EXPERIMENTAL FARM

MILE 1019, ALASKA HIGHWAY
YUKON TERRITORY

PROGRESS REPORT
1953-1959

EXPERIMENTAL FARMS SERVICE
CANADA DEPARTMENT OF AGRICULTURE

64254-6—1

ROGER DUHAMEL, F.R.S.C.
QUEEN'S PRINTER AND CONTROLLER OF STATIONERY
OTTAWA, 1963

Cat. No. A56-432/1959

PROFESSIONAL STAFF

J. W. ABBOTT	Officer in Charge
W. H. HOUGH, B.Sc., M.Sc.	Superintendent
J. Y. TSUKAMOTO, B.Sc.	Agronomist
J. W. MORRISON, B.Sc., M.Sc., Ph.D.	Acting Superintendent

Changes in Staff

J. W. Abbott, who became Officer in Charge in 1945, retired in March, 1956, and J. Y. Tsukamoto was appointed Acting Officer in Charge. In June, 1956, W. H. Hough, Experimental Farms Service, Ottawa, was appointed Superintendent.

In June, 1959, Mr. W. H. Hough died. From July to September, 1959, Dr. J. W. Morrison acted as Superintendent. J. Y. Tsukamoto was Acting Superintendent until the end of that year.

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INTRODUCTION

The first progress report of the Experimental Farm at Whitehorse covered the period from 1945 to 1952. This report is a summary of studies and results obtained from 1953 to 1959.

The Farm is situated at Mile 1019 on the Alaska Highway, in the Yukon Territory. It is 103 miles northwest of Whitehorse, at north latitude 60° 45′, west longitude 137° 35′, and is 1965 feet above sea level.

The Farm is in a gently rolling lake basin. The soils are mainly Brown Wooded, and are derived from a light-textured overlay of fine sand to silt loam. This material is underlain by stratified silt and clay loam. Occasional lake beaches and lake-current sortings are found on the faces of the lake basin. Depressional areas usually have an organic deposit overlying the heavy-textured lacustrine materials.

The climate is described in the meteorological section of this report. The physiography of the area is dominated by the nearby Coastal Range. The mountains affect the climate by moderating air masses moving inland from the Pacific Ocean. The Farm is within the rain shadow caused by the mountains. The growing season is usually cool and dry. Frosts may occur in each month of the year. Crops that are susceptible to light frosts, such as beans, tomatoes and cucumbers, seldom mature.

In the early development of the Farm, primary emphasis was placed on determining what crops could be grown in these northern latitudes. Oats and barley grew and matured satisfactorily, but wheat seldom ripened without frost damage in early fall. Forage grasses generally thrived. Legumes were difficult to establish because of the damaging effects of brown root rot, caused by *Plenodomus meliloti*.

Livestock and poultry were introduced after it was found that feed for them could be produced at the Farm. At present a small herd of beef cattle, a herd of pigs, and a flock of laying hens are maintained to study adaptation and reactions of these birds and animals to sub-Arctic farming conditions.

Gardening of hardy vegetables and flowers has been satisfactory.

In 1957, construction of an administration building and a superintendent's residence improved physical facilities on the Farm. In 1958-59, a garage, a machinery shed, a poultry building, and two staff residences were erected.

WEATHER

Generally the climate of the Yukon is cool and dry. The total annual precipitation is 11.5 inches, of which about 7 inches is rainfall. The rainfall is fairly evenly distributed over the growing season. A low rate of evaporation permits a greater utilization of moisture than is usual in comparable areas of low rainfall.

The frequent frosts recorded at the Farm are the main features of the climate. These are caused by the cooling of the prevailing winds, which come over the glacier-covered peaks of the St. Elias mountain range. During the winter, temperatures are sometimes 40° F. or higher for two to four days. These mild spells during the winter are due to movement of warm air from the Pacific.

Records of evaporation, precipitation, sunshine, and temperature have been taken for the past 15 years in cooperation with the Meteorological Branch of the Department of Transport. Tables 1-10 give the details for 1953 to 1959 along with the long-term averages.

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Table 1.—Monthly and Annual Mean Maximum Temperatures (° F. at 4 Feet Above Ground), 1953-59, and Long-term Averages, Experimental Farm, Mile 1019, Alaska Highway, Y.T.

