CANADA
DEPARTMENT OF AGRICULTURE
EXPERIMENTAL FARMS SERVICE

DOMINION EXPERIMENTAL STATION

FREDERICTON

N. B.

S. A. HILTON, B.S.A. M.Sc. (Agr.) SUPERINTENDENT

PROGRESS REPORT
1948 - 1952

Blight-resistant potato seedlings are shown at left and right, with a centre row of Green Mountain potatoes killed by late blight.

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INTRODUCTION

This Station was established in 1912 to serve the province of New Brunswick. The publication of annual reports was discontinued in 1930. Two progress reports have been published since that date, covering the periods 1931-36 and 1937-47. The present report, covering the period 1948-52, deals with problems in animal and poultry breeding; cereal, forage crop, vegetable and fruit breeding, variety and strain testing; and soil culture and fertilization.

During the period under review three Substations were established.

1. Horticultural Substation at McDonald's Corner, Queens county, in 1947. The research program on this unit will be reported in a separate publication.

2. Blueberry Substation at Tower Hill, Charlotte county, in 1949. The first 5-year progress report of this work will be published in 1954.

3. Potato Breeding Substation at Alma, Albert county. This location was used as the site for the multiplication of potato breeding material in previous years, and was selected as the permanent location in 1948.

The Science Service has set up field laboratories at all three Substations to study insect and disease problems.

A chemistry laboratory was established at Fredericton in 1952 to complement the plant nutrition studies in the Field Husbandry, Horticulture, and Illustration Station Divisions.

Fourteen Illustration Stations are supervised from the Experimental Station. The major fields of work at the Fredericton Station are Horticulture and Soil Fertility, but the program is diversified to meet the mixed-farming problems in the province, and to serve the specialized potato- and fruit-growing areas.

In the interests of brevity only a small portion of the research work conducted during the past five years is reported. Inquiries are invited for further details on the projects outlined or on any problem not mentioned herein.

METEOROLOGICAL RECORDS

The climate of the Fredericton area favors the production of cereal and grassland crops, roots, potatoes, apples and most vegetables. The length of the frost-free period at this Station is usually sufficient for the crops generally grown in the district. The weather records are taken in co-operation with the Meteorological Division of the Department of Transport.

TABLE 1—TEMPERATURE, PRECIPITATION, AND SUNSHINE RECORDS
DOMINION EXPERIMENTAL STATION, FREDERICTON, N.B., 1914–1952

(39 Years)

Month	Temperature °F.			Precipitation			Bright sunshine
	Mean maximum	Mean Minimum	Mean	Rain	Snow	Total precipitation	
				in.	in.	in.	hr.
January	24·2	3·6	13·95	1·27	21·68	3·43	103·47
February	26·4	4·1	15·27	0·83	20·35	2·86	119·94
March	36·5	17·0	26·75	1·59	14·36	3·05	141·14
April	49·2	29·4	39·35	2·54	7·52	3·29	158·88
May	61·3	38·3	50·64	2·90	0·56	2·95	203·99
June	72·2	48·8	60·54	3·57	—	3·57	204·86
July	78·1	55·1	66·61	3·26	—	3·26	230·12
August	76·1	53·2	64·68	3·43	—	3·43	216·56
September	67·5	45·9	56·71	3·54	—	3·54	161·43
October	55·9	36·1	46·03	3·66	1·22	3·78	144·25
November	41·5	25·9	33·68	2·83	7·15	3·55	91·20
December	28·1	11·0	19·61	1·53	17·00	3·23	89·53
Total	—	—	—	30·95	89·84	39·94	1,865·37

TABLE 2—ANNUAL PRECIPITATION, DOMINION EXPERIMENTAL STATION, FREDERICTON, N.B. (1948-1952)*

(Inches)

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1948	3·87	1·32	2·46	2·54	5·46	2·54	4·47	2·71	1·80	2·93	5·26	2·91	38·27
1949	3·22	2·27	3·07	3·07	3·19	2·35	2·11	2·62	7·95	2·29	6·92	3·80	42·86
1950	3·99	4·51	3·03	5·81	1·05	5·91	3·40	3·28	0·72	3·77	9·07	6·29	50·83
1951	4·84	4·79	2·77	5·17	3·59	3·52	6·56	4·38	2·87	3·54	6·29	6·49	54·81
1952	4·95	6·28	1·66	3·07	3·46	5·95	2·05	2·81	2·69	4·69	1·88	2·72	42·21
5-year average	4·17	3·83	2·60	3·93	3·35	4·05	3·72	3·16	3·21	3·44	5·88	4·44	45·80
39-year average	3·43	2·86	3·05	3·29	2·95	3·57	3·26	3·43	3·54	3·78	3·55	3·23	39·94

* For records of previous years see the 1937–47 Progress Report from this Station.

TABLE 3—SPRING WORK, FROST AND FREEZE-UP RECORDS, DOMINION EXPERIMENTAL STATION, FREDERICTON, N.B. (1948–1952) AND AVERAGES*

Frost—Temperature lower than 32·6°F.

Year	Date of beginning work on the land	Date of last spring frost	Number of days in which frost occurred			Date of first frost in the fall	Frost-free period	**Date of freeze-up
			June	July	August			
							days	
1948.....	April 30	May 21	0	0	0	September 17	118	December 12
1949.....	May 3	May 22	0	0	0	September 11	111	November 10
1950.....	May 3	May 15	0	0	0	September 20	127	November 21
1951.....	May 2	May 19	0	0	0	October 10	143	November 22
1952.....	April 21	May 6	0	0	0	September 28	144	November 30
5-year average 1948–1952....	April 30	May 17	0	0	0	September 23	128·6	November 25
39-year average 1914–1952....	—	May 19	4 times	0	0	September 26	129·2	—

* For records of previous years see the 1937–47 Progress Report from this Station.
** Date beyond which work could not be done on the land.

Date of latest spring frost on record.....June 9, 1914.
Date of earliest fall frost on record.....September 8 , 1917.
Shortest frost-free period on record.....102 days in 1917.
Longest frost-free period on record.....154 days in 1933.

LIVESTOCK

S. A. Hilton

Horses

The horse breeding program outlined in the previous Progress Report was continued. Mel Laet II remained at the head of the Percheron stud until the end of 1952. Some interest in the breeding of good horses has continued, 76 privately owned mares being bred during the last five years. Five colts were raised at the Station during the same period.

Dairy Cattle

The Holstein breeding program, as outlined in the Station Progress Report (1937-47) was continued on the "Rag Apple" blood lines. The herd is used in connection with the pasture research program to graze the experimental areas. Production records are maintained and all sires used are evaluated on the basis of the Herd Sire Index. Details regarding these data may be obtained on request. Foundation stock was sold to the Illustration Station at Silver Falls for the establishment of a purebred herd and ten females were transferred to the Experimental Station, Lethbridge, Alta., to be used in a dairy herd management project.

Records are maintained of the feed consumption of all milking females. The average feed consumption per 100 pounds milk during the past five years is: meal—24·11 lb.; ensilage—26·68 lb.; hay—54·79 lb.; roots—10·51 lb.; and pasture—1·44 days. These figures may be used as a basis for calculating the average feed cost of milk production by using local cost figures.

Swine Breeding

Two major breeding projects have been under way during the past five years. (1) A study of the inheritance of carcass quality by using boars and sows from high- and low-scoring lines. This project was carried out in co-operation with the Central Experimental Farm and the Production Service. (2) Breeding and selection of two inbred lines of Yorkshires. One of these lines was developed from a boar and two sows obtained in 1946 from a litter representing one of the high-scoring lines in Prince Edward Island. This "Island" strain proved to be prolific with fair carcass quality, but lacked strength and vigor.

The second strain (Napton) was from a line that had been closely inbred at the Experimental Farm, Nappan, N.S., for three generations. It was combined with another closely inbred line from the Brandon Experimental Farm and the resulting progeny were then inbred. They showed great vigor, fair prolificacy, and carcass quality.

Three "Island" and two "Napton" litters tested in 1952 gave average Advanced Registry scores of 79·7 and 81·0, respectively. These two strains are now being combined and the progeny show marked uniformity and vigor. Both strains have been free from deformities and the program shows definite promise.

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Antibiotics and Vitamin Supplements

A test was conducted in 1952 to study the effect of an antibiotic and vitamin supplement in a ration for suckling pigs. The basic ration was supplemented with 18 grams aureomycin and 18 milligrams B-12 per ton of creep feed. Alternate litters were placed on the basic and supplemented rations, respectively, when the pigs were three weeks of age. The pigs were weaned at eight weeks and continued on the basic and supplemented rations to ten weeks of age. There were significantly greater gains and lower mortality where the antibiotic and vitamin B-12 supplements were used than where the unsupplemented ration was fed.

CEREALS

T. C. Chiasson

Spring Wheat

Over 70 varieties and strains of spring wheat have been tested for yielding ability and disease resistance during the period under review. Of this number, 24 were still on test in 1952, the remainder having been discarded. Only three named varieties were tested for the entire 5-year period.

Acadia, a bearded, hard red spring wheat, has been the highest yielding variety tested during the above period. It is resistant to bunt and black chaff, moderately resistant to stem and leaf rust, semi-resistant to loose smut and has also shown good resistance to some of the forms of root rot, commonly found in the East. It is also resistant to sprouting.

Cascade, a soft white wheat introduced in 1947, has yielded nearly as well as Acadia and has similar disease resistance but has a tendency to sprout in the stook or in the bin if harvested before it is completely ripe and dry.

Huron, an old variety, generally yields well but has very little resistance to disease. It is not recommended when either Acadia or Cascade can be obtained. Data on these varieties are shown in Table 4.

TABLE 4—WHEAT EASTERN RUST GROUP

(5-year average 1948-1952 inclusive)

Variety	Average yield	Days to mature	Length of straw	Lodging resistance	Weight per bushel	Weight per 1,000 kernels
	bu.	days	in.	1-9*	lb.	gm.
Acadia	45·7	101·6	42·7	1·1	63·1	36·2
Cascade	45·0	105·1	47·5	1·1	62·4	37·5
Huron	43·1	105·5	48·4	1·2	63·0	36·0

* A score of 1 means a very strong straw.

Oats

The acreage of oats in New Brunswick is approximately ten times that of any other cereal grain. For this reason testing of oat strains and varieties has been the major project in cereal work at this Station. During the past five years, 286 strains and varieties have been tested for one or more years and of these 59 remained on test in 1952. Data on the five varieties tested for the full five years are shown in Table 5.

Abegweit has exceeded all other varieties in yield during this time. It may be somewhat late in maturing for districts with an extremely short growing season but it is well adapted for most areas of New Brunswick.

Ajax has given the second highest yield in the tests conducted at this Station during the past five years. It has yielded an average of 7·9 bushels per acre less than Abegweit. It is widely adapted throughout the province and is the earliest variety still on test. It is inclined to be high in hull although not much higher than Abegweit. The grain is small and inclined to be thin. Where earliness is essential this variety will undoubtedly be grown for some time yet.

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TABLE 5—OAT VARIETY TEST

(5-year average 1948–1952)

Variety	Yield per acre	Per cent hull	Kernels per acre	Maturity	Length of straw	Lodging resistance	Weight per bushel	Weight per 1,000 kernels
	bu.	%	lb.	days	in.	1–9	lb.	gm.
Abegweit	105·1	27·1	2,611·8	98·1	47·6	1·6	33·5	30·8
Ajax	97·2	27·8	2,388·2	93·4	49·1	2·3	34·7	27·2
Beaver	96·7	24·6	2,478·8	95·7	48·5	2·4	33·5	31·9
Erban	94·1	25·7	2,373·2	96·0	48·4	2·0	32·4	32·2
Victory	92·0	27·2	2,278·4	102·1	51·1	2·2	36·7	31·7

* A description of the varieties listed here will be found in the 1937–1947 Progress Report of this Station.

Beaver has yielded an average of only one-half bushel less per acre than Ajax during the past five years. Because of its low percentage of hull it actually has produced over 90 pounds more kernels per acre than Ajax. It is about midway between Abegweit and Ajax in maturity. As a result of its higher quality and larger and more attractive kernels this variety has gradually been replacing Ajax. However, when Abegweit becomes plentiful its heavier yielding ability will probably make it one of the most popular varieties.

Barley

The barley acreage seems definitely on the increase in New Brunswick. In 1951, for instance, the acreage of barley stood at an all-time high of 22,000 acres. Many factors are responsible for this increased interest, which indicates that barley will probably become a much more important crop in this province than it has been in the past.

