CANADA
DEPARTMENT OF AGRICULTURE
EXPERIMENTAL FARMS SERVICE

DOMINION EXPERIMENTAL SUBSTATION

WHITEHORSE

YUKON TERRITORY

J. W. ABBOTT, OFFICER-IN-CHARGE

PROGRESS REPORT
1945-1952

A fenced Indian garden with Indian log houses in the background. Location: Moosehide near Dawson City, Y.T., N. Latitude 64°.

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DOMINION EXPERIMENTAL SUBSTATION WHITEHORSE, Y.T.

INTRODUCTION

The mention of the Yukon Territory, this land of the Klondyke, invariably called to mind the rousing cadences of Robert W. Service; it called up also Jack London's characterizations, contentious men and dogs in a world of ice and snow. Complementary thereto were toiling files of prospectors, picks and gold-pans clanking, scaling the snow-clad slopes of the White and the Chilcoot passes; on down the Yukon river to Dawson City and it's fabulous Klondyke goldfields.

Thus the Yukon! Certainly agriculture was conceded no place in that legendary land.

In some respects the territory is still legendary. It is of course a land of many glaciers, of towering eminences—Mt. Logan for instance; of startling sub-zero recordings, e.g., minus 83° Fah. at Snag, an R.C.A.F. outpost adjacent to the snow-capped St. Elias range; of ice worms, one-inch angleworms that live, multiply and thrive on the Logan glaciers, and so on. But notwithstanding, the territory is not arctic. Sub-arctic of course, but only its northernmost tip is encompassed by the Polar Circle. Its capital, now the city of Whitehorse, is latitudinally comparable to those capital cities of Europe, Helsinki and Oslo. Furthermore, few realize that the Yukon, the whole of it, lies west of the coastal cities of Vancouver and Victoria, and, it may be added, has a Time Zone of its own—Yukon Time, one hour later than Pacific Time. The territory has only a short beach-front on the Beaufort Sea; its port of commerce being Skagway, Alaska, on the Lynn Canal. A territorial railroad, the narrow-gauge White Pass and Yukon, connects Skagway with the interior city of Whitehorse. From this latter point the freight of commerce is distributed inland by river steamships and highway trucks. The main thoroughfare, incidentally, is the international artery, the Alaska Highway.

The aspect of the territory, generally is mountainous, impressively so on its southwest, its east and its northern flanks. Gold, silver, lead, copper, tungsten, asbestos and coal deposits have been discovered, and worked where practicable; inaccessibility has nonetheless been a restricting factor. Recent geological studies have indicated mineralized treasure yet hidden away in the mountainous terrain of the territory.

The main plain, or plateau of the Yukon, roughly the central portion, is broken by timberline hills and traced by numerous water-courses. Its average elevation is perhaps 4,000 feet above sea level, while the base level of its river valleys varies from 1,000 to 2,400. These river valleys are of particular interest herein, inasmuch as it is on their benches, their terraces and flood-plains that agriculture is introduced.

Through the decades of the century hardy venturers, here and there in the valleys, had expanded garden plots into fields as experimentation revealed gratifying horticultural results. Through the same period the Experimental Farms Service of the Canada Department of Agriculture, had established a system of co-operative experimentation with various operators in the territory. Seed of adaptable species was furnished yearly by the Service for these ventures. The operators performed the cultural labor, and in the fall were obligated to submit a written report in detail of the results. For one reason or another this co-operative system proved unsatisfactory, and was subsequently discontinued.

In the early forties the attention of the western hemisphere was directed to the north—to the North West Territories, the Yukon and Alaska, and much regarding these areas was unknown; one question asked was—were they, or could these frontiers be rendered self-sustaining?

Thus, in 1944, with the advent of the Alaska Highway, the Experimental Farms Service established an Experimental Substation in the Yukon Territory. This action was prompted by a resolution of the Joint Agriculture Committee for the North West Territories and Yukon Affairs, adopted in February of that year. The site to be chosen would have adaptable soil, water in abundance, and accessibility to the travelling public; in this respect a highway frontage was listed as most desirable.

In mid-June 1944 Dr. A. Leahey, Field Husbandry Division, Ottawa, led a party of three on an exploratory survey into the southern Yukon. The party followed the new highway route through the length of the Takhini-Dezadeash valley, directly west 100 miles from Whitehorse. Sites along the highway were examined and appraised; eventually an 800-acre tract of virgin territory was selected at Mile 1018-1019 for the proposed substation. Geographically this site is approximately N. Lat. 60° 45′, W. Long. 137° 35′.

Later in that year essential units of agricultural machinery were secured at the B.C. railhead of Dawson Creek. This original purchase included a field tractor and brush breaker, a disk and a drag harrow, and various small tools of establishment. A two-ton truck was secured also, and the acquired equipment was loaded thereon and transported, via Alaska Highway, to the chosen site at Mile 1019, a passenger car, carrying three other staff members, trailed the loaded truck on that thousand-mile trip.

The convoy arrived at the chosen site on October 4, 1944. This was late season for outpost establishment; the project had been delayed owing to the difficulty of acquiring equipment in war years. Nonetheless, the U.S. Armed Forces, then in command of highway facilities and equipment, were courteously co-operative. A heated building at a nearby construction camp was placed at the disposal of the pioneer agricultural staff; in addition the small staff was accorded mess privileges at transient rates, in the construction camp mess-room until facilities were available on the new substation site.

On the new truck's second trip to railhead at Mile 0, it returned with a small portable sawmill, as conventional building material was extremely scarce on the frontier; in fact during war years was virtually non-procurable. However, improvisation was native of the frontiers, and in this case was commissioned again.

The tree coverage on the new substation site varied from light to heavy. Park-like areas of grass, willow and aspen existed, but were circumscribed; other acreages bore medium stands of aspen and balsam poplars. The remainder bore spruce, some of it to sawmill size. Fire had swept through a portion of this coniferous stand, and tanned boles, trimmed and straight were numerous. Three hundred of these were logged in November, decked, then slab-faced on three sides with the saw. The logs thus fabricated were subsequently used for the construction of three houses and an office building on the farm-site; they were laid block-fashion, and chinked with oakum.

On another area of the substation property green spruce timber was cut, decked, then put through the portable mill. In this operation some 18,000 board feet of green lumber was secured. Later, highway buildings in abandoned army camps were purchased, and salvaged, thus subsequently much commercial material was secured and utilized.

By the spring of '45 two small residences and an office building were completed and occupied. During the preceding winter more agricultural machinery had been secured, in particular one D.4 caterpiller tractor with blade attachment. This machine commenced work in May, and ran continu-

ously until late July, brushing and piling the coverage on twenty-odd virgin acres. This coverage was medium aspen poplar, willow and some spruce. The dozer machine worked admirably, up-rooting and piling bole material up to diameters of 14". As the windrowed material was burned, the rubber-tired field tractor, hitched to an 18-inch brush breaker, completed the task of preparing the land for crop experimentation the following year.

Through intervening years, by practices similar, additional land has been brought under cultivation until in the fall of 1952 about 100 acres comprised the cultivated acreage under crop or pasture on the substation.

One pertinent factor, locational, should be here mentioned, else meteorological data submitted herein may otherwise be somewhat confusing. When the substation location was chosen in 1944 it was clearly realized that climatic hazards were to be anticipated at that particular site. As one approaches N. Lat. 60° altitude becomes extremely important, and increasingly so into the north. The altitude at Mile 1019 is roughly 2,000 feet, and most of the southern territory approximates, or exceeds that figure. On the other hand bench sites in the valleys of streams flowing north, or into the northern waters of the Yukon River, progressively achieve lower altitudes. The altitude of Whitehorse, N. Lat. 60°, is 2,100 feet; at Dawson City, N. Lat. 64°, the corresponding figure is 1,050. Thus the altitude at the substation site, for the territory, is moderate to high. Besides the foregoing a more or less unique factor is included—the proximity of the St. Elias glacial field to the southwest. Interestingly, Mile 1019 is roughly equidistant from Whitehorse on the east, and imposing Mt. Logan, in the St. Elias glacial field, on the west. Prevailing winds in the summertime are inland from the Pacific; these boisterous drifts, over intervening snow-caps, are frequently precursive of dawn-hour frosts; light recordings as a rule, but devastating in statistical form—"length of frost-free period!" (See Table 2.) The significance of the foregoing was appreciated in 1944, when the site was established. Nonetheless, the obvious hazards were accepted inasmuch as results subsequently achieved at Mile 1019, could reasonably be expected by individual venturers elsewhere in more favored valley locations.

No organized soil surveys have yet been made in the territory, therefore any figure given as the total arable area therein must obviously be an estimate. Based on years of indeterminate observation the acreage of arable land in the territory might be estimated at 250,000 acres; a planned survey of the whole territory would probably reveal twice that figure.

A pertinent feature of this arable area is its variability. The river flats and floodplains of the lower valleys are probably the most attractive from an agricultural point of view. These are as a rule fairly level, to gently sloping areas. The surface soil may be described as a dark sandy, or a coarse silty loam, varying in depth from some four to ten feet. Beneath this deposited over-burden there is generally a base of drift gravel.

The organic content of the surface layers is, as a rule, not outstanding, grass swards excepted; the virgin coverage, on the other hand, indicates a desirable degree of productivity. Meadow areas of native grasses bear lush growths; willows, grouped bole clusters, reveal sturdy establishments, while the poplars—*Populus tremuloides*—rise straight and smooth to imposing heights and girths. Stands of spruce are occasional, sometimes predominant, and are generally adaptable for building material, either fabricated or natural.

The Pelly ranch, on the river of that name, is located on a flat of this nature. This property has been cleared and developed for some 30-odd years. During that time horses, cattle, and hogs have been raised successfully. Brome has been the principal forage, while oats, wheat, and barley have been matured through the years. The property consists of some 400 acres of this flat-land.

Another property, quite similar, is located on the Stewart River. This is known as the Maisie-May ranch, and is comparable in area. Horse feed was raised on both these locations in years gone by but since horse power has been displaced by automotive units at the territorial mines, the market for baled hay has disappeared. Both of these ranch properties are now, in consequence, more or less inactive, though one, the Pelly, still maintains a small herd of cattle, and provides winter feed for survey animals.

Other valley properties, improved and operated in years gone by, remain now abandoned. Where sowings of brome grass were made in that era of development, this cultivated forage still controls the area of establishment. The ancient buildings, as a rule, have been obliterated by fire.