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1953	— 6.0	26.6	28.1	44.4	57.0	68.4	69.0	63.4	52.1	37.3	15.2	16.4	39.3
1954	10.6	13.0	32.0	33.7	54.7	66.1	63.1	66.0	54.7	45.5	28.4	2.9	39.2
1955	14.5	20.6	27.4	38.8	50.3	61.1	68.5	59.6	53.7	36.8	3.5	— 2.8	36.0
1956	0.4	10.2	25.2	44.3	55.9	60.6	67.1	63.4	53.3	34.0	30.8	— 0.2	37.1
1957	2.7	17.9	33.4	40.6	55.2	69.9	65.8	70.5	62.9	44.3	28.6	2.9	41.2
1958	12.3	14.4	30.6	48.8	58.0	70.8	70.4	62.1	54.6	34.8	20.2	6.0	40.3
1959	— 9.4	21.9	21.2	41.2	54.5	69.3	65.2	62.1	55.1	38.2	25.5	19.3	38.7
Average, 1953-59	3.6	17.8	28.3	41.7	55.1	66.2	67.0	63.9	55.2	38.7	21.7	6.4	38.8
1945-59	6.0	15.8	29.6	40.9	55.5	65.9	67.6	64.5	55.3	39.7	21.1	6.2	39.0

Table 2.—Monthly and Annual Mean Minimum Temperatures (° F. at 4 Feet Above Ground), 1953-59, and Long-term Averages, Experimental Farm, Mile 1019, Alaska Highway, Y.T.

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1953	—26.5	— 1.7	— 6.8	22.4	29.8	40.3	42.9	39.2	28.9	19.9	— 6.1	— 3.8	14.9
1954	—16.3	—17.5	— 0.7	8.8	28.6	34.7	39.1	36.3	28.0	22.4	13.6	—15.5	13.5
1955	— 5.7	— 7.1	— 4.6	14.4	25.7	32.4	40.2	35.7	26.3	11.5	—20.1	—26.7	10.2
1956	—23.0	—13.3	— 3.9	18.6	27.9	33.5	40.7	38.2	28.3	15.3	12.4	—19.9	12.9
1957	—20.5	—12.6	— 0.4	18.3	30.3	38.8	39.2	39.1	33.8	16.4	7.4	—16.2	14.5
1958	— 8.7	—10.5	— 4.5	21.5	29.5	38.5	41.7	37.0	26.7	10.1	10.0	—12.3	14.9
1959	—30.2	— 7.1	— 4.0	18.2	29.5	39.8	38.0	37.8	31.0	14.2	2.7	— 4.7	13.8
Average, 1953-59	—18.7	—10.0	— 3.6	17.5	28.8	36.9	40.3	37.6	29.0	15.7	2.8	—14.2	13.5
1945-59	—17.3	—12.5	— 1.6	17.5	28.4	35.9	39.8	36.5	29.1	16.3	1.4	—14.9	13.2

Table 3.—Monthly and Annual Mean Temperatures (° F. at 4 Feet Above Ground), 1953-59, and Long-term Averages, Experimental Farm, Mile 1019, Alaska Highway, Y.T.

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1953	—16.3	—12.4	10.7	33.4	43.4	54.4	55.9	51.3	40.5	28.6	4.5	6.3	25.0
1954	— 2.9	— 2.3	15.7	21.3	41.7	50.4	51.1	51.1	41.3	34.0	21.0	— 6.3	26.3
1955	4.4	6.8	11.4	26.6	38.0	46.8	54.4	47.6	40.0	24.1	— 8.3	—14.8	23.1
1956	—22.6	— 1.5	10.7	31.5	41.9	47.0	53.9	50.8	40.8	24.6	21.6	—10.1	24.1
1957	— 8.9	2.6	16.5	29.5	42.8	54.3	52.5	54.8	48.4	30.4	18.0	— 6.6	27.9
1958	1.8	1.9	13.0	35.2	43.7	54.7	56.0	49.5	40.1	22.5	15.1	— 6.3	27.3
1959	—19.8	7.4	8.6	29.7	42.0	54.6	51.6	50.0	43.1	26.2	14.1	7.3	26.2
Average, 1953-59	— 9.0	0.4	12.4	29.6	41.9	51.7	53.6	50.7	42.0	27.2	12.3	— 4.4	25.7
1945-59	— 7.2	0.02	13.9	28.3	41.1	49.8	52.8	49.5	41.2	27.7	10.9	— 5.4	25.2

Table 4.—Monthly Extremes in Temperature (° F. at 4 Feet Above Ground), Experimental Farm, Mile 1019, Alaska Highway, Y.T., 1945 to 1959

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Lowest	—65.0	—65.0	—45.0	—23.0	12.0	20.0	26.0	12.0	1.0	—23.0	—53.0	—54.0
Year	1947	1947	1951	1954	1948	1945	1947	1948	1946	1958	1948	1955
Highest	54.0	48.0	52.0	66.9	82.0	86.0	88.0	83.0	75.2	65.0	56.5	47.0
Year	1949	1945	1951	1958	1947	1950, 1958	1946	1950	1957	1958	1956	1955

Table 5.—Monthly and Annual Precipitation, Inches, 1953-59, and Long-term Averages, Experimental Farm, Mile 1019, Alaska Highway, Y.T.