Twenty-eight varieties and strains of barley were tested at the Station for one or more of the past five years. Only four named varieties were tested for the whole period. The data for these varieties are shown in Table 6.

TABLE 6—BARLEY VARIETY TEST

(5-year average 1948–1952)

Variety	Yield per acre	Days to mature	Length of straw	Lodging Resistance	Weight per bushel	Weight per 1,000 kernels
	bu.	days	in.	1–9	lb.	gm.
Montcalm	67·3	87·6	45·5	3·3	51·8	37·8
Fort	67·1	87·3	44·6	1·5	51·0	37·6
Charlottetown No. 80	64·1	90·6	42·1	3·5	53·3	39·7
O.A.C. No. 21	62·1	86·2	45·6	3·6	49·7	37·4

Fort, a variety which was released in 1952, has had a limited distribution to date. Grower reaction to this variety was good in 1952, which was an extremely poor grain year. In test plots it has outyielded Charlottetown No. 80 by 3·0 bushels per acre and has been about equal to Montcalm. It is much superior in lodging resistance to any variety tested in recent years. Fort is somewhat susceptible to loose smut although it does not appear so susceptible as Montcalm. It does not thresh so easily as Charlottetown No. 80 but seems equal to Montcalm and O.A.C. 21 in that respect.

Field Peas

Eleven varieties and strains of field peas have been tested at this Station during the past five years. The results for the named varieties tested the full five years are shown in Table 7. A description of the varieties will be supplied on request.

TABLE 7—FIELD PEAS VARIETY TEST

(4-year average)

Variety	Yield per acre	Days to mature	Length of vine	Weight per bushel	Weight per 1,000 kernels
	bu.	days	in.	lb.	gm.
Valley	56·9	101·0	63·5	64·5	214·2
Arthur	52·3	99·8	59·0	64·5	206·0
Chancellor	49·4	96·1	58·0	65·8	146·4

Field Beans

Four named varieties of field beans have been tested for the entire 5-year period. Two varieties were added during the last two years. Table 8 shows the data for the two periods. (1952 yields are omitted because of poor germination in test plots.)

It would seem at first glance that for commercial production a variety like Clipper or Lapin would be much more profitable than either Yellow Eye or Soldier. There is, however, a buyer's preference on some markets for the Yellow Eye and Soldier varieties and they usually command a premium. The price relationship would determine which variety would be most profitable.

TABLE 8—BEAN VARIETY TEST

(4-year average 1948–1951)

Variety	Yield per acre	Days to mature	Length of vine	Weight per bushel	Weight per 1,000 kernels
	bu.	days	in.	lb.	gm.
Clipper	48·5	109·8	12·8	64·4	277·2
Lapin	46·4	105·9	12·2	65·4	460·2
Burbank	43·8	106·5	12·8	65·6	261·5
Kenearly Yellow Eye	33·4	101·8	13·3	63·9	504·1
(2-year average 1950–1951)					
Clipper	48·8	109·1	12·8	63·5	278·5
Lapin	47·8	106·2	11·3	65·5	468·9
Burbank	46·3	108·5	12·0	64·0	268·8
Mohawk	41·2	102·8	11·6	62·8	612·7
Soldier	30·6	100·1	12·0	60·5	554·6
Kenearly Yellow Eye	30·0	100·8	12·2	64·0	489·7

FIELD HUSBANDRY

The activities of this Division are of a rather diversified nature. Soil fertility investigations, which comprise an integral part, refer to the use of manures, commercial fertilizer, and soil amendments in the economic production of field crops. Also included are studies relating to cultural practices, chemical weed control, pasture management, and the harvesting and storage of hay and silage. This Division is also concerned with the daily collection of meteorological data.

Soil Fertility Studies

A. A. MacLean

Fertilizer Tests on Different Soil Types

The soils of several of the important agricultural areas in New Brunswick have been classified and mapped by means of soil surveys. In such surveys differentiation is based on certain characteristics expressed within the soil profile. Consideration is also given to the agricultural adaptation and main problems associated with the different soils.

A study of four of the more important soils in the Saint John River Valley has been under way since 1948. Its objective has been to obtain information on fertilizer and lime requirements of different crops under varying soil conditions. Similar studies in other areas are being carried on through the medium of Illustration Stations. It is not presumed that each soil type will respond differently to fertilizer treatments; nevertheless it is imperative to consider all variables and to obtain general supplementary information regarding the properties of the various soils. In addition to inherent differences between soils as a result of soil-forming factors, there will undoubtedly be variations in their productivity and response to applied elements because of past management practices.

The primary objective of the initial studies was to obtain some general information on the overall productivity and fertility response of the more important soils. These formed the basis for more detailed field and laboratory studies initiated in 1952.

Grain

Field tests designed to study the effects of fertilizer elements on oats seeded to hay have been conducted in co-operation with farmers on the Carleton, Interval, Tracy, and Riverbank soils. Treatments containing varying rates of nitrogen, phosphorus, and potash have been applied at the rate of 500 pounds per acre.

Results obtained to date, although not conclusive, are of interest and a brief summary is presented in Table 9.

An application of 500 pounds per acre of 4-12-8 has increased yields 41 per cent on Carleton loam, 6 per cent on Interval silt loam, 22 per cent on Tracy loam and 26 per cent on Riverbank sandy loam. A definite response has been obtained from nitrogen, particularly on the Carleton, Interval, and Riverbank soils. These data are substantiated by further experimental work in which response has been obtained from rates of nitrogen as high as 40 pounds per acre. In the case of phosphorus, yields of oats have been increased on the Carleton loam and Tracy loam. Response to potassium has been small in all instances. The apparent decrease in yield resulting from applications of potassium on Interval silt loam is of interest and is being investigated further.

TABLE 9—EFFECT OF FERTILIZER TREATMENTS ON YIELD OF OATS ON FOUR SOIL TYPES

Soil	Average yield per acre 1948–51		Average yield increase from fertilizer elements		
	No fertilizer	4-12-8 at 500 lb./ac.	Nitrogen	Phosphorus	Potassium
	bu.	bu.	bu.	bu.	bu.
Carleton loam	39	55	8	6	2
Interval silt loam	55	58	6	2	−5
Tracy loam	50	61	3	5	3
Riverbank sandy loam	34	43	6	2	1

Hay

The hay mixture seeded in conjunction with these grain tests consisted of timothy, red clover, and alsike. The results have indicated that fertilizer applied to the grain crop does not contribute a great deal in enhancing yields of succeeding hay crops. The response pattern for first- and second-year hay has been similar; hence the results expressed here are mean values for the two years. An indication of the overall response and the contribution of the individual elements may be observed in Table 10.

TABLE 10—EFFECT OF FERTILIZER TREATMENTS ON YIELD OF HAY ON FOUR SOIL TYPES

Soil	Average yield per acre 1949–52		Average yield increase from fertilizer elements		
	No fertilizer	4-12-8 at 500 lb./acre	Nitrogen	Phosphorus	Potassium
	lb.	lb.	lb.	lb.	lb.
Carleton loam	2,793	2,847	− 82	+255	−119
Interval silt loam	3,482	3,854	−195	+502	+ 65
Tracy loam	2,959	3,759	−116	+584	+332
Riverbank sandy loam	3,427	3,700	+ 7	+ 80	+186

The greatest yield increase from fertilizer has been obtained on Tracy loam, the response being obtained from phosphorus and potassium. Phosphorus has also increased yields on Carleton loam and Interval silt loam. Nitrogen applications, which increased grain yields in all tests, have resulted in slightly lower hay yields on all soils with the exception of Riverbank sandy loam.

Potatoes

Additional field trials relating to fertilizer formulae and rates of application for potatoes are in progress on the Carleton loam. Average yields for the 4-year period 1948-51 show that this soil is highly responsive to fertilization. For instance, 1,500 pounds per acre of a 4-8-10 formula has produced a yield of 266 bushels per acre as compared with 99 bushels per acre on the unfertilized plot. Further, nitrogen, phosphorus and potassium have all played a major role in promoting this increased yield. For example, in this particular instance the data indicate that 35 per cent of this increase may be attributed to nitrogen, 31 per cent to phosphorus, and 34 per cent to potassium.

When considering rates of fertilization a number of formulae containing varying amounts of nitrogen, phosphorus, and potassium have been applied at increments of 1,000, 1,500 and 2,000 pounds per acre. The average yields with these rates in the 4-year period 1948-51 were 240, 251, and 282 bushels per acre, respectively. These increases, although not so pronounced as might be expected, would undoubtedly be highly economical under conditions that have prevailed in recent years.

Pasture

Trials to evaluate various fertility treatments in the rejuvenation of permanent pasture have been conducted on three soil types. Yield data for the 4-year period 1948-51 are presented in Table 11.

TABLE 11—COMMERCIAL FERTILIZER TREATMENTS FOR PERMANENT PASTURES

Treatment per acre	Average yield of dry matter per acre 1948–51, 4 years		
	Carleton loam	Tracy loam	Riverbank sandy loam
	lb.	lb.	lb.
No fertilizer	3,571	2,432	3,262
Phosphorus, 120 lb. P_2O_5 every 3 yr.	4,736	2,987	3,100
Phosphorus, 120 lb. P_2O_5 every 3 yr.+Potassium 60 lb. K_2O every 3 yr.	4,754	3,301	4,335
Phosphorus, 120 lb. P_2O_5 every 3 yr.+Potassium, 60 lb. K_2O every 3 yr.+Nitrogen, 20 lb. annually	4,893	4,288	3,738
Phosphorus, 120 lb. P_2O_5 every 3 yr.+Potassium, 60 lb. K_2O every 3 yr.+Nitrogen, 60 lb. annually	5,964	4,209	4,387

Fertilization has given substantial yield increases on all soils. When the average yields of fertilized plots are compared with the unfertilized, the increases are equivalent to 42 per cent on Carleton loam, 52 per cent on Tracy loam, and 19 per cent on Riverbank sandy loam. The most noteworthy response from phosphorus has been on Carleton loam while increases from potassium have been striking on Riverbank sandy loam. The degree of response from nitrogen has varied in different years and has usually been restricted to the early part of the growing season. In addition to increasing yields, fertilization has resulted in marked increases in the amounts of legumes and grasses composing the pasture sward. At the same time the weed population has decreased. Accordingly the nutritional value and palatability of the herbage on the fertilized plots is highly superior to the unfertilized.

Response of Permanent Hay to Manure and Commercial Fertilizer

In 1943 an experiment was designed to determine what manurial or commercial fertilizer treatment is most economical for hay being left down for relatively long periods. Eighteen treatments, some applied annually and others every three years, were compared as to their relative value in maintaining yields. Although increases over the check were realized in all instances, yields on all plots were declining regardless of treatment. Highest yields were obtained from either 600 pounds of 4-12-6 applied annually or 16 tons of manure every 3 years. The decline in yields from these treatments and the check, as well as returns per acre, are shown in Table 12.

TABLE 12—MANURE AND COMMERCIAL FERTILIZER FOR HAY

Treatment per acre	Hay in tons per acre			Av. return per acre over cost of treatment 1943–51
	1943–45	1946–48	1949–51	
				$
600 lb. 4–12–6 annually	3·1	2·2	1·9	25·75
16 tons manure every 3 yr	2·9	2·3	1·7	26·37
Check	2·2	1·4	0·8	21·54

These data show that yields have steadily declined even on the highest yielding plots. Also the low net return per acre indicates that the maintenance of yields over a long term period from the same seeding is not economically feasible.

Response to Ground Limestone

The value of limestone in increasing yields of certain crops grown on the acid soils of Eastern Canada has been demonstrated by many investigators. In tests conducted on four soil types in the Fredericton area from 1948-51 limestone applied at the rate of two tons per acre increased grain yields on Interval silt loam by 9 bushels per acre or the equivalent of 17 per cent. Smaller increases were obtained on the other soils. In the same test hay yields were increased by 46 per cent on Carleton loam, 7 per cent on Interval silt loam, 19 per cent on Tracy loam, and 20 per cent on Riverbank sandy loam.