Higher bench-lands, or uplands as they are called, are perhaps somewhat more extensive. By far the largest block of this type of land is to be found in the Takhini-Dezadeash valley. This valley land extends west, from Whitehorse, Mile 916, to the Archibald Range at Mile 1025. From the capital city to the Archibald Range the altitude varies from 2,000 to 2,300 feet. Whilst apparently one continuous valley, this extended area actually comprises two ancient lake beds. The waters of one moved east in the Takhini channel to the Yukon River, and thus northwest to the Arctic Ocean; flood-waters from the other moved west in the Dezadeash channel to the Alsek Pass at Mile 1022, thence by the Alsek River, south to the Pacific. The water level in the eastern lake bed probably receded before subsidence took place in the western basin, thus the soil of the Takhini valley is the more mature, though both are similar in type—a lacustrine clay. The boundary, or esker of the two basins, is abrupt and conspicuous. It spans the valley floor from the old Post Office of Champagne, near the Dezadeash Pass, to the opposing mountain bastion four to five miles to the north; by the highway approach it resembles an immense sand-dune, or breast-work, and rises to an altitude, from the valley floor at Champagne, of 80 to 90 feet. Artifacts, reputedly, have been recovered from its crest in recent years.

The territory surrounding Whitehorse, and for some 20-odd miles west into the Takhini valley, may be disregarded as non-arable. The surface layer is quite sandy and carries a light to medium coverage of lodge-pole pine, and some gnarled poplar—*Populus tacamachaca.* Small muskeg pockets are found occasionally through here. Evenutally spruce, aspen and willow take over, and are dominant in light to medium stands as far as Champagne, Mile 974. Meadow areas are encountered but are generally limited in scope, and are scattered. The average width of the valley, between its mountain walls, is perhaps four to five miles; its topography may be described as gently rolling to undulating, with a perceptible slope to the south. The Mendenhall tract, from about Mile 968 to Mile 974, and about five miles in depth, is the most adaptable area in this Takhini valley. The type of soil here may be classified as a fairly good brown clay loam, comparatively free of stones. The coverage on this area is light to medium—spruce, aspen and willow, small meadow areas are numerous.

The Dezadeash valley, beyond the butte of Champagne, more or less duplicates the Takhini in general aspects. It is an undulative valley plain, imperceptibly sloping towards the Alsek Pass to the south and west. Areas of a coarse sandy nature alternate with others carrying an adaptable clay loam. Balsam poplar, somewhat stunted, and unthrifty willow occupy the coarser soils, while spruce, aspen and willow are dominant on areas of arable land. The coverage on this latter land ranges from light, through to heavy, with spruce representing the heavier material. Meadow areas are frequent though seldom extensive. The lower valley benchland, bordering the Dezadeash stream, provides native forage for ranging pack and saddle animals; all of them winter hereon. (The same may be reported for similar areas

adjacent the Takhini stream.) Somewhat heavier coverage, particularly of spruce, occurs towards the western end of the Dezadeash valley. Some of these spruce stands acquired the size of sawmill material; fire later destroyed much of it and highway forces logged the areas for fuel. Approaching the substation site at Mile 1018-1019 the soil may be described as a fine silt to a heavy clay loam, specifically classified as an azonal alluvial soil. Variability is nonetheless strikingly abrupt.

Despite the sandy, inorganic soil of the site, small gardens are numerous in Whitehorse, and are surprisingly productive. Most of them, nonetheless, have been built up, as it were, by the incorporation of transported loam from valley depositions in territory adjacent; commercial fertilizers completed the build-up. The results, as a rule, are fairly warm, responsive sites.

Other benchlands are known to exist, and no doubt a territorial survey would reveal more; for instance there are restricted areas in the south, the Tagish country. In the country of the lower Yukon River—the Pelly, the Macmillan and the Stewart valleys, more of this type of benchland occurs. In these northern areas permafrost is frequently, almost invariably, encountered at varying depths, depending particularly on surface coverage. Under spruce, beneath the base moss and lichen, the frost table may be customarily found at 18 to 24 inches; under deciduous stands and grass the margin may be extended. This characteristic is revealed in areas that have been cleared and cultivated. Subsidence there takes place progressively as the sun's heat penetrates to the subterranean table. Eventually the field's surface becomes undulatory, abruptly so occasionally, into subsidences of 6 to 8 feet. Problems of traction and maneuverability with cultural machinery are then encountered; gullying may form as the subterranean table recedes; even caverning may occur over melting ice-blocks.

Elsewhere, particularly in the south, circumscribed areas of ancient lake beds are found. These average perhaps 50 to 100 acres of open meadow land, and generally carry a fair sward of native forage species. Invariably they are somewhat dished and the centres retain a little runoff until midsummer. Aspen and willow, dense stands as a rule, fringe the perimeters. Soil types vary from a heavy dark clay loam on the outer dish, quite friable when exposed, to a deep mat of semi-decomposed peat in the moist centre basins; a heavy lacustrine clay underlies the area. These meadow depressions offer natural grazing; reclaimed small test plots indicate they would be productive of the hardy forage grasses, i.e., brome, western rye grass and crested wheat grass. Legume forage might be problematic, though *Medicago falcata* has revealed hesitant adaptability. Indications of some alkalinity are noted. Cereal ventures herein probably would be hazardous; and unseasonable frost would no doubt find these forest-fringed hinterland basins.

The territorial areas herein noted as adaptable for agriculture all more or less bear a coverage of poplar, willow and spruce. Poplar and willow are generally found in light to medium stands; spruce will probably be in medium to heavy stands. Meadow areas are numerous but as a rule are scattered and small.

The settler here, as in the park areas of the northern plains, must first undertake the displacement of this native forest cover, most of it shallow-rooted. The old-fashioned axe and grub-hoe have of late years been set aside and power machinery has replaced them. Various items are now used, from the anchored manual stump-puller to the automotive bulldozer and blade. Costs of the displacement vary considerably, depending upon the type and density of the coverage, and the methods employed. Using the bulldozer blade to uproot and pile the material, the estimated costs per acre of deforestation on the substation, from timber-stand to seedbed, ranged from $25.00 to $75.00. Obviously the type of coverage can be determinant.

METEOROLOGICAL DATA

Precipitation

As the following records reveal the main plateau of the territory, the area of population as it were, must be considered a dry country. The average annual precipitation varies yearly and locationally, but the figure is customarily found to be between 8 and 12 inches. The heaviest recorded on the substation in any one year was for 1945, i.e., 14·66″; the lowest was in 1951 with 6·72″. The average over a period of eight years works out to 10·52 inches.

Heaviest precipitation may be expected in September and October; the 8-year average recorded for September is 1·38″; for October 1·51″. At N. Lat. 60° September is the month of the grain harvest. On the other hand the average number of rainy days in this month for that recorded period is only seven days, and a heavy downpour is more or less unusual. No grain harvest on the substation, through the period indicated, has been irretrievably lost; delays, obviously, have nonetheless been encountered.

The average precipitation for the critical months of June and July is 1·09″ and 1·27″ respectively; much of it represented by brief surface showers. The significance of this is reflected in the light yields of forage, and of grains on stubble. With other factors in mind, bacteriological activity and so forth, it may be desirable under these semi-arid conditions to practise a two- in place of a three-year rotation in a grain sequence. Over an arbitrary period, for instance of six years, three fallow crops could be expected to, and probably would exceed in yield the harvests from two fallow and two stubble crops.

The snowfall, over a period of nine months, may represent, roughly, three-sevenths of the year's precipitation. This fall, as a rule, is recorded from September through the winter to the following April. A fall has been recorded in the month of June, but it was considered somewhat unprecedented. Through the winter the snow accumulations build up, for in valley locations there is very little drifting; temperate coast winds settle the seasonal accumulation, but a melting chinook drift is seldom experienced. In fact it may be said that, as a rule the pre-winter snows of late October are six-month snows, inasmuch as portions at any rate are still in the bush, where they fell, the following April.

The average depth of a winter's snowfall is fairly constant; it works out, over an eight-year period, to some 40-odd inches, fresh-fall measurement. Depending upon prevailing winter temperatures, this seasonal accumulation settles into a fairly compact blanket, with a depth, by March, of 8 to 12 inches; this blanket acquires a dense frost-crust, but seldom an impenetrable ice-crust. Local pack and saddle horses rustle and thrive, by pawing to browse, throughout each winter; they seldom get supplemental feed.

The spring commences, generally, late in March. As a rule this period is protracted rather than abrupt; sub-zero recordings may be registered even into the month of March. Under these conditions a small portion of the runoff may be absorbed by the furrow slice, the remainder may move in aimless trickles down the terrace slopes. A prolonged mild spell will nonetheless swell the trickles to streams, thus the menace of erosion is presented on cultivated areas.

The earliest date recording field cultural operations on the substation is April 19, the latest May 10, thus, roughly, an average date of commencement, over eight years, of May 1.

Temperatures

In a mountainous territory of this latitude, and of this scope, comparative data only can be submitted; latitudinally, altitudinally and locationally the recorded readings are strikingly variable. The figures given here are those recorded on the substation instruments. Two sets are used, a maximum and a minimum thermometer in each set. One set is installed at the farm headquarters site, the lowest point in the valley; the other set is installed in the main field area, a bench site one hundred feet higher. After a summer day of blustery coast winds over the adjacent ice-caps, the following day's reading of the headquarters set may reveal one, two or three degrees of frost; the comparative recording of the field set will, on the other hand, reveal a higher reading of some four degrees, thus no frost. Wind currents, altitude, timber proximity and so forth are no doubt pertinent factors.

Summer temperatures, vitally important, are low. The highest summer days reading recorded in eight years was 88° Fah. on July 13, 1946. A reading of 80° Fah., or more, occurs most infrequently; summarized the occasions are revealed thus: in 1945, 0; in 1946, 4; in 1947, 5; in 1948, 10; in 1949, 1; in 1950, 8; in 1951, 12, in 1952, 4. July, as a rule, is the month of the highest recordings.

The mean annual temperature, covering eight years recording, i.e., 1945-1952, is revealed as 26·1° Fah.

The average mean summer temperature, June, July, and August, inclusive, over an eight-year period, works out at 51·4° Fah. In consequence heat-loving species, i.e., corn, tomatoes, beans and so forth, are inevitably cut by early fall frosts.

