented in table 46.

TABLE 46.—INOCULATION VERSUS NON-INOCULATION OF ALFALFA

Plot No.	Treatment per acre	Per cent alfalfa stand (5-year average) 1947-51	Average yield per acre 1947-51
		%	tons
1	Alfalfa inoculated	17·5	1·57
2	Alfalfa not inoculated	3·5	1·22
3	Alfalfa inoculated, lime 2 tons	30·8	2·12
4	Alfalfa not inoculated, lime 2 tons	17·3	1·83

The above results indicate that inoculating the seed and applying limestone is necessary if alfalfa is to be grown successfully on this soil.

The effect of ground limestone on the yield of field crops:—In many agricultural districts soil acidity is a limiting factor in the successful production of legumes. Even when all the nutritive elements are available for the plants and the best methods of farming are practised, it is impossible to obtain the highest yields if the soil is too acid. Soil acidity is corrected by the application of lime, but such factors as drainage must also be improved for satisfactory results.

An experiment was laid down at the Makamik Experiment Substation and carried on for eight consecutive years on a 5-year rotation of hoed crop, grain, and three years of hay. Ground limestone at a rate of 2 tons per acre was applied broadcast on the hoed crops compared with a check receiving no lime. Grain was seeded down with a hay mixture containing 5 pounds of alfalfa per acre. Yields were taken on first- and second-year hay to determine the residual effect of lime, which was applied to the turnip crop in the first year of the rotation. Results recorded on ten crops of first- and second-year hay showed an average yield of 0·94 ton from the check plot whereas the limed area yielded 2·22 tons. A very small percentage of alfalfa was observed on the check plot and the plants were short, weak, light-coloured, and did not survive the winter. This increase in hay yields is explained by the fact that alfalfa usually accounts for 45 to 50 per cent of the hay on the limed area. Furthermore it is almost always possible to harvest two crops of hay every year from the same area.

Other tests at the rates of one, two, and three tons of lime per acre are in progress and it appears that the heavier applications of lime do give positive results.

Cereals

Cereal varieties that have been found best adapted to the area in which the Experimental Station is located are tested further on Illustration Stations in outlying districts. At the Makamik Experiment Substation, the cereals are first tested in rod-row plots. The work is carried on in co-operation with the Cereal Division, Central Experimental Farm, Ottawa.

Its purpose is to determine the adaptability of new varieties compared with the standards now being grown. Data are recorded for each variety under test, on its adaptability, length and strength of straw, resistance to diseases, number of days to mature, and yield per acre. Outstanding varieties are later tested under field conditions and, if approved, they are made available to farmers.

Testing varieties of cereals:—Eight varieties of wheat, ten of oats, and eight of barley are under test at Makamik. Some varieties have been tested for many years, others for two or three years. Straw strength or resistance to lodging is recorded on a 1 to 9 basis, with 1 indicating very good resistance and 9 very poor resistance. The results obtained are presented in tables 47, 48, and 49.

FIG. 13.—(Left): The effect of 2 tons per acre of ground limestone on the growth of alfalfa. (Right): No lime; note poor stand of alfalfa. Photo taken on the District Experiment Substation at Makamik, Que.

TABLE 47.—SPRING WHEAT VARIETY TEST, MAKAMIK, QUE.

Variety	Days to maturity average	Number of years	Straw		Yield per acre	
			Length	Strength, 1-9	Average (bushels)	Years grown
Regent	110	10	33	2·0	21·0	1941–51
Thatcher	113	7	24	1·3	18·3	1942–49
Redman	121	3	30	1·5	26·2	1948–51
Saunders	113	2	24	1·5	19·4	1948–49
Cascade	117	2	28	1·7	27·8	1948–49
Acadia	123	5	30	1·5	25·1	1947–51
Lee	113	1	32	2·5	33·0	1951

Other varieties have also been tested in preceding years. Garnet matures in about 103 days, yielding 14·6 bushels per acre. Reward matures in about 106 days, yielding 15·7 bushels per acre. Other selections were tried for a few years to determine their suitability, but because of their low yield or late maturity further testing was discontinued. Although Acadia is somewhat late in maturing, this new variety is very promising for the district. Regent is still the recommended variety for the district, provided it is sown early.