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual snow-fall	Annual rain-fall	Annual precipi-tation[1]
1953	.26	.73	.23	.95	.64	.84	2.41	.96	.78	2.81	.39	.82	49.8	6.84	11.82
1954	.35	.58	.16	.43	1.11	.70	3.27	1.27	1.78	1.35	1.32	4.36	48.4	11.84	16.68
1955	.53	.14	.80	.07	.03	.41	.67	1.15	.92	.28	.71	.65	31.0	3.26	6.36
1956	.57	.16	.08	.27	.14	3.05	1.86	.58	.59	.22	7.29	1.63	66.6	9.76	16.42
1957	.28	.66	.12	.07	.55	.80	1.59	1.63	.89	1.73	.53	1.11	26.8	7.28	9.96
1958	1.58	.27	.27	.71	.02	.66	.15	2.40	.49	.91	1.02	1.53	55.6	4.45	10.01
1959	.54	.47	.84	.04	.41	1.07	.10	1.60	1.45	.90	1.90	1.54	53.3	5.53	10.86
Average, 1953-59	.59	.43	.36	.36	.41	1.08	1.44	1.37	.99	1.17	1.88	1.60	47.4	6.99	11.73
1945-59	.71	.41	.32	.37	.47	1.16	1.35	1.10	1.21	1.54	1.48	1.35	46.4	6.83	11.47

[1] Ten inches of snow equals 1 inch of rain.

Table 6.—Extreme Monthly and Annual Precipitation, Inches, Experimental Farm, Mile 1019, Alaska Highway, Y.T., 1945-59

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual snow-fall	Annual rain-fall	Annual precipi-tation[1]
Lowest	.22	.05	0.0	0.0	.02	.30	.41	.05	.39	.15	.39	.32	26.80	3.26	6.36
Year	1950	1951	1949	1946	1958	1948	1955	1945	1951	1950	1953	1949	1957	1955	1955
Highest	1.73	.75	.84	2.50	1.11	3.05	3.27	2.40	3.44	3.59	7.29	4.36	66.60	11.81	16.68
Year	1948	1950	1959	1945	1954	1956	1954	1958	1954	1949	1956	1954	1956	1954	1954

[1] Ten inches of snow equals 1 inch of rain.

Table 7.—Monthly and Annual Hours of Bright Sunshine, 1953-59, and Long-term Averages, Experimental Farm, Mile 1019, Alaska Highway, Y.T.

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1953	19.3	66.0	191.7	157.3	245.1	211.5	216.1	197.3	106.4	48.6	24.7	0.0	1484.0
1954	12.8	103.1	165.6	235.7	277.8	263.2	200.6	262.2	152.7	113.2	16.9	0.0	1803.8
1955	7.7	72.9	147.3	210.2	278.4	248.7	286.6	200.7	177.0	94.0	23.8	0.3	1747.6
1956	17.1	70.4	149.8	247.2	320.5	239.1	304.5	200.5	132.7	64.9	3.2	0.2	1750.1
1957	31.3	68.7	196.9	200.2	161.7	277.7	225.4	263.2	163.9	12.3	12.3	0.0	1613.6
1958	18.3	69.6	215.4	274.9	288.0	328.4	293.4	209.3	161.2	111.6	25.4	2.1	1997.6
1959	26.4	71.1	155.4	222.2	276.7	267.0	289.0	165.5	153.7	126.8	30.2	0.0	1784.0
Average, 1953-59	19.0	74.5	174.6	221.1	264.0	262.2	259.4	214.1	149.7	81.6	19.5	.4	1740.1
1946-59	20.7	75.8	165.4	197.3	262.1	258.2	249.8	213.5	148.8	87.5	21.4	.4	1703.3
Lowest	7.7	55.7	124.4	144.3	161.7	172.0	184.7	163.2	106.4	12.3	3.2	0.0	
Year	1955	1946	1946	1952	1957	1949	1946	1947	1953	1957	1956	1949, 1951 1953, 1954 1957, 1959	
Highest	31.3	110.0	215.4	274.9	320.5	328.4	304.5	263.2	186.8	126.8	34.2	2.1	
Year	1957	1951	1958	1958	1956	1958	1956	1957	1950	1959	1946	1958	

Table 8.—Monthly Evaporation, Inches, 1953-59, and Long-term Averages and Monthly Extremes, Experimental Farm, Mile 1019, Alaska Highway, Y.T.