The preceding paragraphs reveal, not a territorial but a locational hazard. The substation site is adjacent to Mt. Archibald, in the lee of the snow-capped St. Elias range, in the southwest portion of the territory. Whitehorse is directly east 100 miles. Dawson City is north of the substation some 230 miles, and Mayo is 180 miles northeast. The average mean summer temperature at the substation is shown above; comparable figures for the three interior sites mentioned are Dawson City, 57·2° Fah.; Mayo 55·3°, and Whitehorse 55·0°. Altitudes of the four sites are—substation 2,000 ft., Whitehorse 2,100 ft., Mayo 1,625 ft., and Dawson City 1,060 ft.; thus latitude is revealed as one factor only.

Coastal winds of semi-hurricane force drift inland over the glacial fields and the substation site, from the Gulf of Alaska, during the month of June. These drifts no doubt have a lowering effect upon early summer temperatures on the southwestern benchlands; on their continued sweep into the interior their force, and this effect, probably diminishes.

With seasonal variations always in mind it is difficult to indicate by arbitrary dates, the length of the growing season. Mean soil temperatures are quite low until late in May. (See Table 7). Native flora—*Populus tremuloides* —burgeons locally about the last week of May; autumn coloration and defoliation occurs, roughly, about the end of September.

The freeze-up may be expected from mid to late October. Winter temperatures, as a rule, are low. Sub-zero monthly means for the three months of December, January and February have twice been recorded. The lowest minimum reading was taken on January 30, 1947, when the instruments registered −65° Fah., and this minimum figure was repeated for three consecutive dates. On the other hand regional winds, under these conditions, are rare to unknown.

Hours of Bright Sunshine

See Table No. 5

In this respect one pertinent feature should be noted. The substation headquarters site is established at Mile Post 1019; immediately to the south, distant about two miles, is the Dezadeash Range of mountains running east and west. This range has an average altitude of 6,000 to 7,000 feet above sea level, and its peaks are more or less contiguous. In December and early January the diurnal arc of the sun is beyond and below the silhouette of these continuous mountain crests; thus for that period no record is recoverable from the gauge. In both directions, east and west along the Shakwak valley, bright sunshine is frequently visible during this period of obscuration.

Soil Temperature

See Table No. 7

At this latitude it was felt that soil temperatures, and the significance thereof, should be more clearly revealed. Two sets of thermometers, a pair in each set, were secured. One of each pair records at a depth of four inches, the other at eight inches.

Both sets were installed in the garden area; this area is located adjoining the headquarters site, actually near the low point in the valley. One block in this garden had been set aside for vegetable tests under sprinkler irrigation; a similar block set aside was duplicative in all plantings, but was not irrigated. A set of instruments was installed on May 17 in each of these two blocks; thus Table No. 7 one recording is given under "irrigated area", and the other under "dry area."

TABLE 1.—METEOROLOGICAL SUMMARY*

Dominion Experimental Substation
Mile 1019, Whitehorse, Y.T.

Month	Temperature °F.			Precipitation			Bright sun (hours) 6 yr.	Evaporation (7 yr.) inches
	8 years			8 years		Total precipitation inches		
	Highest	Lowest	Mean	Rain inches	Snow inches			
	°F	°F						
January	53	−65	−4·0	0·02	6·9	0·70	21·7	—
February	48	−65	−0·2	—	4·1	0·41	80·6	—
March	52	−45	15·4	0·03	2·4	0·27	161·5	—
April	54	−21	28·9	0·32	1·6	0·48	170·6	—
May	82	12	41·9	0·37	1·2	0·50	256·2	3·42
June	86	20	50·2	1·08	0·2	1·10	251·7	4·70
July	88	27	53·8	1·28	—	1·28	249·6	4·01
August	83	12	50·3	0·86	—	0·86	215·5	3·07
September	75	1	42·4	1·02	3·7	1·39	148·4	1·70
October	62	−13	28·8	0·50	10·1	1·51	92·4	—
November	54	−53	10·4	0·32	8·2	1·14	22·6	—
December	37	−25	4·5	—	8·7	0·87	0·3	—
Annual	.....	.....	26·1	5·81	47·1	10·52	167·1	16·90

* Observations are taken in co-operation with the Meteorological Division, Department of Transport.

TABLE 2.—ANNUAL PRECIPITATION

Experimental Substation, Mile 1019, Whitehorse, Y.T. 1945–1952 (8 yr.)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1945	0·70	0·35	0·35	2·60	0·73	1·54	0·98	0·05	3·44	2·37	1·05	0·50	14·66
1946	0·30	0·20	0·40	—	0·04	1·94	1·98	0·46	0·99	0·85	2·37	0·60	10·13
1947	1·25	0·40	0·35	0·47	0·52	1·03	1·67	1·70	0·66	0·77	0·72	1·45	10·99
1948	1·73	0·60	0·56	0·18	0·76	0·30	1·20	1·90	1·36	0·69	1·66	1·09	12·03
1949	0·80	0·24	—	0·19	0·84	0·73	1·11	1·87	1·20	3·59	1·35	0·32	12·24
1950	0·22	0·75	0·12	0·07	0·36	0·68	0·95	0·23	2·27	0·15	0·68	0·90	7·38
1951	0·22	0·05	0·21	0·05	0·53	1·73	0·75	0·16	0·39	1·11	0·82	0·69	6·72
1952	0·40	0·67	0·18	0·28	0·20	0·85	1·59	0·52	0·81	2·56	0·49	1·44	9·99
Average 8 yr.	0·70	0·41	0·27	0·48	0·50	1·10	1·28	0·86	1·39	1·51	1·14	0·87	10·52

TABLE 3.—FROST RECORDS

Experimental Substation, Mile 1019, Whitehorse, Y.T.
Frost: 32°F. or lower, killing frost: 28°F. or lower.

Year	Last frost in spring		First frost in fall		Number of frost free days	Last killing frost in spring		First killing frost in fall		Number of killing frost free days
	Date	Temp.	Date	Temp.		Date	Temp.	Date	Temp.	
1945	July 9	31	August 9	29	31	June 23	27	August 16	26	55
1946	June 20	29	July 18	31	28	May 31	28	August 1	28	62
1947	July 10	29	August 2	29	23	July 13	26	August 15	28	33
1948	July 5	32	July 16	31	11	June 28	25	August 25	12	58
1949	July 7	32	July 29	27	22	July 2	27	July 30	27	28
1950	July 14	32	July 30	27	16	June 3	27	July 30	27	57
1951	June 20	29	July 26	32	36	June 19	27	August 16	27	57
1952	July 10	31	August 18	27	39	July 4	27	August 18	27	44
8-year average	July 4	—	July 30	—	26	June 23	—	August 11	—	49
Shortest crop season	July 5	32	July 16	31	11–1948	July 2	27	July 30	27	28–1949
Longest crop season	July 10	31	August 18	27	39–1952	May 31	28	August 1	28	62–1946

Earliest and latest frost dates (32°F. or lower)
8 Years

Last spring frost	Latest July 14, 1950*
	Earliest June 20, 1951
First fall frost	Latest August 18, 1952
	Earliest July 16, 1948*

Earliest and latest killing frost dates (28°F. and lower)
8 Years

Last spring killing frost	Latest July 13, 1947*
	Earliest May 31, 1946
First fall killing frost	Latest August 25, 1948
	Earliest July 30, 1950

*July 15 assumed midseason date

TABLE 4.—MONTHLY FREE WATER EVAPORATION (4 FT. BURIED TANK)
1946–1952 INCLUSIVE

Year	May	June	July	August	September	Season
1946	3·50*	5·08	3·94	2·94	1·88	17·34
1947	4·06	5·25	4·93	3·31	1·44	18·99
1948	2·94	5·25	3·94	2·81	1·62	16·56
1949	2·69	3·62	3·56	2·56	1·88	14·31
1950	3·19	4·94	3·06	3·06	1·81	16·06
1951	3·31	4·44	4·06	3·81	1·94	17·56
1952	4·25	4·31	4·56	3·00	1·31	17·43
Average	3·42	4·70	4·01	3·07	1·70	16·90

* 3rd to 31st.

TABLE 5.—BRIGHT SUNSHINE

Monthly and annual hours of bright sunshine for years 1947 to 1952 inclusive

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1947	24·9	75·2	131·1	146·4	253·9	212·7	267·4	163·2	146·5	74·0	11·8	0·4	1,507·5
1948	16·8	72·5	141·2	192·4	237·8	330·1	257·4	196·1	137·2	92·8	19·5	1·2	1,695·0
1949	22·7	81·6	204·3	197·2	267·1	172·0	196·9	215·7	171·4	64·5	26·6	—	1,620·0
1950	20·4	62·9	196·2	189·9	259·2	284·4	231·7	246·9	186·8	104·2	26·1	—	1,808·7
1951	23·6	110·0	168·9	153·3	263·9	241·4	295·6	260·7	111·3	119·4	31·7	—	1,779·8
1952	21·9	81·5	127·4	144·3	255·3	269·3	248·6	210·3	137·0	99·7	19·8	0·2	1,615·3
Average	21·7	80·6	161·5	170·6	256·2	251·7	249·6	215·5	148·4	92·4	22·6	0·3	1,671·1

TABLE 6.—MEAN TEMPERATURE

Monthly and annual mean temperature for years 1945 to 1952 inclusive

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1945	9·91	9·48	20·43	26·58	42·24	46·88	50·98	49·88	40·48	31·32	0·47	−0·11	37·38
1946	−0·81	10·14	14·58	30·2	44·27	54·45	53·37	49·54	40·88	29·03	7·25	−15·37	26·46
1947	−14·04	0·16	24·31	30·5	42·04	48·81	53·99	47·93	42·5	28·94	20·52	6·1	27·65
1948	4·15	−5·12	5·89	22·01	43·0	51·86	53·82	49·8	40·36	33·46	9·68	−9·71	24·97
1949	3·38	−6·93	22·27	33·23	40·85	45·8	53·11	49·5	43·98	29·08	16·90	−10·34	26·74
1950	−5·03	−8·93	14·26	23·73	40·75	54·25	52·02	52·51	42·74	24·53	−2·98	−0·29	23·96
1951	−12·00	−5·12	6·64	34·7	43·82	50·2	57·98	52·5	45·9	20·61	5·63	−10·30	24·21
1952	−17·34	4·3	14·7	29·95	38·5	49·2	54·8	50·9	42·1	33·3	25·5	4·25	27·51
Average	−3·97	−0·25	15·39	28·86	41·93	50·18	53·76	50·32	42·37	28·78	10·37	−4·47	26·11