Since 1938 many other varieties have been tested. Alaska matures in about 98 days with a 4-year average yield of 43·6 bushels per acre. Mable, on a 10-year average, matured in 104 days. Erban (7-year average) matured in 107 days, yielding 47 bushels per acre. A few other selections developed chiefly at Ottawa or Macdonald College are being tested in rod-row plots, but the work

TABLE 48.—OAT VARIETY TEST, MAKAMIK, QUE.

Variety	Days to maturity average	Number of years	Straw		Yield per acre	
			Length	Strength, 1-9	Average yield (bushels)	Years grown
Roxton	120	5	41	1·5	54·4	1946–50
Abegweit (S1)	119	4	34	2·0	55·2	1948–51
Banner	116	10	32	2·0	40·8	1941–50
Beaver	114	8	36	2·9	53·6	1944–51
Vanguard	114	11	34	1·8	54·9	1940–51
Mohawk	101	2	26	1·3	51·6	1948–49
Cartier	104	13	34	2·4	43·4	1939–51
Ajax	105	7	33	3·3	56·8	1945–51

has not progressed far enough to draw definite conclusions. Because of resistance to stem rust and its high yielding ability, Ajax is still the most popular variety, and is at present recommended for the district.

TABLE 49.—BARLEY VARIETY TEST, MAKAMIK, QUE.

Variety	Days to maturity average	Number of years	Straw		Yield per acre	
			Length	Strength, 1-9	Average (bushels)	Years grown
Byng	108	10	20	2·0	35·5	1941–50
Montcalm	107	7	23	2·1	36·3	1945–51
Velvet	110	6	22	2·0	27·4	1945–50
Olli	94	12	16	1·0	29·0	1939–50
O.A.C. 21	102	13	25	2·0	28·0	1939–51

Among other varieties tested at Makamik were Nobarb, Vantage, Titan and Galore. These served as demonstration material at the District Experiment Substation, where they were used at farmers' meetings to draw attention to new varieties. At present, O.A.C. 21 is still the recommended variety for the district. However, because of its equally good yielding ability and smooth awn, Montcalm is rapidly gaining in popularity.

Hay Mixtures

Thirteen mixtures of grasses and clovers are grown at Makamik, on duplicate plots, to determine their relative yields and local adaptation. The seed is sown with a nurse crop of oats. Yields obtained from seven different mixtures of grasses and legumes are shown in table 50.

TABLE 50.—TESTING MIXTURES FOR HAY, AVERAGE YIELD FOR 3 YEARS (1947-1949)

Hay mixtures in pounds per acre	First-year meadow average yield
	tons
(1) Timothy 10, Alsike 4, Early Red Clover 6	1·44
(2) Timothy 10, Alsike 4, Altaswede Red Clover 6	1·79
(3) Timothy 10, Alsike 1, Altaswede 6	1·66
(4) Timothy 10, Alsike 1, Early Red 4, Alfalfa 3	1·25
(5) Timothy 10, Alsike 2, Early Red 6, Ladino 2	1·35
(6) Timothy 10, Alsike 2, Altaswede 1, Alfalfa 3	1·37
(7) Timothy 10, Ladino 2, Altaswede 6	1·57

Mixtures containing Altaswede red clover yield more than those containing early red clover. However, mixtures containing alfalfa mature more evenly when the red clover is of the early type.

The growing of altaswede red clover:—The growing of late red clover, one-cut type, in comparison with the early, two-cut type, either sown alone or in mixtures, is an active project at the Experimental Station, Kapuskasing, and is verified at the District Experiment Substation, Makamik, Que. Average yields obtained from varieties for a 6-year period are shown in table 51.

