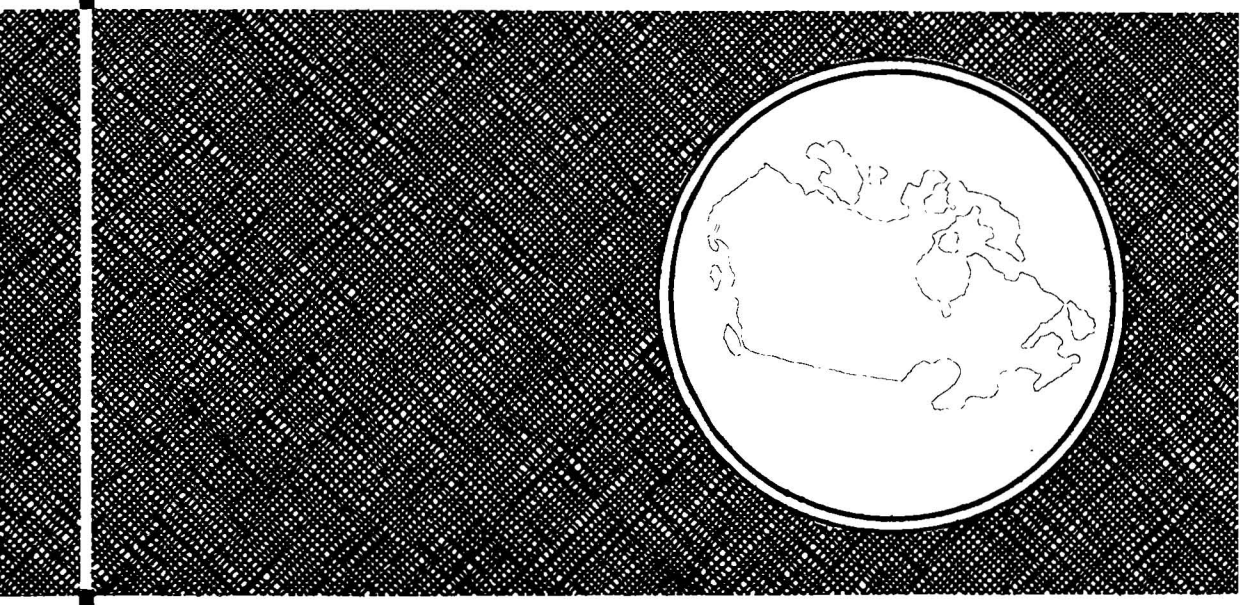
RESEARCH REPORT

1960-1964



Experimental Farm

MILE 1019, ALASKA HIGHWAY
YUKON TERRITORY

RESEARCH BRANCH - CANADA DEPARTMENT OF AGRICULTURE

Research Report

1960-1964

Experimental Farm

Mile 1019, Alaska Highway, Yukon Territory

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CANADA DEPARTMENT OF AGRICULTURE

98254—1

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CONTENTS

HIGHLIGHTS

Studies on the tolerance of alfalfa to *Plenodomus meliloti* showed that phenotypic characteristics were responsible for the tolerance in certain plant selections. Individual plants able to tolerate the disease brown root rot were selected and a breeding program was initiated to develop a disease-tolerant variety. Pasture mixtures were tested under actual grazing and the persistence of the components in the mixtures evaluated. A mixture suited to the region will undergo further testing. The response of bromegrass and timothy varieties to nitrogen fertilizer was investigated. Varietal differences were not apparent; however, increases in protein content, forage and seed yield were observed.

Irrigation, as a method to prevent frost damage to horticultural crops, was studied. The volume of water per degrees of frost required to protect peas and potatoes was determined. Investigations in the design and use of plastic shelters resulted in a new design suitable for home and commercial gardener. Further studies with plastic shelters determined the environment within the shelters when supplemental heat was used and in a shelter that had an air insulation 2 inches thick between walls of double-layered plastic.

The use of clear plastic soil cover and ridge culture improved the soil moisture and temperature conditions for horticultural crops. In 1961-62, nurseries for small fruits and ornamentals were established to develop and select varieties and to study cultural methods of growing small fruits and ornamentals in sub-Arctic regions. A selection of iris (*Iris interior*) named Kluane Beauty was released in 1963.