TABLE 7.—MEAN MONTHLY SOIL TEMPERATURES THROUGHOUT THE GROWING SEASON 1952

Month	Dry area						Irrigated area					
	at 4 inches			at 8 inches			at 4 inches			at 8 inches		
	8 a.m.	5.30 p.m.	Mean	8 a.m.	5.30 p.m.	Mean	8 a.m.	5.30 p.m.	Mean	8 a.m.	5.30 p.m.	Mean
May*	41·6	49·0	45·3	40·8	42·9	41·8	39·6	47·0	43·3	39·1	41·3	40·2
June	49·9	58·2	54·0	49·6	51·9	50·8	48·5	57·1	52·8	48·3	49·6	49·0
July	55·2	63·8	59·5	55·9	58·0	57·0	55·2	63·4	59·3	56·3	57·7	57·0
August	52·6	60·2	56·4	54·4	55·9	55·2	52·5	61·0	56·8	54·9	56·3	55·6
September	42·8	49·1	46·0	45·4	46·1	45·8	42·8	48·7	45·8	44·8	45·3	45·0
Mean	48·4	56·1	52·2	49·2	51·0	50·1	47·7	55·4	51·6	48·7	50·0	49·4

From 17th to 31st only.

Markets

It should be borne in mind that the whole production of Yukon agriculture must find a market within the Territory; that market is obviously limited to the population therein, augmented somewhat by seasonal industrial and defense reinforcements. Regional requirements at present are far in excess of local production; on the other hand storage facilities will be required should the latter begin to catch up.

ANIMAL HUSBANDRY

Cattle

In July 1948 a foundation herd of Shorthorn cattle, one male and two females, was established on the substation. The male, Lacombe Monarch 15, was secured from the Experimental Station at Lacombe, Alta.; the females, Scott Monarch Fannie and Scott Monarch Mattie, were raised at, and secured from the Experimental Station, Scott, Sask.

Housing facilities had in the meantime been constructed. These consisted of a main, open-front, run-in shed, flanked by a closed calving pen at one end, and a sire pen with exercise yard adjacent at the other.

For some days following arrival at Mile 1019 the three animals were confined to the exercise yard, then were given freedom to range in native pasturage, fenced, adjacent.

It was noted through the winter months that during the five to six daylight hours, the herd seldom sought protection in the facilities provided. On the contrary, after an early hour's feeding period in the shed, the animals all chose to spend the remainder of the day, standing or lying contentedly ruminative, at the south base of a barnyard bluff.

Water was provided in a local stream nearby. As a rule the animals voluntarily made the trek daily, but during periods of extreme low recordings they had to be urged occasionally.

Natural increase, two male calves in spring of 1949, raised the herd total to five. The following winter observations indicated the prevalence of Brucellosis; subsequent blood tests confirmed suspicions. The herd was later slaughtered and sold to the meat market in Whitehorse.

Knowledge regarding the source of contagion remains speculative after three years. All animals were originally examined, and certified before shipment to the substation; precautions were observed during the period of transshipment. The theory of contamination from local fauna is difficult to substantiate, yet no other domestic cattle were, or had been within 90 miles of Mile 1019.

Replacement was undertaken in 1951. In August of that year three more animals were secured, again Shorthorns. Two young females, Melfort Missie 13th. and Melfort Augusta 53rd. were transferred from the Experimental Station, Melfort, Sask., and one male, Scott Paymaster 4 E. from the Scott Experimental Station. The animals were transported by rail to the Experimental Station, Beaverlodge, Alta., then by substation truck, via Alaska Highway, to Mile 1019.

The herd increased by one, a heifer calf, Yukon Augusta, in the spring of 1952. All animals went into the winter of 1952-53 thriving and in good flesh. Blood tests for Brucellosis revealed negative reactions of all animals. No problem has yet been encountered, unique, or otherwise unknown to the animal husbandman of the western prairies.

It may be noted here that domestic cattle have been successfully raised and maintained in the Yukon for decades. A herd of mixed dairy cattle, Holstein-Shorthorn, was established in the Klondyke valley in the early years of the century; from 20 to 30 head comprised the herd. Recently these cattle were slaughtered and the ranch was sold. The purchaser of the property plans to establish a herd of beef animals thereon.

A small herd of mixed cattle is at present maintained on the Pelly ranch, near Fort Selkirk.

Two other herds are established in the southern zone of the Territory, one at Robinson some 30 miles south of Whitehorse, and the other near Tagish on the lake front of that name. The animals of these two herds are of the beef types, Hereford and Shorthorn. For disposal the prime animals are slaughtered in late fall months, through approved facilities, and the meat thereof finds a market in the nearby city of Whitehorse. This Robinson operator maintains also a yard of hogs, Yorkshire type; through the summer months some 150 animals are fed and raised on his premises. Feed material for all his pens is secured as kitchen waste from military establishments in Whitehorse. The finished product again finds ready sale in the same nearby market.

Cattle of mixed blood were raised for years at the trading centre of Burwash, on Kluane Lake, in the western zone. Upon the death of the operator in recent years disposal was made of this herd. At Coffee Creek on the lower Yukon, at Maisie-May on the lower Stewart, and at the mining centre of Mayo cattle have been raised successfully for years.

Hogs

Hogs have been raised in the territory in the past, and are being raised here at present. On the other hand the prospective husbandman must first secure land adaptable, and prepare it for the production of feed grains and forage; freight rates for the importation of feed are prohibitive.

It is planned to establish hogs on the substation in the immediate future and facilities are under preparation.

Sheep

Sheep have not heretofore, as far as is known, been raised in the Yukon. However, the territorial valleys offer many sites apparently ideal for a venture of this kind. Nonetheless, while not numerous, predatory animals such as wolves, coyotes and bears, and particularly native dogs, would probably menace a free-ranging flock. Constant supervision of a herder may thus be indicated. Enterprises of a co-operative nature have been envisioned,—for instance several limited flocks banded together and ranging under the watchful eye of a summer herdsman. This might be practical in an area adaptable, and sufficiently extensive. Cougars, incidentally, have recently been observed in the southern Yukon.

CEREALS

Work undertaken with cereals on the substation was fundamental and exploratory. It was known that cereal ventures had been attempted at various sites in the territory through the years. On the other hand, little was known of varietal choices, or the harvest qualities achieved in those pioneer ventures.

At the latitude of the substation it was considered obvious that only the early-maturing varieties of cereals should be first chosen. In 1946, field test plots of wheat, oats, and barley, $\frac{1}{24}$-acre each, triplicated, were established. The wheat sowings comprised four varieties, i.e., Garnet, Reward, Prelude and Thatcher. Oat sowings were made with three varieties, Beaver, Ajax, and Brighton. Barleys sown were Olli, Titan, Prospect, and Newal. All sowings were made on land broken and converted in 1945. Through subsequent years discards and additions have changed somewhat the foregoing lists but some of these mentioned are still considered adaptable.

FIGURE 1—Saunders Wheat sown on fertilized summerfallow, 1951. Wheat sown on stubble gives poorer yields, as seen in the extreme lower right corner of the figure.

Activity of soil micro-organisms is probably confined to the period between the end of May and mid-September, tapering off, more or less abruptly, in the latter month. Spring wheat sowings, regardless of actual seeding dates, seldom emerge until May 15-17. Likewise, this same cereal crop, if summer growth has not been good, will fail to achieve the finish and bloom of maturity after the first of September, an arbitrary termination, as it were, of physiological activity.

Spring Wheat

After repeated tests, introductions and eliminations, two varieties of spring wheat, Saunders and Garnet were selected as the most adaptable. Other varieties, for instance Reward and Prelude, respond to the local conditions, but yields are, as a rule, disappointing. Thatcher was found to be somewhat

hazardous inasmuch as it required a few days more than the aforementioned to achieve maturity. During recent years many other varieties and selections of spring wheat have been field-tested in rod-row plots; by this practice adaptions are revealed.

A concise summary of field-block sowings of spring wheats during the last three years, all on fallow land, is given in Table 8.

TABLE 8.—RESULTS OF TESTS WITH SPRING WHEAT

Variety	Days to Maturity	Years in Test	Average Yields	Sample
Garnet	117*	3	24·61	Generally filled. Invariably carrying a trace of bran frost.
Saunders	119*	3	27·05	Generally filled. Invariably carrying a trace of bran frost.

* Contained in these figures may be days of early-season dormancy; perhaps "emergence to maturity" would in this case be more revealing.

Spring wheat varieties invariably display traces of frost injury. Yields are variable, depending upon nature of site, season and so forth; thirty bushels per acre is regarded as a good fallow yield. The yields on stubble seldom exceed eight to ten bushels per acre.

Samples of cereal crops of the various years sowings since 1946, are retained in sealer containers on office shelves for comparative reference. The samples so retained display varying qualities, yet all may be regarded as good feed, and most as good seed.

Winter Wheat and Rye Varieties

Varieties of winter wheat and rye have been rod-row tested through six winters. The results have been more or less disappointing, since from six sowings only two harvests have been secured. From each of these harvests, the wheat samples were unblemished by frost, and of a bright, plump maturity. Rye samples were outstandingly good.

Sowings of these winter varieties were made annually from August 1 to 10. If sown at a later date, the young plants barely made the desirable rosetted establishment before cold weather terminated all growth. The freeze-up is imminent by mid-October.

1947 Sowings

Wheat; Kharkov M.C. 22, sown August 1, 1947, harvested August 23, 1948. Yielded 29·9 bu. per acre, 387 days to maturity.

Rye; Common, sown August 1, 1947, harvested August 23, 1948, yielded 32·42 bu. per acre, 387 days to maturity.

1949 Sowings

Wheat; Kharkov M.C. 22; sown August 4, 1949, harvested August 28, 1950, yielded 32·01 bu. per acre, 389 days to maturity.

Wheat; Comanche, sown August 4, 1949, harvested August 17, 1950, yielded 24·07 bu. per acre, 378 days to maturity.