TABLE 51.—TESTING VARIETIES OF CLOVER, MAKAMIK, QUE., AVERAGE 6 YEARS, 1940-45

Variety	First cut	Second cut	Total per acre
	tons	tons	tons
Altaswede	3·10	—	3·10
Ottawa Early	1·31	1·36	2·67
Commercial	1·19	1·31	2·50

The results show that altaswede red clover outyielded the others. In one cut, it produced 24 per cent more than the total of the two cuts from the early variety at Kapuskasing and 48 per cent more at Makamik where the two-cut types were cut only once each season. The substitution of Altaswede late clover for early red clover in the hay mixture, gave an increase of 28 per cent at both Kapuskasing and Makamik.

Altaswede is more winter hardy than the two-cut types and is somewhat perennial in habit, lasting several years in the hay field. It matures at the same

FIG. 14.—(Left): Hay mixture containing Early Red Clover. Yield, 2·02 tons per acre. (Right): Hay mixture containing Altaswede Red Clover. Yield, 3·32 tons per acre. Photo taken on the District Experiment Substation, Makamik, Que.

time as timothy and therefore makes a more compatible mixture. It is leafy and produces a high yield from one cutting, which is important in a region where, very often, inclement weather conditions prevent the cutting of a second hay crop.

Altaswede red clover can also be grown for seed production. For several consecutive years, it has been possible to harvest good clover seed and yields as

high as 300 pounds per acre have been recorded. In the same period it was practically impossible to harvest seed from the early variety either from the first or the second growth.

The Improvement of Pasture

The improvement of permanent pasture by the application of chemical fertilizers has been an active project on Illustration Stations for the past ten years. Records derived from ten years of experimental work offer reasonable evidence that pasture fertilization has increased the productivity of pasture swards. Seven plots of one-half acre each were used in this experiment, two were not fertilized and served as checks. Plot No. 1 received an application of 100 pounds annually of sulphate of ammonia, with 600 pounds of superphosphate 20 per cent and 120 pounds of muriate of potash, every three years. On plot No. 2, 600 pounds of superphosphate 20 per cent, and 120 pounds of potash were applied every three years. Plot No. 3 received an application of 600 pounds of superphosphate every three years. The fertilizer treatment of plot No. 4 was an annual application of 100 pounds of sulphate of ammonia, 200 pounds of superphosphate 20 per cent, and 40 pounds of potash. Plot No. 5 was given the same treatment as plot No. 1, but annually. Two, one-square-yard pasture cages were placed on each plot and the yield was recorded as green herbage at regular intervals. The results obtained are shown in table 52.

FIG 15.—Pasture pen on the pasture experiment at Ramore, Ont., 1944. Growth from a complete fertilizer treatment.

Results showed that all fertilized plots gave yields superior to those of the non-fertilized area. Annual applications of 100 pounds of sulphate of ammonia per acre, in addition to phosphate and potash resulted in an increase in yield, but had a slightly depressing effect on the growth of clovers and a stimulating effect on the growth of grasses. Where only one-third of the phosphate and potash was applied annually with 100 pounds of sulphate of ammonia, the results show that a light application of fertilizers annually is not more profitable than a heavy application at intervals of three years. Treatment No. 5 applied annually gave good results, but seemed to be too costly. The greatest percentage of clover was found on the fertilized plot that received superphosphate and potash every three years without any sulphate of ammonia. Superphosphate 20 per cent at the rate of 600 pounds per acre every three years seemed to have more value than either nitrogen or potash in stimulating the growth of the pasture sward, particularly during the first and second year. Because of its relatively low cost it would be the most economical treatment. Another point of interest was the greater growth of weeds and the decrease in the growth of clovers in the