Year	May	June	July	Aug.	Sept.
1953	3.38	4.06	2.91	2.83	1.26
1954	2.61	3.50	3.24	2.47	1.58
1955	3.05	4.93	3.40	2.85	1.12
1956	4.34	6.65	3.86	2.28	.48
1957	4.55	3.60	3.40	3.20	1.70
1958	4.13	5.32	5.34	3.26	.53
1959	2.57	4.07	4.59	.76	.23
Average, 1953-59	3.52	4.59	3.82	2.52	.96
1946-59	3.59	4.64	3.87	2.71	1.19
Lowest	2.57	3.50	2.91	.76	.07
Year	1959	1954	1953	1959	1948
Highest	4.81	6.65	5.34	3.81	1.86
Year	1948	1956	1958	1951	1949

Table 9.—Dates of Frost and Frost-free Periods, 1953-59, and Long-term Averages, Experimental Farm, Mile 1019, Alaska Highway, Y.T.

Year	Frost[1] Last in spring Date	° F.	Frost[1] First in fall Date	° F.	Consecutive frost-free days	Killing frost[2] Last in spring Date	° F.	Killing frost[2] First in fall Date	° F.	Crop days above 28° F.
1953	July 10	31.5	Aug. 9	29.0	30	June 17	26.5	Aug. 22	27.0	67
1954	July 14	31.0	July 23	31.5	9	July 2	28.0	Aug. 16	26.0	45
1955	July 15	30.5	Aug. 12	30.0	28	July 12	28.0	Aug. 16	24.0	35
1956	July 11	32.0	July 23	32.0	12	June 24	27.5	Aug. 5	27.0	41
1957	July 11	32.0	July 24	31.5	13	May 31	27.0	Aug. 20	28.0	81
1958	June 30	30.0	Aug. 2	32.0	33	May 29	28.0	Aug. 16	28.0	79
1959	July 4	31.0	July 18	30.0	14	June 6	28.0	July 24	26.5	48
Average, 1953-59	July 9	31.1	July 29	30.9	20	June 19	27.6	Aug. 14	26.6	56
1945-59	July 6	31.1	July 29	30.0	23	June 19	27.2	Aug. 11	25.9	53
Extremes,[3] 1945-59										
Longest season	July 10, 1952	31.5	Aug. 18	27.0	39	May 31, 1957	27.0	Aug. 20	28.0	
Shortest season	July 14, 1954	31.0	July 23	31.5	9	July 2, 1949	27.0	July 30	—	
Earliest frost	June 20, 1951	29.0	July 16, 1948	31.0	—	May 31, 1957	27.0	July 24, 1959	26.5	
Latest frost	July 15, 1955	30.5	Aug. 18, 1952	27.0	—	July 13, 1947	26.0	Aug. 25, 1948	12.0	

[1] Frost: 32° F. or lower.
[2] Killing frost: 28° F. or lower.
[3] Midseason date: July 15.

Table 10.—Mean Monthly Soil Temperatures (° F.) taken at 8 a.m. and 5 p.m. during the Growing Season at Two Depths, Experimental Farm, Alaska Highway, Y.T., 1953-59

Year	May		June		July		August		September	
Depth inches	4	8	4	8	4	8	4	8	4	8
1953	—	—	60.6	58.4	62.0	60.0	58.7	57.8	46.9	48.0
1954	48.9	45.4	57.4	54.7	57.1	55.8	56.7	56.1	45.6	45.7
1955	43.8	39.8	52.3	49.3	62.9	60.9	56.1	55.3	47.2	47.5
1956	49.9	45.4	57.5	53.7	65.2	61.5	58.2	56.4	46.4	45.8
1957	50.2	45.3	63.0	58.7	59.1	57.1	59.0	58.7	50.3	50.3
1958	50.9	46.5	65.2	61.8	66.4	63.3	58.4	57.0	44.8	44.4
1959	—	—	61.6	58.0	62.3	59.1	56.5	54.6	46.6	45.4
Average	48.7	44.5	59.7	56.4	62.1	59.7	57.7	56.6	46.8	46.7

ANIMAL HUSBANDRY

W. H. Hough

Beef Cattle

A herd of 10 to 30 registered Shorthorn cattle was maintained for observations on their adaptability and tolerance to cold in the area. Beef cattle production was shown to be practical and satisfactory.

The health of the herd was very good. All animals were negative in reaction to tests for tuberculosis and brucellosis. Each cow produced a healthy calf each year from 1954 to 1958.

The cattle were fed home-grown feed and were allowed free access to minerals and salt at all times. The herd wintered well with access to small shelter pens for protection from draughts and precipitation.

Studies are being undertaken on the value of various shelters.

Pigs

Two sows and a boar were obtained in 1957 to observe their tolerance to cold and adaptability to the area.

The animals were housed in a single-storey log barn without supplementary heat. They were self-fed with a ration of 40 percent protein supplement and home-grown grains, at 500 pounds of barley and 300 pounds of oats to 200 pounds of supplements. The daily feed consumption during the winter was nine pounds of the mixture per sow.