FOREWORD

The Experimental Farm is situated at Mile 1019 on the Alaska Highway, in the Yukon Territory. It is 103 miles west of the city of Whitehorse, at north latitude 60° 45′, west longitude 137° 35′, and is 1,965 feet above sea level.

The Farm was established in 1945 mainly to determine the crops that could be grown in these northern latitudes. Later, livestock and poultry were introduced to observe their adaptability to sub-Arctic farming conditions. In 1957, construction of buildings to provide improved and additional physical facilities commenced and was completed in 1961. In 1960, the professional staff increased to three research officers, and a research program in agronomy, horticulture and soils developed. Although weather observations had been taken for some time, an increased emphasis was placed on climatology, and new methods for obtaining data at critical periods were devised and used. A continued testing program of crop varieties provided information on the most suitable varieties of cereal, forage and horticultural crops for the region.

May 1965

H. J. Hortie
Superintendent

WEATHER

The Experimental Farm is located in the southwest part of the Yukon Territory. The massive mountains of the St. Elias range modify the oceanic influence on the winter climate. However, during winter, Pacific air masses do penetrate and temper the cold Arctic air in the southern Yukon. During summer, Pacific air causes somewhat cooler temperatures than in the southeast and interior Yukon. Local variations in topography favor extremes during Arctic cold waves. Entrapped cold air causes low temperatures, which are further intensified by massed cold air moving downslope from the St. Elias Ice Range.

Frosts frequently occur during the growing season, and they were recorded in July in 1960, 1962 and 1963. Mean monthly temperature in June, July and August is about 50 F. Surface soil temperatures are low; only in July do they reach or exceed 60 F.

The total annual precipitation is 11.5 inches, of which about 6.5 inches is rainfall. The even distribution of rainfall during the growing season and the low rate of evaporation favor crop growth, but also frequently delay harvesting.

Long hours of daylight during the summer promote rapid plant growth. The winter days are short and have no effective sunshine.

The number of bright sunshine hours indicates the changing altitude of the sun and the consequent rapid changes in daily temperatures, resulting in very short spring and autumn seasons.

Records of evaporation, precipitation, sunshine and temperature are shown in Table 1.

FORAGE CROPS

Legumes

All species, varieties and strains of legumes tested were susceptible to brown root rot, caused by *Plenodomus meliloti*. The disease has been observed on a number of native leguminous plants. The organism thrives in cool soils and is common in Yukon soils.

Tolerance of alfalfa to brown root rot—A study was made of the phenotypic characteristics of *Medicago falcata* and varieties of *M. media* that make them tolerant to brown root rot. All plants were infected with brown root rot in the field. Stand counts showed *M. falcata* to be the most tolerant to brown root rot. Of the varieties of *M. media* tested, Rambler was the most tolerant. *M. falcata* developed a strong lateral root system and growth, therefore, persisted after the tap root had been damaged. A few plants of *M. media* developed lateral roots only after the tap root had been damaged. The degree of tolerance to brown root rot shown by *M. falcata* and *M. media* varied with the ability to develop a lateral root system.

Alfalfa breeding—In 1961, 56 alfalfa plants were selected for a breeding program to develop an alfalfa resistant to brown root rot. The parents were selected on the basis of their ability to tolerate the disease. Some of the progeny from the crosses made to date show promise.

Grasses

Continued observation of grasses for adaptability to this region showed bromegrass to be the best one for hay and pasture. The timothy variety Engmo

Table I. Meteorological data recorded at the Experimental Farm, Mile 1019, Alaska Highway, 1945-1963