TABLE 52.—FERTILIZER TRIALS ON PERMANENT PASTURE, AVERAGE YIELDS

Yields and Per Cent Clovers, Grasses and Weeds in Fertilized Pasture Trials

Station		No. 1				No. 2				No. 3				No. 4				No. 5				Average of checks			
		100 lb. ammonium sulphate, annually 600 lb. superphosphate 20 per cent, 120 lb. muriate of potash every three years				600 lb. superphosphate, 20 per cent, 120 lb. muriate of potash every three years				600 lb. superphosphate, 20 per cent, every three years				100 lb. ammonium sulphate 200 lb. superphosphate 20 per cent, 40 lb. muriate of potash annually				100 lb. ammonium sulphate, 600 lb. superphosphate 20 per cent, 120 lb. muriate of potash annually							
		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
	(years)	ton	%	%	%	ton	%	%	%	ton	%	%	%	ton	%	%	%	ton	%	%	%	ton	%	%	%
Amos, Que.	1949–51	6·80	50·8	35·3	13·9	6·90	58·3	28·0	13·7	6·57	56·6	31·8	11·6	7·47	52·1	37·9	10·0	7·57	31·6	52·9	15·5	3·79	21·6	51·6	26·8
Champcoeur, Que.	1947–51	7·09	30·8	56·4	12·8	5·21	32·6	49·2	14·6	4·27	27·8	52·2	20·0	5·00	29·4	53·5	17·1	5·62	36·1	52·1	11·8	4·94	32·0	46·7	21·3
Cloutier, Que.	1949–51	4·54	38·0	42·5	19·5	3·00	46·3	21·4	32·3	2·39	34·1	35·4	30·5	2·84	32·6	31·3	36·1	2·64	24·2	48·4	27·4	2·56	27·4	38·7	33·9
Earlton, Ont.	1943–51	8·08	30·5	57·4	12·1	7·02	35·6	50·1	14·3	7·08	37·5	48·3	14·2	7·27	35·4	52·5	12·1	8·48	41·2	47·3	11·5	4·26	14·5	64·6	20·9
Genier, Ont.	1948–51	7·08	42·5	35·9	21·6	7·03	27·2	54·2	18·6	6·98	31·4	49·7	18·9	10·68	28·9	58·9	18·2	8·77	29·5	49·4	21·1	4·83	19·0	47·8	33·2
Launay, Que.	1948–51	6·12	42·9	47·1	10·0	5·95	37·5	48·7	13·8	5·03	41·2	44·8	14·0	6·02	45·8	42·9	11·3	6·05	33·4	52·7	13·9	3·46	35·3	44·3	20·4
Laverlochere, Que.	1944–51	9·48	33·2	53·0	13·8	7·42	40·9	47·1	12·0	8·53	36·5	48·3	15·2	8·51	28·6	54·7	16·7	8·32	35·0	47·9	17·1	5·61	21·7	53·0	25·3
Makamik, Que.	1943–51	8·98	48·1	40·0	11·9	9·12	50·6	35·6	13·8	8·60	51·2	35·4	13·4	8·25	44·4	42·3	13·3	9·48	48·8	37·3	13·9	5·48	23·4	41·8	34·8
Matheson, Ont.	1948–51	8·30	40·1	47·8	12·1	5·01	50·3	38·2	11·5	6·46	53·5	34·3	12·2	5·70	44·5	43·5	12·0	9·52	47·8	42·7	9·5	4·36	24·2	58·1	17·7
Ramore, Ont.	1943–51	8·74	34·2	53·2	12·6	8·76	44·1	44·5	11·4	8·11	36·2	52·2	11·6	9·62	31·2	58·2	10·6	11·19	40·0	48·7	11·3	4·14	12·1	63·5	24·4
Average—47 tests		8·13	37·6	49·0	13·4	7·23	42·4	43·4	14·2	7·14	40·0	44·9	15·1	7·71	35·9	49·6	14·5	8·54	39·1	46·7	14·2	4·62	20·8	53·3	25·9
Per cent yield compared with check		175·9				156·4				154·5				166·8				184·8				100·0			

non-fertilized plots. This means that not only is there less production, but the nutritive value of the herbage is lower than the herbage on the fertilized plots.

Livestock

Livestock are very important in the overall economy of the farm. This is shown by the fact that over a 9-year period, cash income from this source, averaged 52·5 per cent of the total farm revenue in this district of supervision. The improvement of dairy herds constitutes one of the most important phases of work conducted on Illustration Station farms.