All animals wintered each year in good condition. Evidently pigs can tolerate the prolonged winter.

Poultry

A flock of about 100 pullets was maintained to observe their adaptability to the climate.

Until 1956, poultry feed was purchased from Vancouver, B.C. Since then most of the feed has been prepared by mixing home-grown grain and 40 percent protein concentrate obtained from Vancouver.

The pullets were housed in a single-storey log poultry house. During the severe winter weather, four 250-watt heat lamps were used to keep the laying house above freezing.

From 1953 to 1959, Barred Plymouth Rock, Sussex, Leghorn and Leghorn hybrid pullets were compared in their performance and production. Because of the small flock and differences in strains from year to year the results were inconclusive.

A new experimental laying house was completed in 1959 to provide improved facilities for testing egg production, and to determine whether production of eggs in the area is economical.

CEREAL CROPS

J. Y. Tsukamoto

The studies on cereal crops consisted chiefly in testing new varieties of oats, barley, spring wheat, winter wheat, and winter rye. Improved varieties were introduced from various breeding institutions. For a brief period in 1958 and 1959 some studies were conducted on cereal crops for forage.

Oats

Oats are an important cereal crop in the area because they can be used as grain and as roughage. Twenty-five varieties and strains were tested. The important factor in recommending varieties is early maturity, as late-maturing varieties are damaged by early-fall frosts. The performances of the varieties Abegweit, Gold Rain (which is widely grown in Alaska), and Victory from 1953 to 1959 were:

Variety	*Days to mature*	*Length of straw, in.*	*Resistance to lodging*[1]	*Pounds per bushel*	*Bushels per acre*
Abegweit	97.9	31.8	1.8	38.4	65.2
Gold Rain	103.2	35.5	1.3	40.3	63.4
Victory	—[2]	34.9	1.9	39.7	65.3

[1]Scale: 1, erect, to 9, prostrate.
[2]Variety often frozen.

Abegweit matured earliest, had shorter straw than Victory, and was similar to Victory in yield and resistance to lodging.

Other varieties that mature earlier than Abegweit, such as Shefford, Vicland and Larain, yielded less.

Barley

Barley is one of the most important grain crops tested because it matures earlier than any other tested. Prolonged dry weather, which often occurs during early spring and early summer, usually causes barley to be very short. Of 18 varieties tested from 1953 to 1959, three performed well:

Variety	*Days to mature*	*Length of straw, in.*	*Resistance to lodging*[1]	*Pounds per bushel*	*Bushels per acre*
Edda	95.7	28.0	1.5	48.3	50.0
Gateway	94.9	27.6	1.3	50.5	45.1
Olli	92.2	28.1	1.8	49.4	41.3

[1]Scale: 1, erect, to 9, prostrate.

Edda, the highest-yielding variety, is not suitable for malting. Olli matured earliest and gave grain of good quality but yielded the least. Gateway was intermediate in maturity and yield, gave grain of satisfactory quality, and is smooth-awned.

Asa performed well in 1957 and 1958. It matured early, yielded well, and gave good-quality grain, but further testing is necessary before it is recommended.

Spring Wheat

Spring wheat is not recommended because it matured only in 1953 and in 1957. In other years it was damaged by early-fall frost. In a normal season the grain makes poor-grade feed, Saunders being the best of 25 varieties and strains tested.

Winter Grains

Biennial cereal crops, namely, winter rye and winter wheat, grow satisfactorily in the area. In some years a mild spell of warm weather removes snow from the fields, and subsequent cold weather may seriously damage these crops.

Sitnikoff winter rye is recommended because it was more winter-hardy than Dakold and the other varieties tested, though it yielded slightly less. The

four-year averages for Sitnikoff and Dakold were 35.4 and 38.8 bushels per acre respectively.

The most critical factor in suitability of winter wheat is winterhardiness. In normal seasons it matured better than spring wheat and gave better-quality grain. Karkov M.C. 22 is recommended for its winterhardiness and Yogo is almost equally suitable. The four-year average yields were 25.9 and 24.7 bushels per acre. The wheat should be sown about August 1, so that it may develop vigorous rosettes before freeze-up.

Cereal Crops

Use of annual cereal crops as roughage to supplement the hay crop is important in wintering livestock in the area. The forage was studied in co-operation with the Experimental Farm at Beaverlodge, Alberta, in 1958 and 1959.

Oats, barley and wheat were tested and harvested at various stages of growth. Results to date indicated that oats were the most satisfactory. Cutting at the boot stage appeared most satisfactory for quality and yield of forage from oats.