	Air temperatures, F							Average precipitation, inches			Average bright sunshine	Evaporation free surface	Soil temperature, F	
	Mean monthly	Mean monthly		Absolute extreme								Total monthly inches	Mean monthly	
		Maximum	Minimum	Highest recorded	Year	Lowest recorded	Year	Rain	Snow	Total	Hours		Depth 4 in.	Depth 8 in.
January	−6.0	6.9	−16.6	54.0	1949	−65.0	1947	0.01	7.92	0.76	20.21	—		
February	1.2	16.5	−11.4	48.0	1945	−65.0	1947	0.04	4.26	0.43	72.94	—		
March	13.4	28.6	−1.7	52.0	1951	−45.0	1951	0.02	3.81	0.39	152.69	—		
April	28.6	41.0	17.6	66.9	1958	−23.0	1963	0.15	2.18	0.38	200.38	—		
May	41.4	55.5	28.5	82.0	1947	12.0	1948	0.44	0.65	0.54	272.23	3.67	49.9	45.4
June	49.6	64.4	35.9	86.0	1958	20.0	1945	1.18	0.12	1.20	256.65	4.44	58.2	54.5
July	53.2	67.7	40.1	88.0	1946	26.0	1947	1.25	0	1.25	263.21	3.99	60.9	58.5
August	50.0	64.8	36.9	83.0	1963	12.0	1948	1.04	0	1.04	220.41	2.86	57.9	56.6
September	41.6	55.3	29.5	72.5	1957	1.0	1946	1.15	1.09	1.31	145.46	1.18	46.7	46.4
October	28.4	39.9	17.5	65.0	1958	−23.0	1958	0.70	7.23	1.46	84.48	—		
November	10.0	19.9	− 0.1	56.5	1956	−53.0	1948	0.38	10.32	1.44	21.20	—		
December	−4.0	14.0	−13.6	47.0	1955	−54.0	1962	0.26	10.99	1.35	0.51	—		

Extremes[1]

	Frost				Consecutive frost-free days	Killing frost[2]			
	Last in spring		First in fall			Last in spring		First in fall	
	Date	F	Date	F		Date	F	Date	F
Longest season	July 10/52	31.5	Aug. 18	27.0	39	May 31/57	27.0	Aug. 20	28.0
Shortest season	July 14/54	31.0	July 23	31.5	9	July 2/49	27.0	July 30	
Earliest frost	June 20/51	29.0	July 16/48	31.0	—	May 31/57	27.0	July 19/63	28.0
Latest frost	July 15/62	31.0	Aug. 18/52	27.0	—	July 13/47	26.0	Aug. 25/48	12.0

Frost-free period: 23 days.

Killing-frost-free period: 54 days.

[1]Midseason date: July 15.
[2]Killing frost, 28 F or lower.

performed very well on imperfectly drained depressional soils. Crested w' ıt-grass was winter-hardy, drought resistant and an early pasture grass. Sele ns of Russian wild ryegrass, Siberian blue ryegrass and reed canarygrass appeared to be hardy in this region, and they may be promising forages.

Bromegrass, fescue, bluegrasses and other grasses native to the Yukon have been introduced to the nursery for observation.

Fertilizers for Bromegrass and Timothy Varieties

The yields of three varieties of bromegrass, Manchur, Mandan, and Canadian Commercial, grown on Pine Creek silty clay were increased when nitrogen was applied at 33 pounds per acre. Protein content of the forage was not increased significantly. Seed yield was not increased nor was the rate of germination improved by the fertilizer. The root weight per unit volume of soil in the top 6 inches tended to decrease with the addition of fertilizer. There were no varietal differences in response to the application of nitrogen.

The forage yield, protein content of forage, and seed yield of Milton, Engmo, Climax and Drummond timothy were increased by an application of 33 pounds of nitrogen per acre. The rate of seed germination was not affected by the fertilizer. The root weight per unit volume of soil in the top 6 inches tended to decrease with the addition of nitrogen. There were no varietal differences in response to the application of nitrogen. Engmo was the hardiest variety.

Pasture Mixtures

Five grass–alfalfa mixtures seeded on a Pine Creek silty clay were studied for hardiness, persistence and productivity under grazing. Mixtures consisted of combinations of bromegrass, crested wheatgrass, intermediate wheatgrass, Russian wild ryegrass, and alfalfa, *M. falcata* (yellow-flowered alfalfa) and *M. media* (var. Grimm).

Bromegrass, yellow-flowered alfalfa and crested wheatgrass appear to be the best mixture for this region. The recommended rates of seeding per acre are bromegrass 6 pounds, crested wheatgrass 4.6 pounds and alfalfa 4 pounds. Because all varieties of *M. media* are susceptible to brown root rot, Grimm alfalfa decreased in the stand. Yellow-flowered alfalfa was very slow in becoming established compared with Grimm, but because it is tolerant to brown root rot, it persisted better in the stand. Russian wild ryegrass in the mixtures was very slow in becoming established. Intermediate wheatgrass was the least persistent of the grasses in the mixtures. Crested wheatgrass dominated the stands in all these mixtures. When the pasture was grazed by beef cattle, Russian wild ryegrass was the most palatable and intermediate wheatgrass the least palatable in these mixtures.