In areas where potatoes are grown the use of lime may promote scab development. Nevertheless, when this crop is grown in a rotation on acid soils it is often very difficult to obtain satisfactory yields of hay. Experimental evidence indicates that relatively low rates of limestone applied on a rotation of potatoes,

FIG. 1—Many of the soils of New Brunswick require lime for clover. Light applications on potato soils are usually effective. Right foreground: 1 ton ground limestone per acre. Left foreground: no limestone.

grain and hay will result in considerably higher hay yields and at the same time will not materially increase the incidence of scab. In trials at this Station, limestone applied at the rate of 500 pounds per acre following the potato crop has resulted in average increases per acre of 37 bushels of potatoes, 3 bushels of oats, and 0·7 tons of hay. This treatment has not increased the amount of scab and should prove beneficial on soils that are too acid for the satisfactory production of legumes. Further increases in hay yields have been obtained with higher rates of limestone but because of the possibility of scab development such rates are not recommended in a potato rotation.

Additional studies relating to the use of limestone for legumes, particularly with reference to rates of application and method of incorporation in the soil, are under way.

Other Investigations

Other field trials initiated during this period include investigations relating to the use of rock phosphate, particularly with reference to its effects on crop yields and phosphorus status of the soil. The use of soil conditioners and their value in promoting increased yields and improved physical properties of the soil is also receiving consideration. The expansion of the soil fertility research program at this Station to include facilities for greenhouse and chemical laboratory investigations has permitted the undertaking of more detailed studies than was previously possible. Included in such studies are investigations relating to the fertility status of the important soils in the province, particularly with respect to phosphorus and potassium, the effects of liming on availability of various elements, and the correlation of soil tests with crop response to applied elements.

Pasture Improvement

C. F. Everett

Pasture Management

Results of experimental work with dairy cattle at this Station have emphasized the importance of good pasture management. Pastures should be grazed as heavily as possible in the spring to prevent the grasses from heading out. Tests at the Station have indicated that spraying weedy pastures in early June with 1·5 pounds acid equivalent of 2,4-D will give good control of weeds for most of the season. Some perennial weeds, such as Canada thistle, must be sprayed again at a later date to ensure a good kill. Wild white clover will be checked for a time but it will recover before fall.

If the pasture grasses head out it is advisable to mow them around the middle of June to promote the growth of more palatable herbage. As the season advances sufficient growth should be left to protect the soil from excessive drying. Over-grazing the pastures in the late fall should be avoided to prevent excessive winterkilling. When grazing is finished, and rains have softened the droppings, the pastures should be harrowed with a chain type harrow to spread the droppings and loosen the turf. This will permit a more even growth of new clover and grasses.

Permanent Pasture Versus Pasture in a Crop Rotation

An experiment started in 1950 has shown that pasture in a crop rotation has several advantages over permanent pasture. The larger species of grasses and clovers with deep root systems present in cultivated pasture allow a wider variation of uses, quicker recovery after cutting, and better growth in dry weather especially if clover is present. Timothy is more palatable than many of the grasses found in permanent pasture, and it will be eaten off more readily even when it is heading. If pasture is too plentiful, part of the cultivated pasture

can be harvested for grass silage or hay, and the area will still provide pasture later in the season when there is a shortage. Grass silage or hay from these pastures should be harvested by the middle of June in order that the pasture may recover sufficiently for summer grazing.

Commercial Fertilizer Formulae for Pastures

This experiment was started to determine what rate of each of the three major elements nitrogen, phosphorus, and potash in combination would produce maximum yield of pasture herbage. Surface application of the fertilizers was made on plots in an old permanent pasture that had not received fertilizer since 1918. The fertilizer was applied at 500 pounds per acre, annually, for each formula.

All possible combinations of three rates of nitrogen—0, 3 and 6 per cent; four rates of phosphorus—0, 8, 16 and 24 per cent; and three rates of potash—0, 6 and 12 per cent, were used to make up the fertilizer formulae. These provided 36 formulae from a low of 0-0-0 to a high of 6-24-12. The experiment has not been conducted for a sufficient period to report conclusive results. However, there are indications of certain trends that are worthy of consideration. Of the three elements, phosphorus has given the largest increase in yield. When phosphorus was omitted, the two other elements, nitrogen and potash, were comparatively inefficient in increasing yields. To date, the highest rate of each element has given the highest yield. However, the increase in yield as the rate of phosphorus was raised from 16 per cent (80 pounds per acre) to 24 per cent (120 pounds per acre) was relatively small.

A study of the seasonal influence of each element showed the following: (a) Nitrogen gave more than 80 per cent of its total increase in yield before July. (b) Phosphorus gave a relatively level rate of response throughout the first season, but with each succeeding season a greater response has occurred in the spring. (c) Potash gave the greatest increase in midsummer and a fair increase during other periods of the pasture seasons. An analysis of the grasses present in the pasture sward showed that the major fertilizing elements affected the pasture sward as follows: (a) Nitrogen increased the percentage of grasses, but it also caused a decrease in the clover. (b) Phosphorus was the most effective element in increasing clover and in decreasing weeds. (c) Potash increased the percentage of clover slightly.

These trends suggest that a 3-16-12 fertilizer formula would produce the following: high yield of pasture herbage; good production of pasture during midsummer; and a well proportioned pasture sward.

Weed Control Experiments

C. F. Everett

Recent work on weed control at the Fredericton Station has been devoted to testing the value of various herbicides for controlling weeds in the following crops: small grains, potatoes, corn, vegetables, and pastures. These tests have been conducted to determine the safe dosage of various herbicides on certain crops and the effective rate to use for control of weeds. Chemical weed killers fall into two main classes: selective and general contact. Selective herbicides kill certain types of plants but do not injure others, while general-contact weed killers destroy all kinds of vegetation.

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2,4-D (2,4-Dichlorophenoxyacetic acid)

The introduction of 2,4-D sparked the usage and acceptance of chemicals for weed control. Some of the reasons for the present popularity of 2,4-D are its cheapness, its effectiveness, its ease of handling, and its lack of toxicity to man or animals. Its widespread use has also been aided by the introduction of the low-volume, low-pressure sprayer.

Tests at this Station have shown that 2,4-D is useful for the control of mustard and most broad-leaved annual weeds in small grains, many annual and perennial weeds in corn, a number of weeds in pastures, and certain species of bushes in pastures, roadsides, and along fences. Table 13 indicates the average dosage rates of 2,4-D for the control of weeds in crops according to tests at this Station.

TABLE 13—AVERAGE DOSAGE RATES OF 2,4-D FOR USE AS A SELECTIVE HERBICIDE AT FREDERICTON

Crop and time of application	Dosage rate of 2,4-D	Weeds killed or controlled	Weeds not affected
Oats, wheat and barley (not seeded down) —6 inches high.	2,4-D amine: *6-8 oz. acid equivalent + water. 2,4-D ester; 6 oz. acid equivalent + water.	Mustard, wild radish, smartweed, lamb's quarter, and control of most perennials.	Corn spurrey, nettles, and some perennials.
Oats, wheat and barley (seeded down) —6 inches high.	2,4-D amine: 4 oz. acid equivalent + water.	Mustard and most other broad-leaved annuals.	Corn spurrey, nettles and most perennials.
Corn— pre-emergence.	2,4-D amine: 20–30 oz. acid equivalent + water.	Most broad-leaved annuals	Corn spurrey, nettles, couch grass, and some other perennials.
Pasture —early June.	2,4-D amine: 24 oz. acid equivalent + water.	Buttercup, common and fall dandelions, plantain, and control of other perennials.	Thistles and some other perennials require a second spot spraying at a later date for eradication.

* Avoirdupois. Note: 16 ounces avoirdupois = 1 pound.

A number of crops are quite susceptible to 2,4-D. Tomatoes, turnips, some other vegetables and shrubs are easily damaged even by a slight spray drift. Pre-emergence and post-emergence sprays of 2,4-D were tried on potatoes. With all post-emergence applications the potato tops were severely distorted. The results from pre-emergence work with 2,4-D on potatoes have been variable.

Although 2,4-D can control most broad-leaved weeds, it does not affect a number of narrow-leaved annuals and a number of perennials. A few of the troublesome weeds on this Station not affected by moderate rates of 2,4-D are corn spurrey, daisies, nettles, perennial sow thistle, and couch grass. Because of this a number of other chemicals have been tested. Some of these proved effective, but most of the chemicals have been more expensive than 2,4-D.

Dinitro, General Contact

The general-contact dinitro proved to be effective for control of broad-leaved weeds in potatoes when used as a pre-emergence application about two or three days before the potatoes emerge. Moderate rates of dinitro did not cause distortion of the potato leaves; distortion did occur when 2,4-D was used. About three pints of dinitro, mixed with several gallons of fuel or diesel oil and emulsified in sufficient water to give adequate ground coverage (50 to 75 gallons per acre) will control broad-leaved weeds, and it will slightly suppress grasses. If

the crop is not cultivated the soil will remain quite free of weeds for several weeks. Several other herbicides were tested for potatoes, but they did not give satisfactory results.

General-contact dinitro has been found useful for controlling weeds (pre-emergence) in field beans, field peas, and several vegetable crops.

TCA (Trichloroacetic acid)

Tests at this Station show that TCA applied to plowed ground in the spring will control couch grass at rates as low as 25 pounds per acre. However, it also suppresses the growth of grain. When TCA was sprayed on plowed ground in early fall, good control of couch grass was obtained with rates of 40 to 60 pounds per acre. Residual effects of TCA were not noticeable by the appearance and yield of crops of potatoes, oats, fodder corn, and turnips that were planted the following spring. Late fall applications of TCA failed to give satisfactory control of couch grass. When TCA was applied directly on sod ground, rates up to 100 pounds were required to control this weed. TCA is a selective herbicide, mainly a killer of grass-type weeds, but it will kill some broad-leaved weeds and crops, while some grasses remain unharmed.

Cultural Weed Control

The control of weeds on the Station has been maintained by a combination of cultural and chemical practices. A cultural method that has proved very satisfactory for the control of weeds in corn consists of cross-harrowing the corn with a spike-tooth harrow, two or three times after seeding, until the corn is several inches high. This method destroys a large proportion of the tiny weed seedlings as they emerge. However, a slightly heavier rate of seeding is necessary to compensate for thinning by the harrows. Good cultural and cropping practices should form the basis of the weed control program.

FORAGE CROPS

T. C. Chiasson

The forage crop program at this Station has undergone considerable reorganization during the past five years. New projects that were undertaken during this period have not provided enough data to lead to any conclusions. Among these is a rather extensive test of red clover varieties. Six varieties of single-cut and six varieties of double-cut red clover are being compared for hay and seed production, winterhardiness and resistance to disease. Another project was designed to test the value of ladino clover for pastures when associated with a single grass species sown at several rates.

Variety tests of alfalfa and tests of ladino clover for hay are under study. To date, results have not been encouraging. Selection of double-cut and single-cut red clover has also been under way during the past five years. The primary object of this work is to develop a more winterhardy strain of red clover for New Brunswick. No definite progress can be reported at this time.

Test of Hybrid Corn for Ensilage

Very little corn is grown for ensilage in New Brunswick. According to the Bureau of Statistics approximately 2,000 acres of fodder corn are grown annually but the greater part of this is used as green fodder to supplement pastures and to a lesser extent as dried fodder. A yield test of the most promising corn hybrids has been maintained during the past five years to determine which would be most suitable for either ensilage or fodder purposes. The results for the hybrids tested during this period are shown in Table 14.

TABLE 14—TEST OF CORN HYBRIDS FOR ENSILAGE

(5-year average 1948–1952)

Hybrid	Yield per acre (tons)		Per cent dry matter
	Green weight	Dry weight	
Canada 240	14·4	3·67	25·5
Warwick 150	14·3	3·57	25·1
Canada 275	15·8	3·54	22·3
Canada 255	14·4	3·38	23·5
Canada 355	15·8	3·33	21·3
Warwick 250	13·6	3·28	24·1

Canada 240 has given the highest average yield of dry matter per acre for the 5-year period. It is earlier maturing than most other hybrids tested and thus has a higher dry-matter content at harvest time. It is recommended as one of the most suitable hybrids for ensilage, green feed, or dried forage.

With the marked increase in the number of silos in this province, corn may become more widely grown than at present, since it is a suitable substitute for clover. If there are indications that the clover crop is winterkilled severely a few acres of corn is excellent insurance.

Seed Mixtures for Pastures

Rather extensive testing of a large number of grass and legume species has been under way at the Fredericton Experimental Station for several years. In 1946, twenty-two mixtures were laid down in replicated plots. These mixtures consisted of various proportions of the following species: timothy, Kentucky blue grass, red top, meadow fescue, brome grass, reed canary grass, orchard grass, wild white clover, alfalfa, red clover, alsike clover, and ladino clover.

These plots were clipped five to six times each season during the next four years to simulate grazing. The following conclusions were arrived at from a study of the data.