In the case of dairy cattle, milk records are kept to determine the relative productivity of the dairy cows. Operators are encouraged to maintain high quality purebred sires at the head of the herds. They are also strongly advised to rear properly every year at least two heifer calves from their best dams to improve the dairy herd and increase milk production.

At present the dairy cattle population on eight Illustration Station farms is composed of 170 head, made up of 7 bulls, and 125 dairy cows, of which 50 are Holstein, 42 Ayrshire, and 43 crossbred. The results of good management practices, and of selection based on breed and type on production records are shown in table 53.

TABLE 53.—VARIATION IN MILK PRODUCTION, 14-YEAR PERIOD, 1937-51

Milk production group	1937	1951
	Percentage of cows	Percentage of cows
5,000 lb. of milk or under	48·2	8·4
5,000 lb. to 8,000 lb. of milk	51·8	50·6
8,000 lb. to 11,000 lb. of milk	0·0	29·0
11,000 lb. of milk or over	0·0	12·0

NOTE.—Figures shown for 1951 were taken from six dairy herds with a total population of 93 milking cows.

In 1937, when most of the Illustration Station farms were established, 48·2 per cent of the cows were producing 5,000 pounds of milk or under, while in 1951, this number had dropped to 8·4 per cent. Furthermore, in 1937 no cow produced more than 8,000 pounds a year, while in 1951, 12·0 per cent had reached a production of 11,000 pounds or over.

Swine production:—On the stations where pigs are kept, grade Yorkshire sows were selected for breeding purposes on the basis of type, conformation, and litter size. At Champcoeur, Genier, Launay, Laverlochere, Makamik, and Matheson, the operators bred their sows to have two litters per year. In all cases, purebred Yorkshire boars were used. The pigs were fed home-grown grain and were sold on the local market. On an average, for seven stations, 2 sows were kept every year, from which 33 pigs were born. Eight pigs per year on the average were lost at birth or during the brooding age. Records of financial progress of the hog enterprise for the past nine years show that 21 hogs were marketed yearly with an average net return of $391 per station. Over a 9-year period, this enterprise has contributed up to 9·8 per cent of the total farm income.

Sheep production:—Sheep are kept on four stations, and a financial statement of the sheep enterprise has been recorded for the past nine years. An average of 12 ewes were wintered from which 16 lambs were born, 4 died at birth, and 11 were marketed yearly with a net return of $177.35 per station.

Poultry production:—The Barred Rock breed of poultry is kept at Launay, Laverlochere, Makamik, Genier, and Champcoeur, while the operator at

Matheson purchases yearly 500 one-day-old cockerels for meat production only. Records are kept of the mortality during the brooding age, number of hens kept, number of eggs laid, and average price per dozen. For six stations, records show that for an 11-year period, an average of 255 chicks were received in the spring. The mortality rate during the brooding age throughout the same period was 10·9 per cent. An average number of 97 hens was kept, laying 155 eggs annually over a 13-year period. The average return per dozen eggs for five stations over a period of 8 years, was $0.47 per dozen. Records of financial progress show that over a 9-year period, the poultry enterprise contributed up to 10·3 per cent of the total farm revenue.