FIELD HUSBANDRY

J. Y. Tsukamoto

The main studies in field husbandry were on the use of fertilizers. From 1953 to 1959 the weather was cool and dry during April, June, and July, so that grains germinated irregularly and the seedlings developed slowly. In August, rains usually allowed grains to recover, but seldom benefited hay crops because they were harvested from mid- to late-July. Frosts in mid-August usually ended plant growth. Despite this adverse weather, satisfactory grain crops were harvested except for spring wheat, which matured only in 1953 and 1957. Particular attention was given to promoting maturity of grain crops by the use of phosphorus fertilizers.

Fertilizers

Experiments indicated that the soil lacks nitrogen and phosphorus. Phosphorus hastened the maturity of grain crops, and nitrogen increased the yields of hay and pasture.

The average yields of Beaver oats in bushels per acre in an oats–oats–fallow rotation from 1956 to 1959 when barnyard manure and various commercial fertilizers were applied were:

Treatment	*Pounds per acre*	*On fallow*	*On stubble*
Barnyard manure	20,000	66.5	43.3
16-20-0	50	47.8	36.9
Untreated	—	53.1	35.4
11-48-0	100	58.5	35.3
11-48-0	50	57.0	31.8
11-48-0 and 0-0-60	50 and 33	55.4	30.0

Application of ten tons of barnyard manure per acre gave the highest yields. The manure was incorporated into the soil as shallowly as possible. Placing the manure where the soil temperature was highest allowed maximum decomposition. In addition to providing nutrients as reflected by increased yields, manure visibly improved soil structure and water-holding capacity.

Phosphorus fertilizers (11-48-0) gave slight increases in yield on fallow but none on stubble. Nitrogen fertilizers (16-20-0) gave no increase. Addition of potash appeared to lower yields.

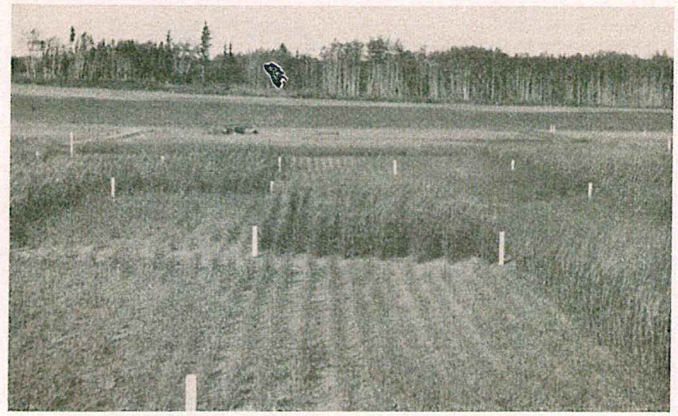

Figure 1.—Olli barley 45 days after a late-spring frost. The crop responded quickly to phosphorus but remained retarded in the check plots and where only ammonium nitrate or potash was used.

Figure 1 shows the differences in response of Olli barley to fertilizer. All of the plots were damaged by spring frosts. Plots receiving phosphate recovered quickly and matured. Those that received nitrogen fertilizers did not recover as quickly and failed to mature.

Pastures responded well to commercial fertilizers. Ammonium nitrate at 250 pounds per acre allowed continuous use and increased the protein content of the forage. Without fertilizer, pastures declined by the third year after seeding.

FORAGE CROPS

J. Y. Tsukamoto

Studies were conducted to select the species and varieties of grasses and legumes that are best adapted to the area as feed for livestock.

Grasses

Bromegrass was the hardiest grass tested and produced satisfactory forage. It was used as the main species in pasture and hay mixtures for upland areas. It was relatively easy to establish, tolerated drought, and was damaged little by insects or disease. The varieties Manchar and Canadian Commercial were found to be suitable.

Crested wheatgrass is hardy and adapted to the area. Because of its early spring growth, is was used in pasture mixtures. It withstood considerable drought.

Intermediate and slender wheatgrasses tolerate drought and are hardy in the area. They were readily established on light-textured soils.

Russian wild ryegrass is winter-hardy and adapted to the area, and was used in pasture mixtures.

Reed canarygrass and timothy were satisfactory for lowland hay, and gave good-quality hay.

Engmo, a recently introduced variety of timothy, was very promising. Creeping red fescue and Kentucky bluegrass are winter-hardy and were easily established, but were often damaged by snow mold. Other promising species as secondary grasses in pasture mixtures were Siberian wild ryegrass, Canada wild ryegrass, big bluegrass, and tall fescue. The wheatgrasses, fescues, and bluegrasses in recent years have been damaged by the insect *Labops hirtus*. Spraying with dieldrin aided in controlling the insect.

Legumes

Ninety-nine species, varieties, and strains of legumes were tested. Yellow-flowered alfalfa, *Medicago falcata,* is the only legume that survived each season. All others were attacked by brown root rot and did not survive through the winters.

Brown root rot, caused by *Plenodomus meliloti,* was first noted at the Farm in 1952. The organism thrives in cool soils. It has since been found to be common in Yukon soils.