(1) Many of the species sown disappear quickly especially following a severe winter. Regardless of the mixture sown the vegetation on all plots will be very much alike in a matter of two or three years or in even less time if a severe winter occurs.

(2) The highest yields of pasture, as indicated by clippings, were secured from relatively simple mixtures of species. For instance, a mixture consisting of 8 pounds of timothy, 4 pounds red clover, and 2 pounds of ladino clover gave the highest 4-year average yield in this test (2,777·5 pounds of dry matter per acre). It was closely followed by a mixture consisting of 8 pounds of timothy, $2\frac{1}{2}$ pounds of alfalfa, $2\frac{1}{2}$ pounds of red clover, 1 pound of alsike clover and 1 pound of ladino clover (2,725 pounds of dry matter per acre).

As a result of the information obtained from various tests of mixtures for pasture and the observations secured on winterkilling of various species, this Station is not, at present, prepared to recommend complex mixtures for seeding down pastures. In the first place, regardless of the mixture seeded, the pasture sward will be very similar in a short time. Secondly, in all the tests conducted to date, the simple mixtures have given the highest yields. Therefore, it is felt that a simple mixture, such as used for seeding down hay fields, will give just as high returns at less cost per acre. The mixture used at this Station consists of 8 pounds of timothy, 7 pounds of red clover, 3 pounds of alsike clover and 2 pounds of alfalfa per acre. If the field is wet the alfalfa is omitted and the timothy increased to 10 pounds per acre. Ladino clover may be included in this mixture in certain areas where it has shown good adaptation.

HORTICULTURE

A marked development has taken place in the work of this Division during the past five years. Greater attention is being paid to more basic research in the field of plant nutrition, while rapid progress has been made in the potato breeding program.

Variety Trials of Apples

R. G. White

Apples occupy a premier position among the fruits grown in New Brunswick, being exceeded in value only by the wild lowbush blueberry For this reason the testing of apple varie ies is an important part of the horticultural work at this Station. Comparisons are made between those being tested and existing commercial varieties such as Crimson Beauty, Melba, Lobo, McIntosh and Cortland. Superior varieties that will ripen in the same season as some of the varieties now grown commercially, or varieties that will supply the market when there is a dearth of local apples are the objective. A late winter type would be particularly valuable.

During the period covered by this report some 136 apple varieties were tested, many of them carried over from previous work. Others are new introductions that are just reaching fruiting age. Present information indicates that only some twenty varieties are worthy of planting at the present time. Those in the forefront are Atlas, Bancroft, Cortland, Joyce, Lawseed, Lobo, Macoun, Melba, Milton, McIntosh, Red Melba, and Sandow. An additional six varieties: Close, Edgar, Hume, Macross, Sharpe's Perfection and O-271 are under close observation.

Apple Breeding

R. G. White and W. B. Collins

This program has emphasized the production of new varieties for the seasons of short supply. The most pressing need, in this respect, is for an apple that is a late keeper and in good condition to market in February and March. There are also other gaps in the season to be filled.

This Station has developed several seedlings that have been tested over a period of years and that are worthy of mention. Nine of these have shown sufficient promise to merit extended trial among growers and other interested parties. Stocks of these seedlings are being propagated at the Station with this in mind.

Three of these seedlings, *27-32-52*, *33-1-131*, and *26-13-81* are early fall apples, while *31-43-2*, *26-8-39*, *29-9-26* and *30-28-2* are seedlings that keep well into the late fall. Two others are winter types, namely *27-22-27* and *31-50-39*. Further information on these seedlings is obtainable on request.

Tree Building

R. G. White

The periodic occurrence of abnormal winter conditions has caused the death of many varieties of apple trees, including the hardy McIntosh. Tender varieties may die out completely but the injury is largely of a type that causes a partial

killing of the bark on the trunk and main scaffold branches. In an endeavour to improve apple tree performance in New Brunswick a tree building trial has been under way at the Station since 1935. Hardy non-commercial stocks are top-grafted to more desirable varieties to see how the finished tree will withstand the winter. One small orchard was planted at Fredericton, and others were located at Queenstown, Cumberland Point, Currieburg, and Pomeroy Ridge. Hardy stocks in use are Antonovka, Anaros, Hibernal, Columbia, Malus Robusta No. 5, Virginia Crab, Malus Robusta, and Hudson seedling. They form the trunk and the first foot or so of the main scaffold branches of the future tree. Varieties grafted upon them have been Bancroft, Cortland, Edgar, Kendall, Lawfam, Lawseed, Linda, Lobo, Macoun, McIntosh, Red Spy, and Sandow. These varieties are also grown as standard single-worked trees growing on their own trunks.

The winterhardiness of varieties grown as standard nursery apple trees depends to a large extent upon the variety or varieties being grown. This work has already shown that varieties like Kendall, Linda, Red Spy and Sandow have winterkilled severely at Fredericton. Edgar has shown some tenderness but has not killed. Bancroft, Cortland, Lawfam, Lawseed, Lobo, Macoun and McIntosh trees have, by comparison, been hardy to date. The ability to survive also varies with the location, as no appreciable degree of winter injury has been observed in any of the other test orchards.

Grafting the same varieties to hardy stocks has in general proved beneficial. The hardy stock Antonovka has shown itself to be a semi-vigorous grower and has made strong, fruitful trees. The majority of the trees on this stock are located at Fredericton where evidence of winter injury is most apparent. The trees at Fredericton are older and weather conditions have apparently been more severe than at the other orchards. The Antonovka framework has enabled such varieties as Sandow, Red Spy and perhaps Edgar to come through the test winters without undue injury, whereas the top-worked Kendall was set back but seems to be recovering. Linda has killed out almost as severely as have the standard nursery trees.

The other hardy stocks are located away from Fredericton in younger orchards where pronounced winter injury has not as yet been a factor.

Information gathered to date would indicate that growers in New Brunswick should use the hardy stocks Antonovka, Hibernal and Anaros for a tree-building program until further data are available.

Mulching Apple Trees

R. G. White

Fruit growers have found that where apple trees are growing in an uncultivated grass sod they are more productive if mulched with some type of vegetative material. The mulch partially removes grass competition, assists in conserving moisture, and on its decay adds humus and plant nutrients to the soil. Materials in vogue eight years ago were usually old hay or straw, with occasionally other materials. Little was then known concerning the value of sawdust or shavings as mulching material.

Provision was thus made to test out, on a limited scale, the theory that sawdust and shavings would make useful materials for mulching fruit trees. Nine uniform Cortland trees, then twenty years of age, were chosen for this test. The sod beneath three of the trees received a 6-inch mulch of softwood shavings, two were mulched with oat straw, two with softwood sawdust and two were left unmulched.

These mulches have been continually maintained for the past eight years and while the results cannot be considered as conclusive they do, however, throw some light on the subject. Trees mulched with the softwood shavings have matured more apples and have given slightly heavier crops than have the other trees. The average fruit size was lowest for this mulch, and the color was fair to good.

Trees mulched with oat straw were, for all practical purposes, as productive as the trees mulched with shavings but the apples were larger and fewer in number. Increase in tree size was greatest for this mulch, fruit color being comparable with the shavings mulch.

Sawdust-mulched trees made the least growth and were less productive than trees mulched with the other materials. Average annual yields (in pecks) were slightly higher than for the unmulched trees. Fruit color tended to be below normal for the variety. Maturity and size of fruit harvested were comparable with the crop from oat straw and no mulch.

The sawdust-mulched trees began to show a nitrogen deficiency by 1947. This was corrected by two applications of a nitrogen fertilizer which supplemented the basic treatment of ten pounds of a 9-5- fertilizer given annually to all the trees. The trees are now very uniform in appearance and can only be criticized for possibly a tendency to be a little too luxuriant and for a lowering of fruit color.

It would thus appear that shavings are as useful for mulching apple trees as oat straw and that, to date, the sawdust mulch at the depth used was only slightly more beneficial than no mulch at all. These comparisons are readliy seen from figures given in Table 15.

TABLE 15—RESPONSE OF 20-YEAR-OLD CORTLAND APPLE TREES TO STRAW, SHAVINGS, AND SAWDUST MULCHES

Fredericton, N.B., 1944–52

Number trees	Treatment	Increase in trunk growth inches	Average number apples per year	Average weight per apple ounces	Average annual yield per tree		Fruit color	Tree appearance
					lb.	barrels		
3	Shavings..	2·74	1,917	4·17	463	3·51	fair to good	good
2	Oat straw	3·03	1,692	4·32	443	3·35	fair to good	good
2	Sawdust...	2·67	1,699	4·28	388	2·94	fair	good
2	Control....	2·92	1,646	4·29	377	2·86	fair	good

Strawberry Breeding

W. B. Collins

Commercial strawberry production in New Brunswick has now reached the point in its development where new varieties would prove valuable. Varieties are desired that will possess a greater degree of disease resistance, a wider range of adaptability to local conditions and, above all, sufficient firmness to stand up under the long hauls necessary to bring the crop to market. A definite attempt is being made at this Station to produce such varieties by a process of breeding and selection. The crosses are made at the Horticultural Division in Ottawa and the seedlings are grown at Fredericton and tested under local conditions.

The selection of individual seedlings is based upon a number of factors; plant vigor, productivity, freedom from disease, and desirable fruit characters. Seedlings that lack one or more of these characteristics are discarded.

Six thousand individual seedlings have been examined in the period under review. The great majority have been discarded as of no value, but several crosses have produced some very desirable plants that are being given a second trial in single 15-foot rows. Ninety outstanding seedlings are now in the second trial stage, and eleven of these show reasonable promise as new varieties. These eleven seedlings and others, as they become available, will be put under number and made available to growers and other experimental stations for an extended trial.

Vegetables

R. G. White

Major emphasis is placed upon variety trials of those types of vegetables that are of sufficient importance commercially to warrant study. Crops tested have largely been snapbeans, cucumbers, garden peas, sweet corn, and tomatoes. Over 150 varieties have been tested since 1948 with gratifying results. The trials indicate clearly the progress made during recent years in the development of new varieties and the advisability of vegetable growers making use of these new strains at planting time.

The following varieties, particularly those in italics, appear to be very suitable for supplying the markets in New Brunswick with productive, early maturing, high quality vegetables. Detailed descriptions of the various varieties may be secured on request.

Beans—	
(Yellow podded)	Pacer (flat), *Cherokee Wax* (round)
Beans—	
(Green podded)	*Contender, Topcrop*, Supergreen, Rival, Logan Improved, Improved Commodore, Logan and The Prince (all round pods)
Corn Sweet—	
(Early)	*Seneca 60, North Star*, Sugar Prince, Golden Rocket, Golden Treasure
Corn Sweet—	
(mid-season)	*Seneca Arrow*, Carmelcross strains, Earligold
Tomatoes Determinate—	
(early)	Bounty, Victor, Labrador No. 66
(mid-season)	Ottawa TO-4
Tomatoes Indeterminate—	
(early)	*Quebec No. 5*
(mid-season)	*Burpeeana Early Hybrid*, Stokeschatham, Ottawa TO-5
Cucumbers—	
(slicing)	*Burpee's Hybrid*, Longfellow, A and C, Marketer
Garden Peas—	
(early)	*Little Marvel*, Alton
(mid-season)	*Director*, Ottawa PE-1, Wyola, Victory Freezer, Perfected Freezer

Chemical Weed Control

R. G. White and W. B. Collins

Weeds are an ever-important problem in the farm economy, particularly when small fruits and vegetables are grown. Hand cultivating is costly and the shortage of labor makes some other means of control advisable. Trials at this Station seek to evaluate the effectiveness of several commercial herbicide preparations upon the control of weed growth. Various experiments were conducted in 1948, 1949, and 1951, emphasis being placed upon the control of weeds in vegetables. A few herbicides were applied to strawberries in 1948.

Strawberries

It was concluded that post-emergence applications of 2,4-D products can be useful in controlling weeds in newly-set plants provided they are used as an aid and not as the only control. A certain amount of hand hoeing must accompany these applications. The optimum amount of 2,4-D to apply would appear to be in the range of 12 to 32 ounces per acre. Lower rates were not effective and higher rates are likely to produce injury. Some injury will be apparent at the above rates but the plants recover. The amine form of 2,4-D produces the least injury to strawberry plants but is not so effective as the ester forms in weed control.