Publicity

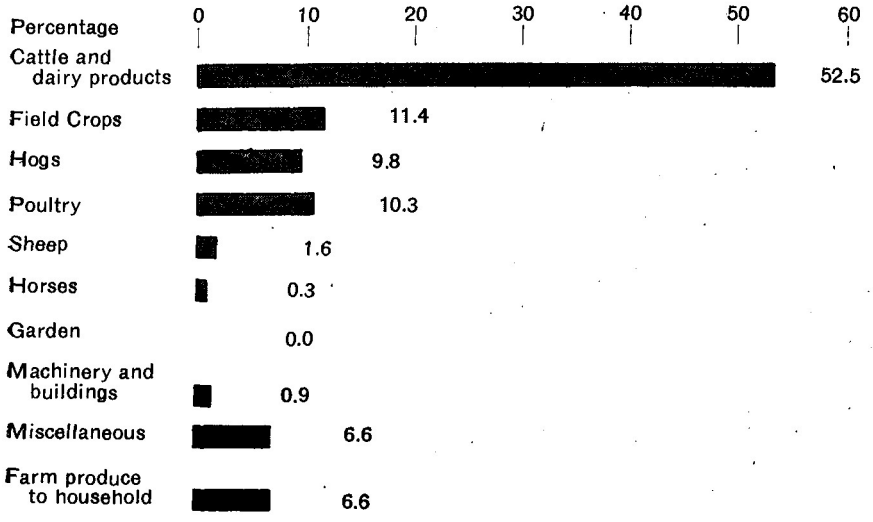
The objective of Illustration Station work is reached only when farmers learn of advancements made in agricultural techniques and improved varieties, and adopt them for their own use. In order to publicize the work being done at the District Experiment Substation and Illustration Stations, field meetings are held and the public invited to inspect the many experimental projects and listen to discussions on agricultural problems. These occasions have been enthusiastically welcomed by neighbouring farmers, some families coming a distance of 100 miles to attend.

There were 175 people present at the first field day held at the Makamik Experiment Substation in 1937. The attendance went up to 1,000 in 1939 with a 13-year average of 424. On the the associated Illustration Stations, a field meeting is also held each year and the average attendance for the past 12 years was 150 farmers. Projects of most interest to the visitors were those dealing with cereals, forage crops, fertilizers, lime, and pasture improvement.

CHART 2—SOURCES OF REVENUE ON ILLUSTRATION STATIONS

Northern Ontario and Northwestern Quebec

1942 to 1951 inclusive



Farm Business Studies

Profitable farming in the district depends on steadily increasing production of field crops, livestock, and livestock products. A financial review of each station was undertaken to determine the degree to which production was converted into cash revenue. Each operator submitted a weekly report giving all the revenues and expenses from the livestock and crop enterprises. Farm products used in the household were also considered as revenue, because they would be available for sale if not consumed by the family.

The information received from each operator covering the total cash revenues and the total cash expenses involved in each enterprise was summarized by stations. The farm products used by the household were valued at market price, and the balance was net cash revenue. A summary statement of farm revenues and expenses over a 9-year period, showed that the total cash expenses were 61·5 per cent of the total revenues. The percentage contribution of the different farm enterprises to total cash income, on a 9-year average, is shown on chart 2.

The true financial picture of one farm is obtained not only by an analysis of the revenues and expenses, but also by assessing the increases or decreases in the farm inventory. For instance, expenses incurred in the purchase of cattle and equipment often result in increased earning capacity for the operator. Increases in revenue can also be obtained by selling surplus equipment. On the other hand large sales of livestock may appear as a high revenue, but in reality the farmer is decreasing his earning capacity. An inventory is taken at the beginning as well as at the end of each year so that average annual progress can be measured.

ACTIVE PROJECTS

Animal Husbandry

Beef Cattle

A 1.532-1	(Policy) Breeding Shorthorn Cattle
A 1.485-1	(Policy) Vaccination (Calfhood) for Contagious Abortion
A 1.585-1	(Policy) Tuberculosis in Cattle, Control of,
A 1.585-2	(Policy) Serum Test for Contagious Abortion
A 1.472-1	Periodic Costs of Rearing Females
A 1.472-2	Periodic Costs of Rearing Males
A 1.545-5	Commercial Fertilizer Formulae for Permanent Pastures

Dairy Cattle

A 2.432-1	(Policy) Breeding Ayrshire Cattle
A 2.485-1	(Policy) Tuberculosis in Dairy Herds, Control of,
A 2.485-2	(Policy) Vaccination (Calfhood) for Contagious Abortion
A 2.585-1	(Policy) Serum Test for Contagious Abortion
A 2.472-1	Periodic Costs of Rearing Dairy Females
A 2.472-2	Periodic Costs of Rearing Dairy Males
A 2.522-3	(Policy) Record of Performance
A 2.572-1	Feed Cost of Milk and Butterfat Production
A 2.144-1	Losses in Ensiling Various Crops