Wheat; Minhardi, sown August 4, 1949, harvested August 21, 1950, yielded 32·05 bu. per acre, 382 days to maturity.

Wheat, Yogo, sown August 4, 1949; harvested August 23, 1950, yielded 28·26 bu. per acre, 384 days to maturity.

Wheat, Marmin, sown August 4, 1949; harvested August 21, 1950, yielded 23·03 bu. per acre, 382 days to maturity.

Rye, Common, sown August 4, 1949; harvested August 26, 1950, yielded 41·88 bu. per acre, 387 days to maturity.

Rye, Dakold, sown August 4, 1949; harvested August 26, 1950, yielded 37·28 bu. per acre, 387 days to maturity.

Rye, Sitnikoff, sown August 4, 1949; harvested August 26, 1950, yielded 37·93 bu. per acre, 387 days to maturity.

All samples were of a bright, well-developed maturity.

Oats

As with wheat, only the earlier-maturing varieties were given consideration during the first years of establishment; after all the site was beyond N. Lat. 60°. On the other hand it was known that oats of good quality had been produced at various territorial points in years past. Varietal identities of these crops were unknown but salvaged samples testified to their good qualities and maturity. Furthermore, stands of this cereal heretofore had customarily been harvested, immature, as green-feed; seed for subsequent sowings was imported yearly. Patches of volunteer oats were repeatedly observed at abandoned firewood benches along the Yukon River, revealing at any rate a degree of adaptability of this species. Incidentally, *Avena fatua,* the wild species, was found adaptable also.

FIGURE 2—Stooked field of Ajax oats, 1951. Plot layout is seen in background.

The varieties originally introduced, Beaver and Ajax, are still considered pre-eminently adaptable. Legacy responds well, its quality of earliness is attractive, and its palatable straw appeals to the cattleman. On the other hand the grain yield is generally somewhat lighter than that of the former two. Valor, outstanding for earliness and appearance comes far behind in productivity. The hulless variety, Brighton, has revealed adaptable qualities also but it is difficult to maintain the threshed grain free of hulled kernels.

In summarizing it may be reported that the early varieties of oats herein noted have been found adaptable and productive throughout the active years of the substation. Subsequent selections now coming forward are showing desirable qualities for this latitude.

On the basis of these tests generally on fallow land or breaking, the varieties are rated as follows:—Beaver and Ajax, equally adaptable and productive. Mature samples, as a rule, have been very good. Yields of from 30 to 60 bushels of mature grain per acre may be expected, depending upon seasonal and locational conditions.

Legacy and Valor, responsive, but somewhat less productive than the former two.

Brighton hulless, has responded to local conditions but on productive fallow land it may not escape a severely damaging fall frost.

Tabulated performance of each variety is difficult to present. During the establishment period comparable sites and conditions were not always available but yearly rod-row trials substantiate the field ratings given above.

Barley

Barley varieties have shown encouraging adaptability and productivity. However, the factor of earliness is still the first consideration. Yields thus far have been consistently fair, and the quality, generally, has been high.

Olli, although an extremely rough-awned type, is the variety held in highest esteem at the substation. Its earliness commends it, despite the fact that Newal, a smooth-awned type, will invariably out-yield it. Newal matures some days later.

Other varieties have been tested in field blocks, particularly Titan and Prospect. For one reason or another each has been dropped in favor of Olli or Newal.

Recent varieties, still in rod-row tests, promise good yields. In the meantime the four varieties above noted have been found more or less suited to the regional conditions. Seasonal samples are as a rule plump and attractive although viability may occasionally be somewhat impaired by an early frost.

Yields from the varieties noted, particularly of Olli and Newal, should reach 25 bu. per acre depending upon condition of land. Prospect is an alternative variety; Titan has been more or less discontinued.

In summary it should be noted that through the active years of the substation all seed stocks of wheat, oats and barley for local sowings were raised on the substation fields.

The preceding paragraph may be qualified thus: since its establishment all block sowings on the substation after 1946, were made with seed raised on the premises. On the other hand, grain from many fields through those subsequent years, particularly of heavy stands, proved by tests to be unfit for seed. Lighter crops during the years indicated, provided seed of acceptable viability.

Ample seed stocks for another year are carried forward annually on the substation.

Flax

Flax, in rod-rows, has been given successive tests through the years. No maturity has been recorded for any variety or selection in these trial plots.

Field Peas

No trial has yet been attempted on the substation with this legume. On the other hand a mature crop of mixed forage—oats and peas—was recently harvested on land adjacent. A similar crop was examined at Mayo some years ago. In each instance both species had produced mature samples, although light in yield.

Periods, in days, to maturity of early varieties of cereals

In determining "days to maturity" of the various cereals it should be borne in mind that factors such as condition of land, precipitation, temperatures and so forth, all have an influence.

Through the past years of testing, maturity periods, in days, have been recorded somewhere within the range herein given:

for wheat, from 105 to 120 days to maturity
for oats, from 100 to 115 days to maturity
for barley, from 90 to 105 days to maturity.

These figures are applicable, more or less to the early varieties only.

In 1952 a Dawson City operator raised field blocks of wheat, oats and barley; the land was spring-converted brome grass sod. The varieties sown were Garnet wheat, Beaver and Ajax oats, and Newal barley; the grain sowings were delayed somewhat pending spring conversion of the sod.

Notes taken during a visit in mid-August indicated the barley approaching a good maturity, oats turning and wheat still short two weeks.

Later the operator purchased a combine and reported that the machine had done a good job of harvesting his wheat, oat and barley blocks. The site is N. Lat. 64°.

FIELD HUSBANDRY

For the first year or so the substation establishment was a multiple problem in field husbandry. Provision of necessary facilities, along with land clearing claimed full-time attention of all staff members.

Conversion of hinterland areas, brushing, piling, burning and plowing was a yearly commitment until recent years. A D4 Caterpillar tractor, equipped with hydraulic blade attachment, furnished the motive power for the main operation of clearing. Boles of spruce, and sometimes of aspen, up to 14″ girths, were uprooted, rolled and piled. The use of the lowered blade to first destroy exposed roots aided in dealing with stubborn trees. Most of the topsoil left clinging to the roots was shaken free and dislodged by rolling, or during piling operations.

Burning the material, 95 per cent green, consumed more time and labor than did the actual task of displacement. Sometimes charred, but unconsumed root-mass material was pushed into adjacent timber where it was piled and burned the following year.

When possible, clearing and piling of heavy stands of green forest material should be done two or three years before cultural conversion of the area is attempted. After that period, the piled material would burn more readily and native organic life in the soil would no doubt be more active.

Whatever method of displacement is adopted at present some little loss of humus and topsoil is to be expected since the native root systems must be dislodged. At present the cost of clearing is a deterrent to most prospective settlers.

FIGURE 3—Breaking land with a caterpillar tractor, July, 1947.

As each block of new land was brought under crop the variability in soil response was noted. This could not be explained on the basis of soil structure but was assumed to be associated with plant-food content, as distinct from texture. In all original sowings this characteristic showed up as circumscribed, irregular patches of anaemic growth, bordered by lush stands of healthy grain. There was no gradual merging of the two varying growths, but invariably a sharp division. The cause may have been lack of bacterial activity, since most

of this patchiness disappeared with subsequent cultural operations. Textural variations in local soils are frequent also, the area of the substation varying from a coarse sand to a fairly heavy clay loam.

A rubber-equipped field tractor did the breaking, pulling an 18-inch breaker. The same power unit functioned for all subsequent field operations.

Fertilizer Tests on Grain

In 1950 a block of land was set aside for fertilizer tests on a three-year wheat rotation of fallow, wheat, wheat. Barnyard manure and commercial fertilizers were used in the amounts shown in the accompanying table. The fertilizers were applied to the crops on summerfallow. A summary of yields, tabulated, may reveal a trend, but as yet a trend only.

TABLE 9.—MANURE AND CHEMICAL FERTILIZERS IN A THREE-YEAR ROTATION WITH SPRING WHEAT

Garnet variety used two years. Saunders variety used one year.	Average yields in bushels per acre for three crop years.	
	On fallow	On stubble
1. Check	33·08	7·17
2. Barnyard manure @ 10 tons per acre	36·09	8·54
3. Ammonium phosphate 11–48–0, at 50 lb. per acre	35·79	7·94
4. Ammonium phosphate 16–20–0, at 50 lb. per acre	34·43	8·19
5. Superphosphate 26% @ 100 lb. per acre	37·84	9·04
6. Ammonium phosphate 11–48–0 @ 50 lb. plus 33 lb. of muriate of potash per acre	33·01	7·14

The site of this fertilizer block is somewhat low, the soil is a fairly heavy silt loam, tardily responsive in the spring, yet eventually quite productive. In consequence the fallow crops hereon have not yet escaped the touch of an early fall frost. On the other hand the stubble crops, generally extremely light, came through with little or no damage.

FIGURE 4—Burning brush during clearing operations in 1950.

Rotation Experiment

A contiguous block was set aside in 1949 to compare the various rotations —bare fallow vs. the residual effects of legume and grass sod. The rotations adopted were:

1. Continuous oats.
2. Two-year rotation—fallow, grain.
3. Three-year rotation—fallow, grain, grain.
4. Six-year rotation—grain, grain, hay seeded down, hay, hay, hay and partial fallow.

As in the test with fertilizers more cropping years are required to secure reliable, conclusive data; the factors involved are many, though perhaps not unique.

In this country of limited precipitation it was considered inadvisable to attempt establishment of the first-year hay in rotation 4, by seeding with the second-year oats as a nurse-crop. It was felt that with limited moisture, aggressive competition of the oat crop, and a short growing season, the young forage seedlings would not be well established before winter closed in. Thus the first-year hay was laid down in the summer of the third year of the rotation; the plot was plowed and worked, semi-fallowed in the early season, then later sown to a meadow mixture. No hay crop could be taken that year, yet three were taken subsequently before conversion. Thus through a six-year period the rotation produced five crops, two of grain and three of hay.

The following table summarizes results of rotation experiments for the four-year period.