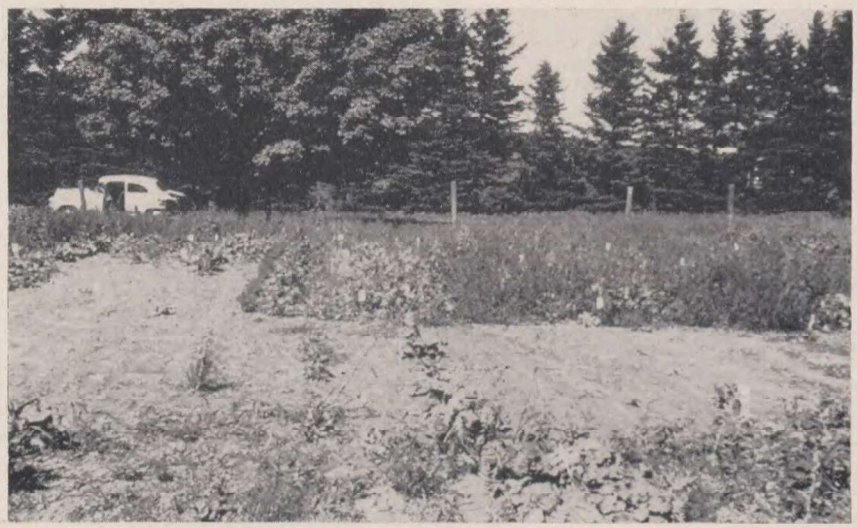


FIG. 2—Some chemicals give good weed control but will sterilize the soil, if used to excess.

The weeds concerned were lambs' quarter, common chick-weed, shepherds' purse, purslane, barn grass, and couch. It should be noted that grass constitutes one of the worst weeds in strawberry plantations. This is not controllable by 2,4-D preparations. It appears very difficult to find a herbicide that will be toxic to grass and yet not injure the strawberry plants.

Vegetables

Various herbicides were employed in an effort to obtain efficient weed control in vegetable crops. A number of the best of these are discussed below giving their effect on weeds and the various crops grown.

Dow General and Dow Selective.—These two materials gave equally good results when applied as a pre-emergence spray on beans, peas, corn, and potatoes. Weed control was good, with the exception of grasses, and there was no injury to the crop. Application was made from two to three days previous to emergence of the crop. The optimum rates appear to be 3 pints per acre for Dow General and from 3 to 5 gallons per acre for Dow Selective. Two or three gallons of fuel oil should be used with the Dow General in the spray tank for best results. Both of these materials proved injurious to beet and cucumber germination and probably should not be used with these crops.

Premerge—This material proved to be an excellent herbicide on the basis of one year's trial. Used at rates of 5, 8, and 12 quarts per acre, Premerge was very effective as a pre-emergence weed killer applied 2 to 3 days before crop emergence. The 5-quart rate was considered to be as effective as the higher rates and was not so damaging to crops. At this rate there was no injury to peas nor beans, although corn was set back slightly. Rates higher than 5 quarts produced severe injury to peas and corn. Beans appear very resistant to injury at all rates.

C.M.U.—This material has shown promise as a pre-emergence spray for beans, peas, and corn. The material is toxic to these crops if applied at too high a rate. Three pounds per acre gives good weed control but destroys the crops. Good control, however, was obtained with 1 pound per acre and the crops were not set back nor injured.

Several other materials under trial varied in effectiveness, but none approached the control achieved with the above-mentioned products. Even though the weeds listed can be controlled, there still remains the big problem of controlling grass. Until this problem has been solved the control of other weeds loses its effect.

Potato Breeding

L. C. Young and H. T. Davies

The potato-breeding program at the Fredericton Station is in the nature of a co-operative project between the Experimental Farms and Science Services of the Canada Department of Agriculture, with the Experimental Station assuming the responsibility for the horticultural phases of the program, including the making of the crosses, the production and multiplication of seedlings and the assessing of the commercial value of all productions. The Plant Pathology Laboratory is responsible for the determination of the disease resistance, and the Entomology Laboratory for studies on insect resistance of various seedling productions. The Horticulture Division, Central Experimental Farm, Ottawa, supervises the testing of seedlings throughout Canada.

The ultimate objective of the program is the production of new varieties of potatoes, combining resistance to one or more plant diseases or insect pests with suitable horticultural characteristics. Major emphasis has been placed upon breeding for resistance to two common diseases, late blight and common scab.

The period under review has been characterized by three important developments.

(1) The construction of an implement shed, an office and laboratory building and a greenhouse at Alma, and a modern storage cellar at Fredericton has greatly increased the efficiency of the work.

(2) The determination of the existence of physiologic forms of the late-blight organism, *Phytophthora infestans*, in the Maritime Provinces has greatly complicated the blight phase of the program. The situation now closely parallels that confronting the wheat breeders in the West. The breeding program is being revised as rapidly as possible to meet these changing conditions.

(3) Greatly increased emphasis was laid upon the virus aspects of the program, particularly during the latter part of the period. This was made possible as the result of additional staff appointments to the Plant Pathology Laboratory and the provision of extra greenhouse accommodation by both Services. Major attention was devoted to virus X, a virus which has given considerable concern to growers of the Keswick variety during the past two years. The objectives were the development of a strain of Keswick, free of virus X and the ultimate elimination of virus X from all seedling stocks. Sufficient progress was made to permit the distribution of a sizeable quantity of virus-tested stock of the Keswick variety to two growers in New Brunswick in the spring of 1953. This will be multiplied for general sale and distribution. An additional supply of stock seed will be made available by the Station in 1954, and it is expected that within the course of three or four years, there will be a sufficient supply of Keswick, relatively free of virus X, to meet all demands.

Diversity and Extent of Project

The diversity and extent of the project is illustrated by a consideration of the data, presented in Table 16. Figures are given, showing the number of seedlings, produced in the various phases of the program, for the period 1933 to 1947, inclusive, for each of the years 1948, 1949, 1950, 1951, and 1952 and also the total to date.

A grand total of 235,283 seedlings have been produced and tested to date. Of these, 121,041 seedlings have been developed in the late-blight phase and 38,241 seedlings in the common-scab phase of the program. In addition, an attempt is being made to combine resistance to common scab with resistance to late blight, and also various viruses. Actually, a total of 64,377 seedlings have been produced in an effort to develop a new variety of potato combining resistance to common scab with other desirable characteristics.

Increasing attention has been devoted to virus diseases during recent years. During the years 1951 and 1952, a total of 12,034 seedlings were produced in an effort to develop stocks resistant to viruses A, B, C and X, alone and in combination with resistance to late blight and common scab.

TABLE 16—NUMBER OF SEEDLINGS PRODUCED 1934-53 INCLUSIVE

Objective	1934-1947	1948	1949	1950	1951	1952	Total to date
Resistance to Mild Mosaic	33,640	—	—	—	—	—	33,640
Resistance to Late Blight	83,730	7,431	5,673	8,571	8,455	7,181	121,041
Resistance to Common Scab	20,525	4,868	5,461	2,483	1,201	3,703	38,241
Resistance to Late Blight and Common Scab	1,260	5,070	2,590	3,940	3,343	486	16,689
Resistance to Leafroll and Common Scab	—	71	—	—	—	—	71
Resistance to Aphids and Common Scab	—	280	3,061	36	—	—	3,377
Resistance to Common Scab and Various Viruses	—	—	—	102	1,635	4,262	5,999
Resistance to Virus X	—	—	—	—	1,001	1,810	2,811
Resistance to Late Blight and Various Viruses	—	—	—	—	692	2,634	3,326
Resistance to Late Blight and Ring Rot	—	—	—	—	688	—	688
Resistance to Aphids and Late Blight	—	232	—	2,027	—	—	2,259
Resistance to Leafroll and Late Blight	—	72	—	—	—	—	72
Resistance to Leafroll	974	189	—	—	—	—	1,163
Resistance to Aphids	2,593	244	—	—	—	—	2,837
Miscellaneous	2,231	621	—	175	42	—	3,069
	144,953	19,078	16,785	17,334	17,057	20,076	235,283

Testing of Seedling Productions

The screening of any seedling population, on the basis of horticultural characteristics alone, requires a tremendous amount of routine work. The preliminary evaluation considers such factors as type of growth, season of maturity, estimated yielding ability, tuber type, and starch content as indicative of cooking quality. After several years of observation of this type, the more promising selections are included in replicated yield trials at two locations in the province and the quality is finally determined by actual cooking trials. Additional tests are conducted on Illustration Stations and private farms.

The testing for resistance to insects and to various diseases is a very important phase of the program. Since it is the responsibility of officials of the Science Service, it is merely referred to in this report

Because of the diversity of soil and climatic conditions and the variation in market requirements existing throughout Canada, it is essential that seedlings be grown and tested in all regions. Such a scheme of organized and widespread testing has been in operation since 1945. Co-operating in these trials are Experimental Stations, Substations, and Illustration Stations in every province as well as several Agricultural Colleges. This outside testing is under the supervision of N. M. Parks, Horticulture Division, Central Experimental Farm, Ottawa.

TABLE 17—SUMMARY OF SELECTED AND UNSELECTED POTATO SEEDLINGS DISTRIBUTED TO EXPERIMENTAL FARMS, STATIONS, SUBSTATIONS, AGRICULTURAL COLLEGES, AND OTHER CO-OPERATING INSTITUTIONS IN CANADA AND OTHER COUNTRIES

(1948–52 inclusive)

Year	Number of selected potato seedlings	Number of unselected potato seedlings	Number of Experimental Farms, Stations, etc., in Canada	Number of other institutions in Canada	Other countries receiving seedlings for trial
1948.....	625	1,742	13	2	United States.
1949.....	991	1,928	21	6	United States.
1950.....	990	4,452	23	7	Venezuela.
1951.....	670	3,647	30	8	United States, England, Belgian Congo, Angola (Portuguese West Africa), Ethiopia.
1952.....	591	2,663	23	7	United States.
Total...	3,867	14,432			

Reference to Table 17 indicates the extent of this work. During the period 1948-52, inclusive, a total of 3,867 selected seedlings and 14,432 unselected seedlings were distributed to co-operators for trial purposes. The number of co-operating institutions in Canada varied from a low of 15 in 1948 to a high of 38 in 1951.

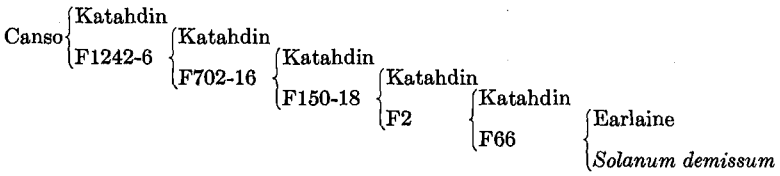
Trial shipments have also been sent to the United States, England, South America and to Angola, Belgian Congo and Ethiopia in Africa.

New Varieties

As a result of this breeding program, two new varieties have been produced to date, "Canso" and "Keswick".

The CANSO Potato

The Canso variety, a product of the Fredericton Potato Breeding Program, was introduced in 1950 and became available for commercial production in 1951. It was first grown at Fredericton in 1942 and originated from a cross between Katahdin and an unnamed Fredericton seedling 1242-6, which in turn included in its parentage four unnamed seedling varieties, the named varieties Katahdin and Earlaine and the wild potato *Solanum demissum* Lind. The pedigree is as follows:



Detailed Description—Plants medium in size, spreading; stems thick, slightly angled; nodes moderately swollen, green; internodes green; wings very prominent, heavily waved, green; stipules large, green; leaves medium length, midrib green, scantily pubescent; primary leaflets close, medium green, large size, definitely pointed; mean length $4 \cdot 52 \pm 0 \cdot 37$ inches, mean width $2 \cdot 90 \pm 0 \cdot 37$ inches, index $64 \cdot 24 \pm 2 \cdot 03$; secondary leaflets many in three positions, on midrib between pairs of primary leaflets, at junction of midrib and petioles of primary leaflets, and on primary leaflet petioles; tertiary leaflets medium in number in three positions, on midrib between pairs of primary leaflets, at junction of midrib and petioles of primary leaflets, and on primary leaflet petioles; inflorescence much branched; leafy bracts very small on about one-fifth of inflorescences; penduncles medium in length, intermittently winged, scantily pubescent; pedicels medium in length, green, scantily pubescent.

Flowers—Calyx lobes medium in length, green, scantily pubescent; corolla large, color light lilac; anthers orange yellow; pollen poor; style slightly curved, stigma lobed, green.