Horses

A 3.572-1	Cost of Horse Labour
A 3.572-2	Cost of Maintaining Work Horses

Swine

A 5.532-1	(Policy) Breeding Yorkshire Swine
A 5.551-1	Fecundity and Nursing Capacity in Swine, Study of,
A 5.672-1	Cost of Raising Pigs to Time of Weaning

Apiculture

Ap. 2.5	Races of Bees for Honey Production
Ap. 2.1.5	Wintering Surplus Queens

Cereals

Ce. 1.01.01	General and Supplementary Tests of Spring Wheat
Ce. 1.02.05	Breeding Spring Wheat for Eastern Canada
Ce. 1.10.01	A Study of the Response of Varieties of Spring Wheat to Length of Day and other Environmental Conditions
Ce. 1.07	Production and Maintenance of Elite and Registered Seed Stocks of Spring Wheat
Ce. 3.01.01	General and Supplementary Tests of Oats
Ce. 4.02.05	Breeding Improved Oat Varieties with Disease and Lodging Resistance for Ontario
Ce. 4.08	Production and Maintenance of Elite and Registered Seed Stocks of Oats
Ce. 5.01.01	General and Supplementary Tests of Barley
Ce. 5.02.01	Breeding Improved Varieties of Barley for Eastern Canada
Ce. 5.07	Production and Maintenance of Elite and Registered Seed Stocks of Barley
Ce. 7.01.01	General and Supplementary Tests of Field Peas
Ce. 7.02.01	Breeding Improved Varieties of Medium Sized Field Peas with Early Maturity and Disease Resistance
Ce. 17.05	A Study of the Losses Caused by Disease in Spring Wheat

Field Husbandry

F.6.1.3.2	Preparation of Sod Land for Grain
F.10.16.2.1	Methods of Surface Drainage Parts 1 and 2
F.10.16.2.2	Tile-drained versus Undrained Land
F.1.1	Meteorological Records
F.3.1.2	Sequence of Crops
F.8.4.1.64	Perennial Sow Thistle Eradication
F.8.5.1.39.1.1	Control of Perennial Weeds by Herbicides in a Grain Crop
F.8.5.1.40.1.1	Control of Couch Grass by Herbicides
F.8.5.2.1.17.1	Control of Weeds in Potatoes by 2,4-D
F.4.2.3.4	Commercial Fertilizer Formulae for Pastures
F.9.2.4	Losses in Ensiling Various Crops
F.5.1.3.4.1	Part 1. Manure and Commercial Fertilizer Combinations for Barley
F.5.1.3.4.1. and C.51.04	Part 2. Manure and Commercial Fertilizer Combinations for Barley
F.10.4.3.1.2	Hay and Forage Harvesting Machinery and Equipment (Forage crop harvester, p.t.o. and engine drive)
F.10.1.1.0	Farm and Garden Tractor Operating Costs and Utility

Forage Crops

Ag. 5.01	Field Corn—Variety Test for Ensilage Purposes
Ag. 5.07	Alfalfa—Variety Tests
Ag. 5.08	Red Clover—Variety Tests
Ag. 7.01	Turf Grass Experiments
Ag. 5.14	White Dutch Clover—Variety Tests
Ag. 2.01	Plant Introductions and Testing of New Species
Ag. 5.23	Perennial and Biennial Grasses and Legumes for Hay
Ag. 5.24	Perennial and Biennial Grasses and Legumes for Pasture
Ag. 5.24.12	Commercial Fertilizer Formulae for Pastures

Horticulture

H-261	Annual Flowers, Variety Experiment
H-274	Herbaceous Perennials Variety Experiment
H-298	Hedges, Variety Experiment
H-307	Trees and Shrubs, Flowering, Ornamental and Shelter, Variety Experiment
H-797	Flowering Bulbs, Variety Experiment
H-21	Strawberry, Variety Experiment
H-793A	Bush Fruits, Currant, Variety Experiment
H-793B	Bush Fruits, Gooseberry, Variety Experiment
H-793C	Bush Fruits, Raspberry, Variety Experiment
H-102	Corn, Variety Experiment
H-795	Leguminous Vegetables, Variety Experiment
H-803	Root Vegetables, Variety Experiment
H-804	Leafy Vegetables, Variety Experiment
H-805	Vegetable Vine Crops, Variety Experiment
H-806	Solanaceous Vegetables, Variety Experiment