TABLE 10.—RESULTS OF 4 YEARS OF EXPERIMENT, 1949–1952

Rotation No.	Treatment	Rotation sequence	Average yield per acre
1.	Continuous oats	Four years	25·05 bu.
2.	Two-year rotation	Fallow, grain	54·74
3.	Three-year rotation	Fallow, grain, grain	—
	1st year grain		53·44
	2nd year grain		31·22
4.	Oats on partial fallow after three years hay		44·26
	Oats on stubble 2nd yr		27·84
	Fallow. Sown to hay in midsummer.	Not harvested, immature growth	—
	1st year hay	Mixed hay—grasses and legumes	1036 lb.
	2nd year hay	Mixed hay—grasses and legumes	1398 lb.
	3rd year hay	Mixed hay—fall fallowed after hay crop	1123 lb.

Tillage Dates and Methods of Plowing

An experiment to determine the comparative value of fall and spring plowing and surface tillage, without plowing, for summerfallow and stubble crops was commenced in 1950. The results for three years are shown in Table 11. It would appear that spring plowing for fallow gives somewhat better results than the other two methods of preparing fallow. No significance can be given to the slight differences in the yields of the stubble crops from the different cultural treatments.

TABLE 11.— RESULTS OF TILLAGE TESTS

3-year treatment—fallow, oats, oats

Treatment	Mean yields on fallow	Mean yields on stubble
Spring plowed for fallow and stubble grain	47·80 bu. per acre	22·64 bu. per acre.
Fall plowed for fallow and stubble grain	42·09 bu. per acre	23·47 bu. per acre.
Surface tillage for fallow and stubble grain	43·63 bu. per acre	21·29 bu. per acre.

FORAGE

Grasses

The main problem encountered in the forage plots and meadows was not so much one of adaptability, as of productivity. Many of the grasses popular in the west have responded with perfect adaptability. Brome, crested wheat, western rye, selections of creeping red fescue and Kentucky blue react as natives. Reed canary grass and timothy may perhaps be included on sites where moisture is adequate. Meadow fescue and Canada blue grass have succumbed in the plots sooner or later.

The yields of fodder from upland forage blocks have as a rule been disappointing. Low soil temperatures, belated reaction of soil organisms, semi-arid condition,—one or all these factors are probably contributive. On the other hand, fallow oat crops sown for feed material, are abundantly productive; subsequent stubble crops, nonetheless, are persistently light.

Various mixtures, including brome grass, crested wheat grass, rye grass, timothy, alfalfa, and sweet clover have been included in the tests. Results vary little between sowings of single and of multiple species; yields of forage have invariably been quite light.

Fertilizer applications to measured blocks of established forage stands have been made in recent years. The result in no case was appreciable, yet it may be stated that the response from phosphate applications could be determined.

Until the year 1951 all forage sowings were established on dry upland sites.

Resulting establishments were as a rule satisfactory, but subsequent yields were consistently light.

The territory has many low, or swale areas and in 1951 such an area on the substation was brushed and broken, after spring runoff moisture had flooded away. In October of that year this area was sown down to a forage mixture heavy in legumes.

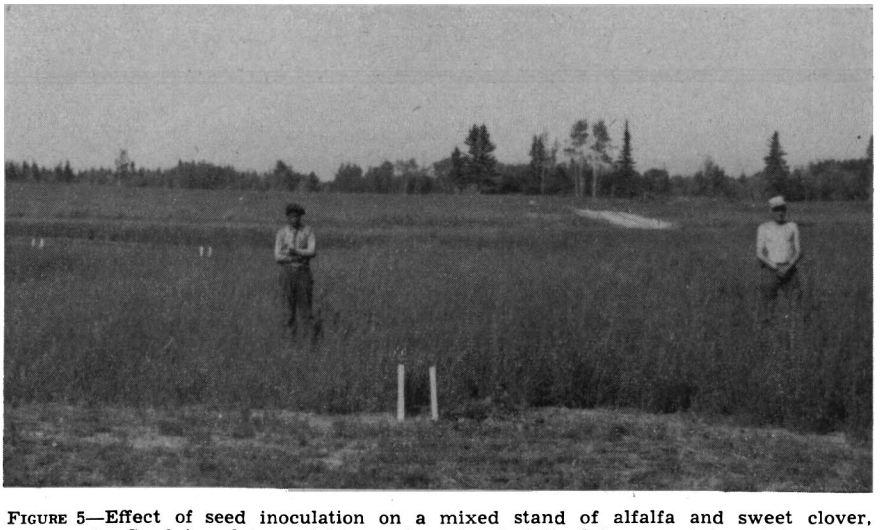

FIGURE 5—Effect of seed inoculation on a mixed stand of alfalfa and sweet clover, 1950. Seed for plot on right was inoculated; left plot was not inoculated.

When surface water disappeared in late May 1952 the forage sowings became visible the length of the field. Throughout the subsequent season this forage stand made lush growth and went into the winter of 1952-1953 as a promising crop. No harvest was taken in 1952.

The soil of these areas comprises a 6- to 8-inch peat loam over a heavy clay. Under otherwise arid conditions moisture is retained in these depression areas and native forage thrives. Winter survival of legumes is still nonetheless problematical.

Forage Crops

Many of the clovers have been established on the substation, in rows or in field blocks, but few of them display the hardiness to survive the first winter. The hardiest variety of red clover has invariably succumbed to the rigors of one winter. Alsike and the white clovers have so far achieved no more than a five per cent survival.

Varieties of sweet clover have proved semi-adaptable. Brandon Dwarf has made a fair showing. Common Yellow and Arctic White Blossom have revealed a degree of adaptability also, but the yield in no case has been commendable. The Yellow Blossom variety is used successfully, and fairly extensively, in the Mayo territory.

Alfalfa, *Medicago media,* is the most desirable, yet its response thus far has been erratic. Through the years many of the varieties have been established in rows, blocks or in meadow sowings. Patches of this legume still survive in blocks established six years ago, though the growth is not vigorous. On the other hand blocks established three years ago have succumbed up to 100 per cent.

Fortunately, *Medicago falcata,* the yellow-flowered Siberian alfalfa, has responded much more encouragingly, particularly in spaced sowings of 24 and 30 inches; yet when sown in solid stands the yield has been disappointing.

Many of the purple-flowered alfalfa stands, in fact most, have suffered extensively from attacks of the fungus *Plenodomus meliloti.* This organism destroys the tap root of the plant at plow-sole level. The affected plant thus is deprived of its main source of sustenance, yet is maintained precariously in a non-productive condition throughout the season, by its small sub-surface feeder roots. When affected the plants acquire an anaemic appearance and are easily pulled up by hand.

Medicago falcata, on the other hand, appeared to be less susceptible to this form of attack. All the sweet clovers were affected and suffered extensively therefrom.

Thus at this date it may be reported that alfalfa responds, and survives productively, when sown in spaced rows of 24 inches, while full survival is infrequent in any field plan. When sown as a mixture with grass, particularly brome, the legume survival has, at best, been precarious; this survival, in many sowings, consisted of odd plants.

Sanfoin and birds-foot trefoil have been found non-adaptable in the nursery rows.

Much experimental work remains to be done in the study of forage. Corn, sunflowers and soybeans have not yet been tested. Annual hay, millet for instance, would probably be non-adaptable owing to the semi-arid nature of the territory. Cereal hay, particularly oat green-feed, though not yet raised as forage on the substation, may perhaps be considered a fairly dependable fodder crop.

Recent introductions in the forage block give promise of regional adaptability. Intermediate wheat grass, Russian wild rye grass, *Elymus sibericus,* Canada wild rye grass, *Poa glauca,* green stipa grass and tall fescue all have given indications of adaptability. Brome grass is considered admirably adapted.

It has been noted herein that varieties of clover have failed to respond in the nursery test rows. Indicating perhaps the research still to be done, it may be noted further that white, a strain of alsike, and occasionally odd patches of red clover, survive and fortuitously propagate in vacant lots and waste areas of Dawson City and Mayo. Both of these places are far north of the substation site. Types of soil may be more determinant than latitude; altitude may be significant also.

On all higher, or upland areas devoted to forage crops, the yields have been consistently light, varying through the years from one-third to two-thirds of a ton per acre. These areas were as a rule of mixed forage varieties. On the other hand many swale areas are to be found in the territory. Most of these areas carry a heavy growth of native vegetation, and under cultivation would no doubt be adaptable to many forage varieties. An area such as this on the substation was converted in recent years and has since become the main source of the farm's forage.

HORTICULTURE

Vegetable Crop

Vegetable culture has been practised in the Yukon valleys for decades. Through the years of the Klondyke gold rush, and even preceding that period, small valley plots had been devoted to the culture of the common vegetables. The produce of the Dawson gardens, both quantity and quality, had become known beyond the territorial borders. The native producer had bragged unashamedly of the superior table virtues of his garden produce when compared with those of similar products imported from southern districts; deterioration of the latter through storage and transportation periods was no doubt disregarded in the controversy. Nevertheless the quality of produce from northern gardens is unexcelled and production of the common garden vegetables is an extremely important enterprise to those confined to hinterland communities.

The following vegetables have been tested in the substation garden, with results as indicated.

Asparagus:—Thus far not productive. Probably non-adaptable. Responds somewhat better in lower valleys.

Beans, Broad:—Occasional maturity. Do very well north in lower locations. Broad Windsor is preferred.

Beans, wax and green podded:—No variety tested had sufficient hardiness to thoroughly mature in the garden plots. Small beans have been gathered from the earliest vines. Contender, Pacer, Strider, Stringless Green Pod and Round Pod Kidney Wax respond most promisingly. Usually injured by unseasonal frosts. (These mature remarkably well in Dawson City gardens.)

Beets:—Mature yearly to prime commercial roots. One of the Detroit Dark Red strains, selection No. 16, annually bolts up to 90 per cent. XXX Globe, Flat Early Egyptian and other Detroit Dark Red selections are perfectly adaptable, and react normally.

Brussels Sprouts:—Improved Half Dwarf, set out as transplants, are generally productive; full maturity may be problematical.

Cabbage:—Most varieties, set out as transplants, have matured abundantly. Golden Acre and Viking Small Early are good as early varieties. Copenhagen Market and Glory of Enkhuizen are good as mid-season; Penn State Ballhead as late and a keeping variety. Savoy types matured in fair percentages most years. Mature heads of late varieties pulled and scaled have weighed up to 26 pounds each. All varieties have matured firm heads from seed sown directly into garden rows; size was nonetheless much smaller and later than were heads from transplants.