Tubers—Shape, short elliptical, medium thick, mean length $3 \cdot 23 \pm 0 \cdot 15$ inches, mean width $2 \cdot 95 \pm 0 \cdot 13$ inches, mean thickness $2 \cdot 17 \pm 0 \cdot 11$ inches; indexes, width to length $88 \cdot 0 \pm 5 \cdot 66$ inches, thickness to width $73 \cdot 63 \pm 5 \cdot 07$ inches, thickness to length $67 \cdot 45 \pm 5 \cdot 68$ inches; skin smooth, self colored, dark cream buff; eyes shallow, same color as skin; eyebrows medium long, curved, medium prominent; flesh white; maturity late.

General Description—The Canso is a moderately vigorous variety, maturing at the same time as the Green Mountain. The tubers are short, elliptical in shape, medium thick, regular in outline, white in color, smooth, bright, and attractive in appearance The eyes are shallow.

Late Blight—The vines are field-resistant to the common form of late blight, and the tubers, although susceptible, are much more resistant than those of Green Mountain. This variety is susceptible, however, to some of the newer forms of blight.

Virus Diseases—Canso is field-immune to viruses A and B and behaves toward other common viruses in much the same manner as existing varieties. It expresses leafroll very clearly.

Other Diseases—It has been reported as being highly resistant to wart as found in Newfoundland.

Entomological Characteristics—This variety has no particular resistance to insects, and should be given the same insecticidal protection as other commercial varieties.

Cooking Quality—Canso approximates Green Mountain and is much superior to Katahdin in cooking quality. This has been demonstrated in cooking trials and is also indicated by starch analysis records. In replicated yield trials at Salmonhurst and McDonald's Corner in 1950 and 1952, Canso averaged 14·9 per cent starch as compared with 15·1 per cent for Green Mountain and 13·6 per cent for Katahdin. The results of these and other trials, based on the testing of 51 samples of each variety, show that Canso has averaged 1·02 per cent more starch than Katahdin. Furthermore, reports from hotels, restaurants, and other institutions indicate that Canso is rapidly gaining popularity because of its excellent cooking quality and its economy from a mechanical peeling standpoint.

Yielding Ability—Canso is not a heavy yielding variety, but in tests to date, has at least equalled Katahdin in this respect. In replicated yield trials at two locations and for a 3-year period Canso averaged 362·1 bushels per acre of marketable potatoes as compared with 315·5 bushels for Katahdin.

Other Characteristics—This variety has a tendency to produce its tubers near the surface of the ground, and has to be adequately hilled in the same manner as Katahdin. It frequently produces oversized tubers and is very subject to hollow heart. The latter condition varies greatly according to location. Very close planting, reduced fertilizer application, the use of vine killers and any other practice that prevents the production of oversized tubers, will aid greatly in controlling this trouble.

The KESWICK Potato

The Keswick variety, a product of the Fredericton Potato Breeding Program, was introduced in 1950 and became available for commercial production in 1951. It was first grown at the Alma Isolation Station in 1944 and originated from a cross between Green Mountain and an unnamed Fredericton seedling, which in turn included in its parentage two unnamed seedlings, the variety Earlaine and the wild potato *Solanum demissum* Lind. The pedigree is as follows:

Keswick { Green Mountain / F1020-1 { Earlaine / F581-16 { Earlaine / F333-1 { Earlaine / *Solanum demissum*

Detailed Description—Plants large, erect; stems medium thick, slightly angled; nodes slightly swollen, green; internodes green; wings very slightly waved or straight, not prominent; stipules large, green, glabrous; leaves moderately long, broad, midrib green, very scantily pubescent, winged, pairs of primary leaflets often not opposite; primary leaflets medium green, four pairs, primary leaflets moderately open with little overlap; leaflet petioles green; mean length 4·12±0·34 inches, mean width 2·50±0·21; index 60·67±4·45; secondary leaflets medium in number on midrib between pairs of primary leaflets; tertiary leaflets few to medium in number; inflorescence medium branched; leafy bracts on approximately one-third of inflorescences; peduncles long, scantily pubescent; pedicels long, green, sparsely pubescent.

Flowers—Calyx lobe tips medium in length, green, scantily pubescent; corolla large, white, anthers orange yellow; pollen poor, style slightly curved, green, stigma lobed.

Tubers—Shape elliptical to oblong; medium thick; mean length $3 \cdot 42 \pm 0 \cdot 23$ inches, mean width $2 \cdot 97 \pm 0 \cdot 17$ inches, mean thickness $2 \cdot 23 \pm 0 \cdot 12$; indexes, width to length $84 \cdot 45 \pm 7 \cdot 91$ inches, thickness to width $74 \cdot 13 \pm 4 \cdot 93$ inches, thickness to length $65 \cdot 39 \pm 6 \cdot 03$ inches; skin smooth, self colored, dark cream buff; eyes medium depth, same color as skin; eyebrows short to medium long, curved, medium prominent; flesh white; maturity medium late about midway between Irish Cobbler and Green Mountain.

General Description—The Keswick potato is a vigorous variety, maturing ten days to two weeks earlier than Green Mountain. Although actually not an early variety, it sizes its tubers early, and upon occasion has equalled Warba in the production of tubers for the very early market. The tubers are elliptical to oblong in shape, medium thick, somewhat irregular in outline and white in color. The eyes are medium in depth. The tubers are not so smooth as those of Canso, and oversized tubers may be somewhat rough.

Late Blight—The vines are field-resistant to the common form of late blight, and the tubers, although susceptible, are much more resistant than those of Green Mountain. This variety is susceptible, however, to some of the newer forms of blight.

Virus Diseases—Keswick is field-immune to virus B and behaves toward other common viruses in much the same manner as existing varieties.

Other Diseases—This variety has shown a slight degree of resistance to common scab under certain conditions and has been reported as being highly resistant to potato wart, as found in Newfoundland.

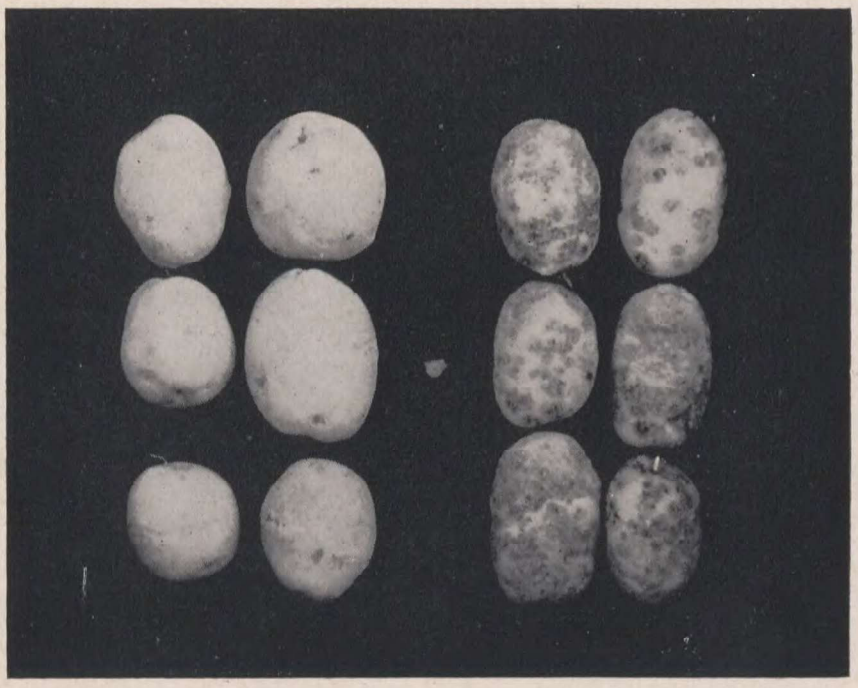


FIG. 3—Resistance to common scab is an inherited factor and can be incorporated in new varieties. On the right are Green Mountains from a hill adjacent to scab-resistant seedlings (left.)

Entomological Characteristics—Keswick has no particular resistance to insects, and should be given the same insecticidal protection as other varieties.

Cooking Quality—This variety has been rated as excellent in cooking quality, being equal to Green Mountain and much superior to Katahdin in this respect. In replicated yield trials at Salmonhurst and McDonald's Corner in 1950 and 1952, Keswick averaged 14·7 per cent starch as compared with 15·1 per cent for Green Mountain and 13·6 per cent for Katahdin. The results of these and other trials, based on the testing of 52 samples of each variety, show that Keswick has averaged 1·0 per cent higher starch than the Katahdin variety. Furthermore, chain-store reaction to this variety in New Brunswick has been most favorable to date.

Yielding Ability—Keswick is a heavy yielding variety, approximating Green Mountain and exceeding Katahdin in this respect. In replicated yield trials at two locations and for a 3-year period Keswick averaged 439·3 bushels of marketable potatoes per acre as compared with 433·9 bushels for Green Mountain and 315·5 bushels for Katahdin. These records combined with those from the preceding two years, and therefore based on trials at two locations and for a 5-year period, show Keswick with an average yield of 415·4 bushels per acre of marketable tubers as compared with 416·5 bushels for Green Mountain. The variety Katahdin was not included in the first two year trials.

Other Characteristics—Its chief fault is a tendency to oversize and become somewhat rough on rich soils. Fortunately this fault can be overcome by close planting, reduced fertilizer applications, and the use of vine killers, when necessary.

Potato Varieties Differ in Starch Content

It is generally recognized that the starch content of uncooked potato tubers gives a fairly accurate indication of the cooking quality of the sample. Data collected with more than 60 varieties indicate that potato varieties differ widely in starch content and hence in cooking quality, even when grown under comparable cultural conditions.

The variety Katahdin was used as the standard, and the starch content of other varieties was listed as the amount by which they differed from the standard. A variety averaging 1·0 per cent starch higher than Katahdin was listed as +1·0 per cent whereas a variety averaging 1·0 per cent starch lower than Katahdin was listed as −1·0 per cent.

A quality rating was then arbitrarily allotted according to the followingscale.

Starch Content	Quality Rating
−0·3 per cent and lower.....	poor
−0·2 per cent to +0·3 per cent.....	medium
+0·4 per cent to +0·9 per cent.....	good
+1·0 per cent and higher.....	excellent

Of the 17 varieties on each of which 18 or more tests have been made, 4 were rated as excellent, 5 as good, 5 as medium and 3 as poor in quality. The varieties receiving these ratings were as follows: *Excellent*—Canso, Green Mountain, Keswick, Russet Burbank. *Good*—Houma, Irish Cobbler, Kennebec, Mohawk, Sequoia. *Medium*—Earlaine, Katahdin, Sebago, Teton, Warba. *Poor*—Canus, Chippewa, Pontiac.

Several varieties with only one or two tests have shown a relatively high starch reading. Most of these are of little interest except from a breeding standpoint. The variety Noordeling is very high in this connection, with a starch reading, as based on two tests, 5·2 per cent above Katahdin. Unfortunately, attempts to date to secure seed from this variety have met with failure because of premature abscission of buds.

ILLUSTRATION STATIONS

E. A. Grant

Illustration Stations at present in operation in New Brunswick and the names of operators are as follows:

Station	*County*	*Operator*
Baker Brook	Madawaska	Claude Levasseur
Cumberland Point	Queens	W. C. McQuinn
Currieburg	York	Howard Sandwith
East Centreville	Carleton	Ernest Emery
Lower Derby	Northumberland	W. R. Taylor
Mont Carmel	Kent	Cloris Melanson
St. Charles	Kent	Antoine Daigle
St. Isidore	Gloucester	Peter Robichaud
St. Quentin	Restigouche	Martial Dube
Salisbury	Westmorland	Truman Lewis
Salmonhurst	Victoria	Jens Larsen
Siegas	Madawaska	Romeo Ruest
Silver Falls	Saint John	A. B. Shillington
Welsford	Queens	T. C. McCullum

During the period under review, operations were suspended at two stations, Black River Bridge, operator J. W. Cameron, and Hampstead, operated by J. B. Elder. Two of the stations listed above, Salmonhurst and Welsford, were opened during the period.

This report does not deal with all active projects. Emphasis has been placed on summarizing a number of projects which have been active over a period of years. A list of active projects appears at the end of this report. Information relative to the details or results of any of these are available on application. Reference is also made to the 1937-47 report of the Fredericton Station.

Rotation Studies

Of primary importance in the development of a sound land-use policy on Illustration Stations is the adoption of one or more definite rotations. The choice of rotation depends on a number of factors. The most important is that it produce a maximum of the crops desired, thus, a short rotation is most desirable for the production of hoed crops while longer rotations are more satisfactory for forage production.