Poultry

P. 1.112	Pedigree Breeding for Egg Production
P. 2.171	Snow versus Water
P. 5.13	A Study of Requirements in Ventilation, Insulation, and Temperature Control in Laying Houses under Rigorous Winter Conditions
P. 8.41	Costs of Egg Production

Illustration Stations

Rotations

IS-E1.31	Hoed Crop, Cereal (s), Clover
IS-E1.42	Hoed Crop, Cereal (s), Clover, Timothy
IS-E1.43	Cereal (s), Clover, Timothy, Timothy
IS-E1.51	Hoed Crop, Cereal (s), Clover, Timothy, Timothy
IS-E1.53	Cereal, Cereal (s), Clover, Timothy, Timothy

Illustration Stations—Continued

SOIL FERTILITY

IS-02.03	Chemical Fertilizer as a Supplement to Farm Manure
IS-02.03B	Chemical Fertilizer as a Supplement to Farm Manure (Rate of application)
IS-02.03C	Chemical Fertilizer as a Supplement to Farm Manure (Place in rotation when hoed crop grown)
IS-02.03C2	Chemical Fertilizer as a Supplement to Farm Manure (Place in grain rotation)
IS-02.04B	Chemical Fertilizer: Study of Formulae
IS-02.08	The Effect of Ground Limestone on Farm Crops

CULTURAL METHODS AND PRACTICES

IS-03.01	Control of Weeds by Cultural Methods
IS-03.04	Study of Tillage Methods (Eastern)

AGRICULTURE ENGINEERING

IS-04.03	Improving Hygienic Conditions in Old Stables
IS-04.08	Whitewashing and Painting of Farm Buildings

METEOROLOGICAL STUDIES

IS-05.01	Study of Regional Climatic Conditions as Related to Crop Production
IS-05.02	Records of Regional Precipitation

CEREALS

IS-06.02	Date of Seeding
IS-06.04	Introducing Suitable Varieties of Cereals
IS-06.05	Testing Cereal Varieties

FORAGE CROP STUDIES (HAY CROPS)

IS-07.01	Testing Mixtures for Hay or Pasture
IS-07.08	Methods of Producing Seed of Leguminous Plants
IS-07.09	Methods of Producing Seed of Grass Plants
IS-07.10	Inoculation versus Non-inoculation of Legumes

PASTURE INVESTIGATIONAL STUDIES

IS-08.02	Chemical Fertilizers for Pasture: Study of Formulae

ROOT AND SILAGE CROPS

IS-09.03	Oats, Peas, and Vetches as a Hay and Silage Crop
IS-09.07	Methods of Growing Root Crops
IS-09.12	Turnip Variety Test

POTATO PRODUCTION STUDIES

IS-10.05	Potato Variety Test
IS-10.06	Potato Disease and Insect Control

HORTICULTURE

IS-11.02	Stimulating Interest in the Development of the Farm Garden
IS-11.07	Tree Fruit Variety Test
IS-11.17	Farm Home Beautification

Illustration Stations—Concluded

LIVESTOCK

IS-13.01	Dairy Cattle Production
IS-13.03	Animal Pathological Records
IS-13.05	Sales of Livestock for Breeding Purposes
IS-13.06	Beef Production
IS-13.07	Swine Production
IS-13.08	Sheep Production

POULTRY

IS-14.01	Poultry Production
IS-14.04	Sale of Hatching Eggs, Pullets, and Cockerels for Reproduction

FARM MANAGEMENT

IS-17.03	Studies of Various Defects in Regional Farming (Study of Farm Productivity and Progress)
IS-17.04	Study of Farm Business

PUBLICITY

IS-19.01	Field Days
IS-19.02	Publications and Presentation of Results

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