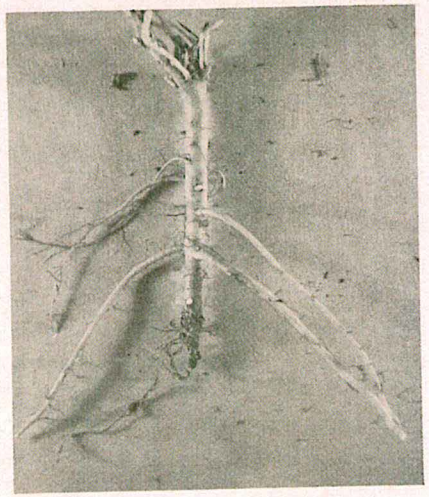

Figure 2.—Typical root of *Medicago falcata* showing brown root rot infection and damage to the tap root. Only the lateral roots were temporarily sustaining plant growth.

Yellow-flowered alfalfa tolerates this organism (Figure 2), evidently because, unlike *M. media,* it has a more extensive lateral root system. Yellow-flowered alfalfa flowered well (Figure 3) and set seed in abundance, but seed seldom matured.

Hay and Pasture Mixtures

Studies on hay and pasture mixtures were begun in 1956. Although alfalfa did not survive more than a few years, the mixture of alfalfa, bromegrass, and crested wheatgrass appeared the most promising for hay and pasture.

Figure 3.—*Medicago falcata* flowers profusely, but seed production is often light and not dependable because of early-fall frosts.

HORTICULTURE

J. Y. Tsukamoto

Because of adverse weather during the growing season, few garden crops grow well without special treatment. Tender vegetables, such as beans, cucurbits, and corn, require protection from frost. Since the growing season is short, many vegetables and annual flowers are best started indoors in spring and transplanted outdoors after killing frosts are past. Satisfactory vegetables were produced in this way.

Annual Flowers

The following flowers tolerated light frost and produced attractive bloom.

For borders:—Alyssum (*Lobularia maritima*): Carpet of Snow, Violet Queen. China aster (*Cellistephus chinensis*): Kirkwell Dwarf. Lobelia (*Lobelia erinus*): Crystal Palace. Nemesia (*Nemesia strumosa*), mixed colors. Phlox (*Phlox drummondi*), mixed colors.

For bedding:—African daisy or Cape marigold (*Dimorphotheca aurantiaca*), mixed colors. Butterfly-flower or poor man's orchid (*Schizanthus wisetonensis*), mixed colors. California poppy (*Eschscholzia*), mixed colors. Candytuft (*Iberis amara*): Giant Hyacinth, white. China aster (*Callistephus chinensis*): Queen of the Market, California Giant, Giant Crego. Clarkia (*Clarkia elegans*): Royal Bouquet, mixed colors. Cornflower (*Centaurea cyanus*), mixed colors. Toadflax (*Linaria maroccana*): Fairy Bouquet. Dwarf morning glory (*Convolvulus tricolor*), mixed colors. Love-in-a-mist (*Nigella damascena*): Miss Jekyll. Mignonette (*Reseda odorata*): Sweet Scented. Petunia (*Petunia hybrida*): Fire Chief, Rose of Heaven, Red Satin. Pot marigold (*Calendula officinalis*): Orange King. Flowering flax (*Linum grandiflorum* var. *coccineum*), scarlet. Snapdragon (*Antirrhinum majus*): Majestic varieties. Strawflowers (*Helichrysum bracteatum* var. *monstrosum*).

For background:—Painted tongue (*Salpiglossis sinuata*): Emperor, mixed colors. Burning bush (*Kochia scoparia* var. *trichophila*). Baby's breath (*Gypsophila elegans*): Covent Garden, Carmine. Sweet pea (*Lathyrus odoratus*): Spencer varieties.

Perennial Flowers

Few perennial flowers are adapted to the area. The following were found hardy or (with asterisk) semihardy.

For borders:—Pink (*Dianthus plumarius*).

For bedding:—Bleeding heart (*Dicentra spectabilis*).* Columbine (*Aquilegia* sp.): Long-spurred Hybrid.* Daylily (*Hemerocalis* sp.): Dr. Rigel, *H. thunbergi*. Iris (*Iris setosa* ssp. *interior*), native iris. Gaillardia (*Gaillardia aristata*). Lychnis (*Lychnis chalcedonica*).* Poppy (*Papaver* spp.), oriental poppies, Iceland poppies. Peony (*Paeonia* spp.): Festiva Maxima, Sarah Bernhardt. Speedwell (*Veronica spicata*).

For background:—Larkspur (*Delphinium*): Pacific Hybrid.