Three-Year Rotation—Hoed Crop—Grain Seeded—Clover

At East Centreville, Carleton county, considerable success has been achieved with this rotation as indicated by the yield records in Table 18. This soil, classified as Caribou loam is ideal for potato production; clover catches have also been satisfactory. One ton of fertilizer per acre is applied to the potato crop in this rotation. The original formula used was 4-8-10 but in recent years has been changed to 5-10-10. The second crop clover is plowed down.

At Mont Carmel, Kent county, on a soil classified as Queens sandy loam only medium success has been achieved with this rotation. At this station, second-crop clover is grazed, but regular manure applications of 10 tons per acre are made supplemented by 1,500 pounds fertilizer per acre. However, because of the sandy nature of this soil the gradual improvement in yield and soil tilth noted at East Centreville has not been evident at this unit.

TABLE 18—3-YEAR ROTATION

Hoed Crop—Grain Seeded—Clover

Station	Potatoes		Swedes		Oats		Barley		Clover	
	Number of crop years	Av. yield bu.	Number of crop years	Av. yield tons	Number of crop years	Av. yield bu.	Number of crop years	Av. yield bu.	Number of crop years	Av. yield bu.
East Centreville.	9	401·1	—	—	6	60·5	3	41·82	7	1·41
Mont Carmel.....	9	250·7	7	21·03	6	39·5	—	—	7	1·37

Four-Year Rotation—Hoed Crop—Grain Seeded—Clover—Hay

This rotation has proved very successful on most units. Many New Brunswick farms have large areas that are not suitable for regular planting to hoed crops, in fact large areas of such crops are not desired in the mixed farming program. This applies to many Illustration Stations, consequently it has been a practice to establish this rotation on comparatively small fields of one to five acres, selecting the area of the farm most suitable for hoed crops. Methods of fertilization vary as fields in these rotations are used for experimental purposes, however, the basic treatment is manure at 10 tons per acre applied either in preparation for the root crop or to the grain stubble. A mixed fertilizer application of 1,000 to 1,500 pounds per acre is made to the root crop.

FIG. 4—Plant food deficiency experiment at St. Isidore, showing turnips from a representative drill 66 feet long.

From left to right:

Check plot	3·96	tons per acre
Muriate of Potash 100 lb. per acre	6·20	" " "
Sulphate of Ammonia 250 lb. per acre	13·46	" " "
Superphosphate 500 lb. per acre	14·65	" " "
5-10-5 1000 lb. per acre	23·10	" " "

Space does not permit a discussion of results at each individual station but yield records are summarized in Table 19. Soil at each of the stations concerned is classified as follows: Baker Brook and Lower Derby—Riverbank Sandy loam; St. Quentin—Caribou loam; Salisbury—Petitcodiac and Salisbury clay loam; Welsford—Parleeville gravelly loam.

TABLE 19—FOUR-YEAR ROTATION

Hoed Crop—Grain Seeded—Clover—Hay

Station	Potatoes		Swedes		Oats		Clover		Hay	
	Number crop years	Av. yield bu.	Number crop years	Av. yield tons	Number crop years	Av. yield bu.	Number crop years	Av. yield tons	Number crop years	Av. yield tons
Baker Brook.....	6	363·4	—	—	3	25·3*	5	1·85	4	1·27
Lower Derby....	22	276·0	18	23·07	16	58·2	23	2·07	24	2·01
St. Quentin.....	7	445·0	4	16·93	4	51·3	4	1·54	2	1·52
Salisbury.....	11	162·6	13	17·14	13	46·4	12	1·49	8	1·40
Welsford.....	3	415·2	3	24·71	2	48·0	1	2·35	—	—

* Wheat instead of oats at Baker Brook.

Five-Year Rotation—Hoed Crop—Grain Seeded—Clover—Hay—Hay

This rotation is adaptable to many farms, particularly where all the available cultivated land is suitable for planting to hoed crop. When followed exactly it permits one-fifth of the land in hoed crop, one-fifth in grain, and three-fifths in hay. It is possible, however, to vary this percentage considerably as is frequently done on Illustration Stations where this rotation is used. Where only a small acreage of hoed crop is desired, the remaining portion of this field is frequently used for grain production, if larger amounts of hoed crop are grown a portion or all of the third-year meadow can be used for this purpose. This is frequently done at the Siegas and Currieburg stations when it is desired to increase seed potato production to meet market conditions or to separate different varieties as required by seed-growing regulations. All or part of the third-year meadow has also been used on occasion for pasture when regular pasture areas are short. Another variation of this rotation, frequently followed at Siegas is to precede the hoed crop with grain.

Manure and fertilizer applications in this rotation are similar to those applied in the 4-year rotation except that additional fertilizers are applied to grain and hoed crop when planted instead of third-year meadow. Yield results with this rotation are summarized in Table 20.

TABLE 20—FIVE-YEAR ROTATION

Hoed Crop—Grain Seeded—Clover—Hay—Hay

Station	Potatoes		Oats		Clover		2nd year Hay		3rd year Hay	
	Number crop years	Av. yield bu.	Number crop years	Av. yield bu.	Number crop years	Av. yield tons	Number crop years	Av. yield tons	Number crop years	Av. yield tons
Currieburg.....	15	365·1	10	44·6	14	1·39	12	1·22	6	0·97
St. Charles.....	14	203·6	10	32·5	14	1·39	13	1·14	3	0·57
St. Isidore.....	18	201·9	18	30·6	21	1·01	18	0·89	6	0·67
Siegas.....	17	264·8	17	47·2	20	1·78	15	2·00	—	—

Soil Fertility Tests

An experiment at the East Centreville station has been conducted since 1943 and is designed to study the effect of manure, limestone and additional fertilizer to the grain crop in a rotation of potatoes, grain, and clover. Treatments and results are summarized in Table 21.

TABLE 21—EFFECT OF MANURE, FERTILIZER, AND SOIL AMENDMENTS

EAST CENTREVILLE

Treatment per acre*	Potatoes bu.	Oats bu.	Barley bu.	Clover 1st cut tons	Clover 2nd cut tons
8T manure on grain stubble	412·5 (9)	58·0 (5)	44·3 (3)	1·42 (8)	1·22 (3)
500 lb. Dol. limestone after potatoes	396·9	54·9	44·0	1·61	1·25
Check	391·2	53·4	35·2	1·16	0·90
400 lb. 3–15–6 on grain	400·5	67·8	44·0	1·25	1·17
8T manure in preparation for grain	406·1	58·9	41·6	1·48	1·14

* In addition to treatments listed all plots received 1 ton of 4–8–10 or equivalent.
( ) Figures in parenthesis indicate number of years crop records available.

The above figures indicate the following: (1) manure has a beneficial effect on all crops in the rotation; (2) limestone improved the clover crop and barley crop; (3) additional fertilizer for grain improved that crop and also the succeeding clover crop; (4) none of the above treatments have thus far caused scab on potatoes.

Fertilizer Formula Trials with Potatoes—East Centreville

A formulae test was conducted at East Centreville comparing 12 different fertilizer treatments. This experiment was laid down in a 3-year rotation of potatoes, oats, and clover and was carried on for a 6-year period. The treatments were applied to four replicates and randomized in order to overcome error resulting from soil variation. Manure at 10 tons per acre was applied to one replicate. In addition to yield records, a starch content analysis was also made on tubers. Results are summarized in Table 22.

TABLE 22—EFFECT OF FERTILIZER FORMULA AND MANURE ON THE YIELD AND STARCH CONTENT OF POTATOES—EAST CENTERVILLE, N.B.

Six-year average 1945 to 1950, inclusive.

Fertilizer formula	Yield per acre manure bu.	Yield per acre no manure bu.	Increase due to manure bu.	Starch content of tubers %
2,000 lb. 0–8–10	275·5	245·5	30·0	14·45
2,000 lb. 2–8–10	318·2	289·8	28·4	14·35
2,000 lb. 4–8–10	339·0	282·9	56·1	14·33
2,000 lb. 6–8–10	339·4	285·1	54·3	14·11
2,000 lb. 4–4–10	310·6	259·7	50·9	14·23
2,000 lb. 4–12–10	347·4	331·8	15·6	14·35
2,000 lb. 4–8–5	357·7	331·4	26·3	14·72
2,000 lb. 4–8–15	322·2	303·4	18·8	13·82
1,000 lb. 4–8–10	312·6	242·8	69·8	14·72
1,500 lb. 4–8–10	323·4	282·6	40·8	14·63
2,500 lb. 4–8–10	360·2	283·5	76·7	13·95
Check	219·8	168·5	51·3	15·81

The above figures reveal the effectiveness of manure in boosting yield, the average increase being over 40 bu. per acre. Response from nitrogen leveled off at 4 per cent; yields continued to increase from phosphorus up to 12 per cent; best results from potash were at the 5 per cent level. Yields increased with each level of a 4-8-10 formula up to 2,500 pounds on manured plots but leveled off at 1,500 pounds on unmanured plots.

High starch content indicates mealiness and good table quality. In this respect the above figures indicate that starch content was reduced as the rate of application of complete fertilizer and of potash was increased.

Pasture Studies

A fertilizer experiment that includes five fertilizer treatments and a check has been conducted at 12 Illustration Stations for varying periods since 1944. Altogether, yield records are now available for a total of 75 tests.

Yield records for this experiment reveal the importance of phosphorus in a pasture fertilizer. Superphosphate applied every third year at 600 pounds per acre resulted in an increase in yield of 2·5 tons per acre of green grass. The addition of 100 pounds per acre of muriate of potash applied every third year resulted in a further increase of 0·4 tons per acre. Sulphate of ammonia at 100 pounds per acre applied annually increased the yield by 1·18 tons per acre. Experience has shown that nitrogen gives best results when applied annually, preferably in the spring. Results of this experiment indicate that mineral fertilizers (phosphorus and potash) give equally good results when applied every third year as opposed to applying small yearly amounts. A heavy application equivalent to 1,000 pounds 2-12-6 applied annually gave the heaviest yields in this test. However, results were not consistent at all stations and it is doubtful if applications at this rate are profitable, except possibly as an initial treatment.

Renewing Poor Pasture Sods

Pastures on which the sod has become very thin, consisting chiefly of poor type grasses and weeds, are very common in New Brunswick. Such areas can be improved by surface applications of fertilizer but improvement is often slow and can be expensive. In 1950 an experiment was started on the Illustration Station at Welsford (Summer Hill) designed to study methods of improving such a pasture. Yield records to date indicate that surface working with either a disk or spring-tooth harrow, followed by reseeding and fertilizing, give best results. This treatment gave an average yield of 4,700 pounds of dry matter per acre. Where the old sod was plowed and harrowed in the usual way followed by reseeding and fertilizing, the yield was 4,250 pounds per acre. Fertilizer applied to the old sod yielded 3,435 pounds per acre. These yields compare with 1,170 pounds per acre for the untreated area.

Farm Organization and Business Studies

Records of cash receipts from 15 stations through the period 1939-1951 show that 49·8 per cent of total revenue was derived from cattle and dairy products, 16·8 per cent from field crops, 7·1 per cent from poultry, 9·7 per cent from hogs and 8·7 per cent from miscellaneous sources. Farm produce consumed in the household comprised 7·9 per cent of total revenue.

Farm Capital

Inventory records for 11 stations, most of them covering the period 1941-51, show an average of 56 per cent of their capital investment in land and buildings; 20 per cent in livestock and 23 per cent in machinery and equipment. The average investment per acre of crop land amounts to $190.32 while the average

gross receipts per acre is $78.82. The figures for individual stations are summarized in Table 23. Over the period under study most stations have increased the percentage of their investment in livestock and machinery and equipment. Investments per acre and gross receipts have also increased. Generally speaking, there is a consistent relationship between investment per acre and gross receipts per acre; that is those stations with high investments per acre show the highest receipts per acre. One exception, the Mont Carmel station, shows receipts above average while investment per acre is below average; it is worth noting that the percentage investment in livestock at this unit is almost double the average.

FIG. 5—Experimental Cranberry Bog at Cumberland Point. Right: natural bog. Left: Improved bog showing results of ditching, grading, turfing and sanding.