CEREALS

Early-maturing cereal varieties are a requisite in the Yukon owing to the short growing season, low temperatures and cool, moist weather in late summer and early autumn. Many new varieties and strains were tested as they became available. Contacts were maintained especially with sources in Finland, Sweden and Norway for suitable early-maturing varieties.

Br ˉ v

ˏlli continues to be the recommended barley variety. The 7-year average yield for Olli was 41.3 bushels per acre. The Finnish varieties Valle I, Ottra Ta, Varde, and Tammi yielded well and were of good quality; they will be tested further.

Oats

The recommended oat variety is Abegweit, but earlier-maturing varieties are desirable. Recent tests showed that the varieties Mabel, Shefford, Glen, Shield and Chibino 2 were promising. The 2-year average yields were Mabel 58.4 bushels per acre, Shefford 64.0, Glen 71.6, Shield 55.1, Chibino 2, 64.6, and Abegweit 67.7 bushels.

Wheat

Spring wheat is not recommended in this region.

Winter Rye

The variety Sitnikoff was the hardiest winter rye tested here. Under variety evaluation tests, Antelope and Sitnikoff had the highest winter survival and gave high yields of grain of satisfactory quality. Average 3-year yields were Sitnikoff 48.2 bushels per acre and Antelope 57 bushels. Of all the varieties tested, Sitnikoff and Antelope proved to be the best varieties for this region.

HORTICULTURE

Vegetables, small fruits and ornamentals were evaluated for hardiness and adaptability to the Yukon. Varieties of fruits and vegetables were tested as they became available, and if suited to the region were placed on the recommended list. Perennial and annual ornamentals, imported and native, were tested for suitability and adaptability.

Vegetables

Greenhouse and plastic shelter trials—In greenhouse variety trials, Quebec 5 gave the earliest and Gardener the highest tomato yield. In unheated plastic shelters, Earlinorth gave the highest early yield and Gardener the highest yield. Mandarin produced the highest and earliest cucumber yields in unheated plastic shelters.

Early planting—Yields of broad beans, Brussels sprouts, late cabbage, red cabbage, carrots, leek, onions (sets and seed), parsnips and peas were increased by seeding or planting earlier than normal. Seeded crops were sown 10 days earlier than the normal date of May 27 and transplanted crops planted 21 days earlier than the normal date of June 11. Early planting did not increase the yields of beets, broccoli, early cabbage, lettuce and rutabaga. The harvesting date of head lettuce was advanced 3 weeks, broad beans and cauliflower 2 weeks, and broccoli and early cabbage 1 week by planting early.

Potatoes—Three selections of the variety Early Gem were tested with Warba and Norland for yield of marketable tubers. The 4-year average marketable yields for the Early Gem selections were Whitehorse 4, 5.0 tons per acre; Whitehorse 5, 5.5 tons; and Whitehorse 10, 6.3 tons. The 2-year average yield for Norland was 6.0 tons per acre. The selection of Early Gem, Whitehorse 10, had

the highest yield and the lowest surface area with scab. Norland had the highest total solids and best appearance. In some years, the Early Gem selections showed serious net necrosis. The disorder is not attributed to disease, but may be due to climate (early frost). The possibility of minor element deficiencies is being studied.

Fruit

Fruit trees trained in a creeping habit wintered beneath the snow without damage and have made fair growth.

Native currants, gooseberries, and raspberries wintered well without protection and produced fruit. Hardy domestic raspberry varieties Chief and Honeyking wintered satisfactorily when the canes were laid flat and held by wooden poles.

A number of second backcross seedlings of strawberry, Senator Dunlap × wild (*Fragaria glauca*) and Pixie × wild, wintered without injury and show promise.

Ornamentals

Native species of shrubs have been introduced for hedging and ornamental purposes. Hardiness in perennial shrubs and annual flowers is being evaluated. A list of recommended varieties has been prepared and may be obtained on request.

A selection of the native fibrous-rooted iris (*Iris interior*) named Kluane Beauty has been released and is now being multiplied for distribution.

Cultural Methods

Frost protection with sprinkler irrigation—Sprinkler irrigation protected peas, potatoes, and excised bean plants from frost injury. Excised bean plants were protected from serious injury when plant temperatures were maintained above 30.6 F. Potato foliage and peas were not injured seriously when maintained above 30.0 F. An application rate of 0.034 inch per hour maintained plant temperatures above 30 F at air temperatures of 26.5 F; 0.047 inch per hour protected to 26.3 F; 0.065 inch per hour protected to 24.0 F; 0.085 inch per hour protected to 22.3 F; and rates of 0.110 inch per hour and higher protected to lower than 19.0 F. The method has increased the yield of marketable potatoes by more than 50%. The increased yield is attributed to the increased time the tubers had to reach a marketable size.