Cauliflower:—Set out as transplants, this vegetable does well. Firm mature curds have been harvested that had a pulled weight of 10 pounds each. Any of the Snowball varieties responds well. Firm but smaller curds have been produced from seed sown directly in garden rows; maturity was two to three weeks later than transplants.

Carrots:—Quite adaptable, but yield better in the lighter soils. Chantenay, Imperator and Amsterdam have done well; Nantes, Danvers varieties and Touchon have done well also.

Celery:—Transplanted into cold frame in southern exposure, this vegetable has made good commercial bunches. Salt Lake, (Utah) variety is preferred.

Corn:—No variety has yet reached maturity in the substation garden. Extreme earliness is imperative. The mean summer temperature of the latitude is low for this species, probably too low. Corn responds better in lower northern valleys, but cannot there be rated adaptable.

Cucumbers:—Not adaptable for outdoors. Are invariably raised, and respond productively, in greenhouse. Varieties Marketer, Early Fortune, White Spine and Straight Eight have all done well under substation glass.

Kohlrabi:—Probably adaptable. Not tested in substation garden. Raised successfully at other territorial points.

Muskmelons:—Adaptable only under glass.

Lettuce:—Both head and leaf varieties do well at all territorial locations. Of the leaf varieties Grand Rapids is recommended. For head growth, Great Lakes, or any of the Imperial selections. New York 515 does well also, in fact is first choice on substation.

Onions:—Sown directly into garden rows, onions on the substation have never produced bulbs of commercial size. Sown in flats in the greenhouse, and transplanted, most varieties have produced bulbs sizable and of good quality. All the standard varieties have done well thus transplanted. Onion sets are quite productive. Early Yellow Globe, Red Wethersfield, and Yellow Globe Danvers are all reliable.

Parsley:—Champion Moss Curled variety quite adaptable.

Green Peas:—Most varieties, but particularly the early ones, do well. Later varieties should perhaps be avoided, though most of these are productive in the northern, lower valley locations. Rows of Telephone vines, a late variety, seven feet high and loaded with mature pods, have been photographed in mid-August. That was near N. Lat. 64°. On the substation the Laxton varieties are adaptable. Alton, Selkirk, Wasatch and Engress have also done well. At other locations Homesteader, Little Marvel, Stratagem and American Wonder are highly regarded.

FIGURE 6—View of luxuriant growth of cabbages and potatoes. Photograph taken July 21, 1946.

Parsnips:—Only Harris' Model has been productive. Hollow Crown seldom produced edible roots. On the other hand, all varieties usually respond with perfect root formations in northern valleys.

Peppers:—Adaptable only under glass.

Pumpkins:—Not adaptable outdoors on substation.

Potatoes:—On the substation site a light summer frost is a seasonal menace. A certain risk is borne by the potato grower, more than by the producer of leaf and other root vegetables. An unseasonable frost may impair a promising crop, or at any rate may retard development. Nonetheless the substation has produced seven successive crops, of quality varying from a poor fair, to a fair good. Common scab is becoming somewhat of a problem in older garden sites, particularly in soils with neutral or slightly alkaline reactions. As a rule the lesions are comparatively shallow, and seldom run together, thus the infections may be described as light scab. Infections of rhizoctonia and witches broom are occasionally encountered; early blight was suspected on two occasions. On the other hand the common diseases are seldom active problems. It has been annually noted that potatoes on the lower valley sites acquire a higher degree of maturity, at comparable dates, than do those raised on the substation. Site, soil, altitude and so forth are extremely important to the potato culturist. Varietal choices at Mile 1019 are given here—with some qualifications. Carter's Early Favourite is a white smooth variety of high quality. It yields well, and is one of the earliest maturing varieties in the test. This variety is recommended as one of the most adaptable tested thus far. Canus and Columbia Russet produce nice samples but yields are usually low. It is difficult to disregard the old Irish Cobbler variety; the tubers are rough, and the seed-eyes are deep, but yield and quality are consistently dependable. Vick's Early and, surprisingly, Green Mountain have responded fairly well, though both as a rule are somewhat short of tight-skin maturity. Bliss Triumph produces a few large and many small tubers. Early Ohio was discarded. Epicure yields well but quality is generally low. Netted Gem is too late. Warba, like Bliss, produces a few large and many small, non-commercial tubers.

At this latitude the warm, sandy loams appear much more desirable for potato culture than do the heavier clay loams. At planting time it has been found good practice to plant the sets shallowly, that is, if sprouted, to cover and firm the set only to the tip of the main sprout. At other territorial points Warba, Pontiac, Vick's Early and Green Mountain are favored.

Radish:—Perfectly adaptable up to three periodic sowings. Cherry Belle, Comet, French Breakfast and White Icicle, in that order are chosen here. The root maggot attacks a percentage in later sowings.

Rhubarb:—Adaptable at all points in the territory. If well tended, watered and given nutritional supplements,—liquid from steeped barnyard manure is good—then this plant responds productively. Macdonald is favored. Canada Red is good. Ruby is not so productive, and moreover is susceptible to redleaf disease.

Spinach:—All varieties bolt at an early stage. Swiss chard is considered substitutional at the substation.

Squash:—Non-adaptable in station garden. On the other hand, at more favored sites in the lower valleys, matured squash are yearly produced.

Swiss Chard:—Responds quite well on the substation. Lucullus is the variety recommended.

Turnips—summer:—Perfectly adaptable. Varieties recommended in order of choice are Petrowski, Purple Top Milan and Early White Milan.

Turnips—swede:—Adaptable at most points in the territory. Outstanding in preference is Laurentian, followed eventually by Sutton's Champion, Hall's Westbury and Improved Bangholm, in that order.

Tomato:—Adaptable only under glass in the territory. This fruit has been matured outdoors infrequently, and then only in some sheltered southern exposure. Under greenhouse culture admirable fruit is yearly produced. Vetomold, and other wilt-resistant varieties are preferable under glass. It may here be noted that in some of the territorial greenhouses visited, pruning, particularly of tomato plants, was found to be ruthlessly intensive. In some instances the plants were completely defoliated, nothing but bare stems and odd fruit clusters remained. At this latitude of accelerated seasons moderate and systematic pruning is desirable; defoliation should nonetheless be avoided.

Destructive Insect Pests

Little trouble has thus far been encountered. In the early season some cutworm damage is anticipated, but depredations are seldom extensive. Attacks have heretofore been countered by locating and "picking" the few insects out of seasonal circulation. However, a poisoned bran mixture is maintained available.

The red turnip beetle as a rule is seasonally encountered. Turnips, particularly the summer varieties, and radish suffer most from this pest. A few dustings of the afflicted plants with one or another of the commercial poison dusts, derris or DDT, will control the attack.

It may be said that the cabbage root maggot is seasonally present, yet seldom in devastating numbers. An attack by this insect must be more or less anticipated, since control measures are ineffective once its presence is apparent. Odd plants of cabbage and cauliflower are attacked in the substation garden each year. Chlordane emulsion used when the plantings are set out, will help to control infestation.

No other insect pest has given concern, thus far, in the substation garden. A few grasshoppers are always present, and gophers must be trapped.

Irrigation for the Common Vegetables

For some three years supplemental water has been applied to an area of the garden set aside specifically for the purpose of comparing the results of irrigation versus dry culture.

The two garden blocks in the test were identical in soil, layout and treatment, excepting only that the one block was given supplemental showering, while the other—"dry culture"—received only natural precipitation. The sowings and plantings therein were otherwise identical. Upright standards, with "butterfly" sprinkler heads, were used. Water temperatures in July, were generally in the 60°s, Fah.

It should be noted in the first place that the soil of the whole garden area is a fairly heavy silty clay loam, somewhat inclined to compaction, as distinct from baking.

Under these local semi-arid conditions the results thus far have been somewhat controversial. Briefly it may be reported that only a marginal increase in yields of certain vegetable species has been recovered; other species, on the contrary, have reacted as though the supplemental showering were deleterious.

The leaf vegetables, for instance cabbage, cauliflower, spinach and chard, may be said to have responded with larger head and leaf structure under the sprinklers; conformation and texture were otherwise no more than comparable with similar productions raised in the area of dry culture.

With peas and beans the reaction was more or less negative, beyond a perceptible tardiness to maturity under the showers. It was negative to deleterious with potatoes; the yields were somewhat lighter, and the commercial percentages were lower under irrigation. Carrots, onions and beets were inferior in quality and yield under the sprinklers, when compared with similar species raised in the dry area. Reactions of turnips, lettuce, radishes, and so forth, to supplemental water, were negligible; though in this respect it may be noted that the turnip roots, under the sprinklers, were somewhat larger, yet coarser, than were those raised in the dry area.

In summary it should be recorded that elsewhere in the territory irrigation practices have produced encouraging results. These were obtained on soils more permeable—peat loams, sandy loams—and in locations generally more favorable. Where temperatures are moderate and the seasons are short, much is yet to be learned of irrigation.

Fruits

Currants:—Much time and study has been devoted to these fruits. Currants, red, white and black, were introduced in 1946, by cuttings imported. Mortality was high through the first two seasons, for the weaker plantings succumbed. The remainder struggled through to establishment during successive years, into bush form. Fall frosts probably injure the season's young growth since extensive mortality is recorded each spring. No unit in the plantation has yet achieved a healthy bush stature. Only an odd bush has produced ripe fruit, and this in each case most sparingly. The red variety, Holland, has produced some fruits on lower branches. This is considered the hardiest of the reds. Magnus has produced, also sparingly, during the past two seasons. This is accepted as the most adaptable of the blacks. White Grape has also contributed a few mature berries, thus is considered the hardiest of the whites. In the last year or so powdery mildew has impeded healthy development of the black varieties. A lime sulphur spray is recommended for this affliction. This bush fruit is not cultivated to any extent in the territory; the local gardener points out that he doesn't need to, since the native variety is quite plentiful.

Gooseberries:—Little success has yet been achieved with gooseberries. All importations have sooner or later succumbed. One plant of Oregon Champion made new growth for four seasons, progressively weaker, until exhausted by these futile seasonal efforts. No viable plant remains in the plantation. The wild variety, transplanted, thrives and produces abundantly in the substation garden.