TABLE 23—DISTRIBUTION OF CAPITAL, INVESTMENT PER ACRE AND GROSS RECEIPTS PER ACRE

Average 1941–51—New Brunswick Illustration Stations

Station	Land and buildings Percentage of total investment	Livestock Percentage of total investment	Machinery and equipment Percentage of total investment	Investment per acre of crop land $	Gross receipts per acre of crop land $
Baker Brook(1)	49	28	23	179·32	70·82
Currieburg	47	18	35	203·24	81·99
East Centreville(2)	44	9	47	161·81	70·12
Lower Derby	60	22	18	241·09	99·24
St. Charles	68	14	18	103·06	30·95
Mont Carmel(3)	54	38	8	165·69	97·28
Salisbury	60	20	20	161·37	54·74
Silver Falls	60	20	20	453·70	229·07
St. Quentin(4)	43	24	33	125·82	50·91
St. Isidore	73	18	9	137·94	29·75
Seigas	63	13	24	160·44	52·10
Average	56·4	20·4	23·2	190·32	78·82

(1) 1945–51 (2) 1942–51 (3) 1942–51 (4) 1945–51.

POULTRY

L. Griesbach

A flock of Barred Plymouth Rocks has been maintained at this Station for experimental purposes for many years. Males from outstanding matings in flocks throughout the province and elsewhere were used from time to time and the blood of sires with superior progeny on Experimental Farms and Stations was incorporated into the flock during the years 1939 to 1944. Rapid feathering was also incorporated into the flock during this period through a male received from the Central Experimental Farm. While considerable attention has always been given to flock improvement studies, emphasis has been placed on research in breeding problems since 1947.

Fertility

Fertility began to decline seriously in 1947. The average fertility from pedigreed matings in 1947 and 1948 was only 71·2 and 64·0 per cent, respectively. New blood was brought into the flock in 1949 and 1950 through four males from two unrelated flocks. The fertility of the Barred Plymouth Rock flock, from pedigreed matings, in 1951 was 92·4 per cent and in 1952, from mass matings, it was 97·4 per cent.

The high fertility obtained in the last two years indicates that the low-fertility problem has been overcome. The flock is now being used as a test line for crossbreeding purposes. Fertility should become stabilized at a high level because replacement stock is being produced from a large number of males.

Capons

One hundred Barred Rock capons were raised each year for three years. Cockerels from the regular flock were caponized at six weeks of age for this work. A summary of the results is shown in Table 24. Calculations are on a "bird-day" basis and weights of dead birds are included. The feed consumption per bird and per pound gain would be higher than indicated in the table if only birds alive at the end of the test were considered. It is of interest to note that feed efficiency increased each year, corresponding to a decrease in age when marketed. This emphasizes the importance of marketing the birds as soon as they are well enough finished to insure good grading results. The dressing percentages can be used as a guide in estimating relative value of live, dressed, and drawn birds.

TABLE 24—BARRED PLYMOUTH ROCK CAPONS

Item	1948	1949	1950	Average
Number of capons started	100	100	100	100
Mortality (%)	4·0	2·0	1·0	2·3
Age when marketed (days)	225	208	198	210
Average feed consumption (lb.)	62·7	55·4	47·6	55·2
Average live weight when marketed (lb.)	9·3	9·0	8·3	8·9
Average cold dressed weight (lb.)	8·1	7·8	—	8·0
Average drawn weight (lb.)	6·5	6·3	—	6·4
Feed consumed per pound gain (lb.)	6·8	6·2	5·8	6·3
Per cent grades special and A	91·6	98·0	93·9	94·5
Per cent dressed weight of live weight	86·7	86·7	—	86·7
Per cent drawn weight of dressed weight	81·0	80·8	—	80·9
Per cent drawn weight of live weight	70·3	70·0	—	70·2

Brooding

The use of individual brooder stoves for brooding chicks has given satisfactory results under a wide variety of conditions. However, in large-scale operations, the labor required to tend a number of heating units becomes a problem and the fire hazard increases with each additional unit. The trend has been toward the use of central heating plants and large brooder houses. Heat may be supplied by warm air distributed through ducts or by warm water distributed through pipes above the floor or embedded in the floor.

Electricity is also becoming widely used to supply heat by a wide variety of methods. One of the newer methods is by the use of infra-red heat bulbs, a method which is giving very promising results. Another method is by embedding electric heating cable in the concrete floor to produce what is generally known as floor radiant heat. This latter method has been used at this Station since 1949.

It was found that a temperature of 90° to 92° at a level of two inches from the floor is required to keep the chicks comfortable for the first few days. The temperature can then be lowered gradually. If deep litter is used it can be pushed to the sides when the chicks are small in order that the floor and air may warm up properly. The litter will gradually cover the floor and after the chicks are well feathered little or no heat will be required to keep them comfortable and the litter in good condition.

The problem of keeping costs at a reasonable level is still under investigation but the average electricity consumption for two years during the regular brooding period at this Station for this method of brooding was 7·1 kwh per square foot of floor space. Brooding costs have been estimated at various rates for electricity and at different levels of chick concentration as shown in Table 25.

Floor radiant heating with electricity permits brooding with a minimum of labor and a low degree of fire risk. However, the problems of fuel cost (electricity) and litter management for disease control require further study.

TABLE 25—COST OF ELECTRICITY PER CHICK FOR BROODING

Floor space per chick	Rate per KWH		
	1c.	2c.	3c.
	cents	cents	cents
1 sq. ft.	7·1	14·2	21·3
½ sq. ft.	3·6	7·1	10·7
¼ sq. ft.	1·8	3·6	5·3

Strain Testing and Crossbreeding for Broiler Qualities

The testing of strains for broiler qualities was started in 1951 as the first phase of an experiment to test a new breeding technique known as reciprocal recurrent selection. For this first phase of the experiment, 30 dozen hatching eggs from each of a number of broiler strains are obtained each year and hatched at the same time as the Station's Barred Plymouth Rocks. The chicks are mixed together, provided with one square foot of floor space per chick in the brooder house, and fed a high energy broiler ration for twelve weeks. Live weights are obtained at six and twelve weeks of age and the chicks are then reared on range for laying stock. They are housed when 24 weeks old and records are kept of body weights, egg size, egg production, and mortality of each strain. The breeding pens are made up in such a way that hatching eggs are

obtained from each pure strain and from reciprocal matings of each strain with this Station's strain of Barred Plymouth Rocks (Fredericton Strain). One hundred broilers are raised to twelve weeks from each type of mating. Live weights and mortality are obtained for each strain and each crossbred. Dressed weights, carcass grade, and some body measurements are also obtained.

The results of the first year's work show that there are considerable differences in rate of growth to twelve weeks of age between different strains and crosses. Hybrid vigor, as expressed by more rapid growth than either parent, was exhibited by seven of the eight crosses. After three or more years of strain testing the strain that gives the most hybrid vigor when crossed with the F.B.R. strain, will be retained. Selection for increased hybrid vigor will be initiated within the two strains.

Breeding for Egg Production

In breeding for egg production, selection on the basis of the individual's own performance has been practised for many years. This is known as mass selection. The experience of many breeders has been that mass selection is usually effective in raising the level of egg production in relatively low-producing flocks but sooner or later it ceases to be effective. Progress can still be made by progeny testing (i.e. the use, as breeders, of the old proven parents of superior progeny). The progeny test is limited in its practical application but family selection (i.e, selection of the entire group or part of a group of sisters based on the average performance of the group) is widely practised and recommended.

Family selection has increased in popularity to the point where, in some cases, the performance of the individual is neglected entirely. Further information on the relative value of individual and family selection would be of value in a practical breeding program, and in this connection an experiment, which involved a progeny test of full sisters with known egg production records, was conducted at this Station from 1947 to 1951.

Each set of matings included all the full sisters in a family mated to the same male giving rise to an unculled population of daughter families. Egg production records of survivors were compiled for a period of 365 days from the time each pullet laid her first egg. Actual trap-nest records were used up to September 4, and production for the balance of the year was calculated. Thus egg production records were obtained from progeny of full sister dams that had been mated to the same male.

The experiment was designed to compare the breeding value of full sisters with high and low egg production records, the family average being the dividing line between high and low producers. Comparisons were also made of selection on the basis of individual records and family records. The results are shown in Table 26.

TABLE 26—AVERAGE EGG PRODUCTION WITH DIFFERENT METHODS OF SELECTION

Year	No selection Progeny of all dams	Individual Selection		Family Selection		Selection within Families	
		Progeny of dams below av.	Progeny of dams above av.	Progeny of families below av.	Progeny of families above av.	Progeny of dams below family av.	Progeny of dams above family av.
	(eggs)	(eggs)	(eggs)	(eggs)	(eggs)	(eggs)	(eggs)
1948.....	229·8	228·4	230·8	229·9	229·6	223·7	233·6
1949.....	203·2	197·9	207·4	204·2	202·1	196·8	208·8
1950.....	229·9	225·8	232·4	229·0	231·1	227·0	231·6
1951.....	232·6	231·6	233·3	231·4	233·9	230·9	234·1
Average.....	224·5	221·8	226·5	224·3	224·7	220·5	227·5

The data show that the progeny of dams with records above the family average produced an average of 7 eggs a year more than the progeny of dams with records below the family average. This difference was shown to be statistically significant.

Dr. J. L. Lush (Am. Nat. 81: 241-261) has shown that for traits with low heritability, family selection will be more effective than individual selection and that when heritability is high, individual selection will be the more effective. Dr. I. M. Lerner and associates (Plty. Sci. 28: 903-913) have shown that the relative amount of attention to be paid to individual and family selection is a function of the degree of heritability and of family size.

Heritability of survivor egg production was calculated to be 34 per cent, and there was an average of 7·8 sisters per family in the work at the Fredericton Station. At these levels family selection alone would be expected to be 1·07 times as effective as individual selection.

The actual results show an increase of 4·7 eggs per bird from the progeny of dams above the average of the flock over those below the average, whereas family selection alone, using the flock average as the dividing line between low and high families, gave an increase of only 0·4 eggs from using the high families over the low families. The relative difference in results obtained from this experiment and that expected, between individual and family selection, may have been affected by low fertility in the first three years of the experiment which eliminated a number of potential dams. The introduction of new blood to overcome the low fertility may also have affected the results.

A total of 185 dams and 1,446 daughters were tested. These numbers should have ensured accurate results under the conditions of the experiment and the difference of 7 eggs obtained from progeny of high dams over the progeny of their low full sisters is an important consideration.

ACTIVE PROJECTS

Animal Husbandry

Breeding Holstein cattle; Percheron horses; Yorkshire swine.
Milk and butterfat production, feed consumption and cost studies.
Feed requirement studies; dairy females; draft horses.
Swine breeding studies.
Self-feeding versus hand-feeding of bacon hogs.

Cereal

Grain variety and strain breeding selection and yield studies (oats, barley, spring and winter wheat, field peas and beans, flax).
Spring wheat disease loss studies.
Cereal crop studies on percentage of natural crossing.

Field Husbandry

Meteorological records.
Pasture studies, fertilization and management.
Grain seeding, rate studies.
Weed control studies for farm crops, chemical and cultural.
Fertility studies field and greenhouse, on soil types (grain, hay, potatoes, pasture).
Potato fertility studies (continuous versus in rotation, rate and source of potassium, manure versus fertilizer versus combination of these).
Soil amendment studies for grain and hay.
Soil conditioner studies.

Forage

Grass and legume variety and strain studies.
Hay and pasture crop studies, perennial and biennial grasses and legumes.
Corn variety trials; silage and grain.

Horticulture

Vegetable variety trials (corn, pea, snapbean, radish, lettuce, cucumber, melon, squash, tomato).
Potato breeding.
Strawberry breeding.
Bush fruit variety trials (raspberry, gooseberry, black currant).
Tree fruit variety trials (apple, pear, plum, cherry).
Tree fruit breeding (apple).
Nutritional studies; horticultural crop plants.
Fruit and vegetable; storage investigations.
Hedges, variety trial.
Flowering and ornamental shrubs, variety trial.
The role of growth-promoting substances in horticultural practice.
Chemical weed killers, vegetables.

Illustration Stations

Crop rotation studies.
Commercial fertilizer studies (supplement to farm manure, rates, formulae, place in rotation).
Ground limestone, for farm crops.
Organic matter, for farm crops.
Weed control, chemical and cultural.
Soil conservation studies, contour farming; water erosion control.
Cereal variety trials.
Seed mixture studies, hay and pasture.
Pasture fertilization and management studies.
Grass and legume silage, production studies.
Root and framework studies, apple.
Cranberry production studies.
Farm business and management studies.
Farm woodlot management studies.

Poultry

A comparison of floor radiant heating and standard hover methods for brooding chicks.
Breeding for the improvement of broiler qualities, through strain testing and crossbreeding, by the reciprocal recurrent selection technique.

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