Water temperatures ranged from 49 F in August to 41 F in September. On cool evenings, water temperatures dropped 2 to 4 degrees. When water temperatures dropped to 35 F at source and air temperatures dropped to 22 F, sprinkler mechanisms became inoperative.

Plastic mulch and cultural techniques for vegetables—Polyethylene mulch and plant beds shaped in different types of ridges were used to study their effects on temperature and moisture of the soil and the yield of cabbage. Clear polyethylene mulch increased soil temperature and increased the yield of cabbage regardless of kind of ridge, exposure of ridge and soil moisture. Morning soil temperatures varied only slightly, but large variations were recorded in the afternoon. The afternoon temperatures were highest in the single simple mulched ridge and lowest in the mulched double ridge.

Mulched and unmulched plots that had the highest soil moisture gave the highest yields. There were no differences between ridge rows running north and south and those running east and west. Mulching did not affect the maturity of the cabbages.

Plastic shelters for tender crops—The environments in plastic shelters that had a single layer of 4-mil polyethylene and shelters that had a double layer of 4-mil and 2-mil polyethylene were evaluated for production of tomatoes. Four-mil polyethylene was used for the outer layer and 2-mil for the inner layer of the double-layer shelters. The design of the shelter is described in the publication *Plastic crop shelters and greenhouses.*

The shelters maintained higher minimum and maximum air temperatures than those in the field; kept the soil temperatures higher; and increased the frost-free period, the killing-frost-free period and the number of degree-days (above 42 F). Also, the mean minimum relative humidity was higher in the shelters. The mean maximum relative humidity was similar. Evapotranspiration was three to four times higher in the open field than in the shelters.

Maximum temperatures were kept much the same in the two kinds of shelters by ventilation on warm days. On cool days in October when no ventilation was given in the double-layer shelter, maximum temperature was higher than in the single-layer shelter. Mean maximum temperatures were 5.5 to 6.5 degrees higher at the 5-foot level than at the 1-foot level, and mean minimum temperatures were 1.1 to 2.3 degrees lower. The double-layer shelter retained heat better than the single-layer shelter. This extended the frost-free period 33 days, extended the killing-frost-free period 15 days, and increased the number of degree-days by 310.

The relative humidity and evapotranspiration were similar in both kinds of shelters. In the double-layer shelter, soil temperature was higher whereas soil moisture was lower.

The yield of ripe fruit was similar; the double-layer shelter produced higher early yields, and the single-layer shelter produced higher late yields. Heating the shelters at periods of low temperatures late in the season increased yields in both single- and double-layer shelters. The single layer required about 50% more heat than the double-layer shelter. The increase in yield due to the additional heating was greater in the single-layer shelter. The addition of heat may have been offset by the decreased light in the double-layer shelter.

ANIMAL HUSBANDRY

Beef Cattle

A herd of Shorthorn × Hereford cattle have been maintained to observe management practices for beef cattle in this region. Native range provided a short pasture season. Grazing was satisfactory from June until September 1. Cows carrying calves born in March began losing weight in September. Cows carrying calves into September noticeably declined in condition. Yearling steers followed a similar pattern; gains in weight were satisfactory until September when a sharp decline occurred with continued grazing.

Calves weaned in August were wintered satisfactorily in open high-board and in open-faced barn shelters. They were fed 12 pounds of brome hay per day plus mineral supplement in October, and this was increased to 16 pounds by March the following spring. Grab samples of the feed had a total protein content

of 8%. Animals in the high-board-style shelter wintered as well as those gi the additional protection of an open-faced barn. Breeding cows were maintained in a thrifty condition when fed 16 pounds of brome hay per day plus mineral supplement. There were no losses at calving and the mean calf weight at birth was 86 pounds.

Poultry

A flock of 300 Hyline Hybrid layers were observed for production when fed a laying mash which contained locally produced barley, oats, wheat and rye. Egg production levels were similar when comparing wheat and barley as the basal feed. When winter rye made up 20% of the grains in the layer ration, there was no effect on egg production.

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