Ornamental Trees and Shrubs

A very few species of imported ornamental trees and shrubs survived the winters. The following shrubs appeared winter-hardy and adapted to the area: bush cinquefoil (*Potentilla fruticosa*), contoneaster (*Cotoneaster lucida*), oriental spiraea (*Spiraea media*), Preston lilacs (*Syringa prestoniae*), Golden clematis (*Clematis tangutica*), and Altai Scotch rose (*Rosa spinosissima* var. *altaica*).

Mugo pine (*Pinus mugo* var. *mughus*) is the only ornamental conifer that appeared to be winter-hardy. There are, however, native trees that can easily be transplanted and used as ornamental plants. They are: paper birch (*Betula papyrifera*), lodgepole pine (*Pinus contorta* var. *latifolia*) and native junipers (*Juniperus communis* var. *saxatilis* and *J. horizontalis*).

Fruits

Of the tree fruits, bush fruits, and small fruits tested, only a few bush fruits were adaptable to the area. Raspberry plants survived the winter, but were heavily infested by mites during the growing season. Pixwell gooseberry was winter-hardy and produced satisfactory fruits. Saskatoon was the hardiest of all the fruit plants tested, bore fruit each season, and was injured little or not at all during the winter. Plums, apples, crabs, and pears were not winter-hardy. Sandcherries formed fruits in some seasons, but the fruit did not mature.

Cultivated strawberries did not survive the winters consistently well. In studies on crossing cultivated varieties with local wild strawberries, promising hybrids were obtained.

Vegetables

Figure 4 shows the value of starting cauliflower indoors and growing it in flats until danger of frost has passed.

The following varieties gave vegetables of good quality from seed sown outdoors:—Broad beans: Windsor. Beets: Detroit Dark Red, Flat Egyptian. Carrots: Amsterdam, Goldinhart, Red Cored. Leaf lettuce: Salad Bowl, Grand Rapids. Onions: onion sets. Parsnips: Short Thick, Hollow Crown. Peas: Alaska, Little Marvel, Laxton's Progress. Radishes: Cherry Belle, Comet. Rutabagas: Laurentian. Spinach: America, King of Denmark, Bloomsdale. Swiss chard:

Figure 4.—Mature cauliflower, started indoors and transplanted (left row); and immature cauliflower, seeded directly in the garden (right row).

Lucullus, Fordhook Giant. Turnips: Early White Milan, Purple Top Milan. Rhubarb: Macdonald, Canada Red.

The following varieties were satisfactory when grown in the greenhouse for transplanting to the garden:—Broccoli: Da Cicco, Italian Early Green Sprouting. Cabbage: Golden Acre, Viking, Badger Market, Copenhagen Market, Glory of Enkhuizen. Savoy cabbage: Early Drumhead. Cauliflower: Codania, Early Snowball, Alte. Head lettuce: Premier Great Lakes, Imperial, Great Lakes.

The following variety was satisfactory when grown in the greenhouse for transplanting to cold frames and later to the garden:—Celery: Utah 15.

The following varieties yielded satisfactory crops when grown in the greenhouse:—Cucumbers: Surecrop Hybrid, Marketer. Peppers: Tendersweet. Tomatoes: Quebec No. 152, Early Chatham, Early Lethbridge.

Many varieties and seedlings of potatoes were studied in 1956 and 1957 to select a potato that is scab-free and early. Promising selections were obtained from Early Gem. The earliest variety, though susceptible to scab, was Warba.

Irrigation for Gardens

In 1956 and 1957, irrigation of garden crops was studied. Contrary to earlier findings at the Farm, irrigation favored plant growth and increased the yields of root and leafy vegetables.

Tests in 1956 and 1959 showed that sprinkler irrigation prevented damage to tender garden plants from late-spring and early-fall frosts. The plants were not damaged even when the air temperature reached as low as 18.5° F. This method of protection is useful mainly in prolonging the growth of late-maturing vegetables and the blooming period of flowers.

Growing Tender Vegetables under Plastic Shelter

In 1958 and 1959, tender garden plants were grown under plastic A-shelters, each of which covered an area of 9 by 28 feet. Corn, tomatoes, beans, and cucumbers yielded satisfactory crops. In 1959 annual flowers were

grown, and yielded the bouquet that was presented to her Majesty Queen Elizabeth II in Whitehorse on July 19. The shelters gave higher soil and air temperatures, reduced evaporation of soil moisture, and gave protection from late-spring and early-fall frosts.

OFF-STATION TESTS

J. Y. Tsukamoto

Off-station test plots were established from 1947 to 1956 to determine local adaptabilities of various cereal and forage crops. These were arranged on 13 sites from the southern to the west-central part of the Territory. Because of the limited extent of the tests, the results were inconclusive. However, cereal and forage crops that are adapted at the Farm are evidently suitable for other areas in the Yukon, especially the central area.

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