Raspberries:—In this area success remains elusive. A number of varieties have been introduced, and as a rule these have achieved establishment. Through the growing season all varieties make fair cane growth, and flank sucker growth is ruthlessly destroyed. In the fall the canes are laid down and weighted to hold the snow of winter. The following spring rejuvenation is extremely tardy, and new growth is seldom vigorous. The blossom set is generally late, weak and scanty, in fact the aspect of the plantation through the summer is of a species striving for adaptation to the tempo of abbreviated seasons. The rigors of winter can evidently be tolerated, but the period to fruition and re-establishment of cane growth may be too brief. Severe fall frosts may also be damaging to the young canes. Odd mature fruits are formed from the earlier blossoms, yet the fruits of mid-season seldom fill out but remain on the canes green, dwarfed, and immature. In the meantime the canes of the current season have emerged and attained natural growth. This cycle is thus more or less repeated each year. Starlight, Chief, Herbert, Adams

Number 87 and Latham, in that order, are considered the hardiest. Fruit of Starlight is of poor quality and the variety is a light producer. At various points in the territory this species responds and fruits productively. The soil factor may be potent in this, or it may be a locational problem. Wild fruit is abundant to N. Lat. 64°.

Strawberries:—Encouraging, yet far from complete success, has been achieved with the strawberry. Many of the commercial varieties have been introduced but most of them have eventually succumbed. A survivor plant of the Dunlap variety has come through four winters, never vigorously, but propagation from its runners has established a small plot that now appears fairly adaptable. This little bed produces sparingly but it is hoped that selection may improve this. A similar story may be recorded for two plants of Pixie. This bed is quite small, and the plants therein lack vigor, yet establishment seems assured. Another variety, an unnamed hybrid, is quite hardy and adaptable. Its fruit lacks quality and its productiveness is somewhat disappointing. The original plants, as Sitka hybrids, were secured from an Alaskan plantation. At this latitude all plants benefit by winter protection and native moss is admirably suited for the purpose.

Sandcherries:—The bush growth of this fruit appears fairly hardy. Some tip-killing is recorded each spring. Fruits set as a rule on the lower branches, but nothing approaching maturity has been observed through five seasons. The Manmoor variety has set fruit consistently.

Plums:—All attempts at establishment have failed. Occasionally an odd root survived a winter but the growth of the following season was weak and the unit eventually succumbed.

Apples and Crabs:—Siberian Red seedlings were introduced in 1946. Eight out of twenty-four of these seedlings have survived. Through the years mouse girdling and winter-killing have held the young trees down to bush growth of 36 inches or so. No blossoms have yet been formed. Later additions include crab and apple crab selections. Of these Adam and Dauphin came through the first winter unimpaired and show a promising degree of adaptability. Trail succumbed the first winter. Heyer No. 12 appears encouragingly adaptable. This latter, and an unnamed variety, reputedly survived and bore fruit at Dawson City, N. Lat. 64°.

Saskatoons:—A Beaverlodge Experimental Station selection, No. 9, was introduced in 1946. Establishment was slow yet mortality was insignificant. In 1952 the rows produced fruit abundantly; the bush growth was six feet high, with a similar girth measurement. This species, though native of the west, is found only occasionally in the southern Yukon. On the other hand it is reputedly quite plentiful in the northern territory, in fact an established transplantation thrives and produces in a garden at Mayo, N. Lat. 63° 30′.

Ornamentals

Greene's Mountain Ash, *Sorbus scopulina:*—Precariously established. Most of seasonal growth is killed during successive winters.

Native *Sorbus americana:*—Material was unfortunately bruised when secured in its habitat near Bennet Lake, Y.T. Subsequent establishment in substation garden, after three seasons, is still uncertain.

Silver Buffaloberry, *Shepherdia argentea:*—Apparently hardy, but somewhat unresponsive. Seldom injured through winters but seasonal growth is insignificant.

Pygmy Peashrub, *Caragana pygmaea:*—Well established for three years. Killed out completely winter of 1951-52.

Chokecherries, Yellow, *Prunus virginiana:*—Quite hardy and adaptable. Established in 1946. Has not yet bloomed.

Golden Clematis, *Clematis tangutica:*—Hardy and well established; appears perfectly adaptable. Climbs and blooms freely.

Hedge Cotoneaster, *Cotoneaster acutifolia:*—Slow to develop but quite adaptable. Blooms freely.

Elder, European red, *Sambucus racemosa:*—Tender. Grows rapidly throughout the season, but each winter the growth is killed down to ground level.

Honeysuckle, *Lonicera tatarica:*—Has responded quite well, and blooms freely. Some degree of winter injury occasionally.

Lilac, *Syringa dilitata* hybrid:—Probably not adaptable. One small bush has survived for five years; injured through winters. Seasonal growth quite insignificant. Has not yet bloomed.

Hybrid lilac, *Syringa* var. Jessica:—Identity not certified, believed correct. Plants semi-hardy. Blooms annually, somewhat sparingly; once profusely.

Manitoba Maple, *Acer negundo:*—Only semi-hardy. Seasonal growth regularly killed through winter.

European Bird Cherry, *Prunus padus commutata:*—Falsely called the May-day tree. Hardy and adaptable. Has made fair growth through five years; occasionally slight winter injury. Has not yet bloomed.

Northwest Poplar, *Populus petrowskyana:*—Semi-hardy, yet progressively showing some adaptability. Injured extensively through first winter; less in recent years.

Griffin Number 4:—Much like Northwest in adaptability. Upright form.

Pear, *Pyrus ussuriensis:*—Ornamental, came through one winter unimpaired.

Rose, Altai, *Rosa spinossima Altaica:*—Quite hardy, blooms freely each season. Single cream blooms.

Rose hybrid Betty Bland:—Adaptable. Little winter injury. Has bloomed freely each year. Pink, double.

Rose, hybrid Hansa:—Fairly adaptable. Has bloomed freely. Double, red, fragrant.

Rose, hybrid Harison's Yellow:—Questionable. Kills back extensively. Has not yet bloomed.

Rose, hybrid Yatkan:—Precariously established. Has not yet bloomed.

Germander Spiraea, *Spiraea chamaedryfolia:*—Quite adaptable. Blooms freely each season.

Spiraea media:—Very good. Blooms freely each season.

Spruce, Colorado, *Picea pungens:*—Probably not adaptable. Through five years has made insignificant growth, yet precariously survives. All top growth injured in 1950-1951 by frost.

Willow, Silky White, *Salix alba sericea:*—Struggled to establishment for years, then succumbed.

Perennials

Aquilegia vulgaris, Common Columbine, Long spurred hybrid:—Semi-adaptable. Plants set out responded fairly well. Later one by one succumbed. Native variety abundant.

Dicentra spectabilis, Bleeding Heart, Common:—Adaptable. Blooms freely each year.

Delphinium, Wrexham strain:—Perfectly adaptable. Blooms lustily each year.

Delphinium, Pacific hybrids:—Perfectly adaptable. Blooms lustily each year.

Dianthus deltoides, Maiden Pink:—Fairly adaptable. Winter protection advisable.

D. plumarius, grass pink:—Fairly adaptable. Winter protection advisable.

Hemerocallis, Daylily, Dr. Rigel:—Became fairly adaptable. Now blooms sparingly.

H. Middendorffii:—Became fairly adaptable. Now blooms sparingly.

Margaret Perry:—Became fairly adaptable. Now blooms sparingly.

Dragoman:—Perhaps the sturdiest.

Hesperis matronalis, Dames Rocket, Biennial:—Adaptation questionable. Young plants survived one winter 50 per cent. Succumbed later through season. Did not bloom.

Iris, Native:—Responds quite well under cultivation. Blooms profusely.

Iris sibirica, Ottawa hybrids:—Introduced in 1952 to fair establishment.

Paeonia:—Peonies required a year or two to achieve adaptation.

Duchess de Nemours:—White.

Festiva Maxima:—White.

Inspector Lavergne:—Crimson.

Reine Hortense:—Pink.

Sarah Bernhardt:—Pink. All the above responded slowly and with little vigor for two seasons. Subsequently the varieties listed achieved fair establishment. All have bloomed, the first two quite freely.

Polemonium caeruleum, Greek Valerian:—Semi-hardy, worth trial.

Scilla sibirica, Siberian Squill:—Not readily adaptable; after three years 20 per cent of roots precariously hanging on. Might do better planted in sand, with sand mixed in subsoil.

Veronica spicata, Spike speedwell:—Quite hardy. Recommended for borders.

The following short list is appended suggesting other perennial species that may prove adaptable; many of them have responded elsewhere in the Territory. *Aster alpellus;* Monkshood, *Acontium roseum; Chrysanthemum,* Alaska, Shasta Daisy; *Heliopsis Scalera* Var. incomparabilis, Sunflower; *Lavatera thuringiaca,* Rose Mallow; *Linum perenne,* Perennial Flax; *Lythrum salicaria,* Purple Lythrum; *Penstemon acuminatus,* Sharpleaf Penstemon; *Phlox paniculata,* Summer Phlox, and we suspect, others. It's probably advisable that the importation of nursery stock be made in the fall months, whenever practicable. If, upon arrival, establishment of the material is impossible, then it may be heeled-in for the winter. On the other hand, if spring importation is attempted, the material will arrive at this latitude, well out of dormancy, at least fully burgeoned or even in early leaf. As a rule this state is in anticipation of the local season by some ten days. Thenceforth, through the harsh pre-summer conditions, these importations must struggle, out of step as it were, to readjustment. Through that period many of the tenderer species succumb.

Annual Flowers

It should be noted here that the following list may not, in fact does not, include all the species and varieties found responsive in the Territory. Soil, location, altitude and so forth give variable results; blooms have been observed elsewhere in the valleys that have either failed, or have not yet been found adaptable on the substation. Some of the following make a far better showing if started indoors and carefully transplanted later; these are indicated by asterisks. Root masses should be disturbed as little as possible when transplanted.

Sweet Alyssum, *Lobularia maritima:*—Good, particularly for border.

**Antirrhinum majus,* Common snapdragon:—Very good.

Brachycome, Swan River Daisy:—Good.

Rocket Candytuft, *Iberis amara:*—Showy and quite hardy.

**Calendula officinalis,* Pot Marigold:—Very Good.

**Coreopsis:*—Worthy of trial.

Centaurea, (Bachelor's Button) Cornflower:—Excellent.

Clarkia elegans, Rose Clarkia:—Good.

Ipomea tuxtlensis var. Heavenly Blue, Morning Glory:—Good.

**Cynoglossum amabile,* Chinese Houndstooth:—Worthy trial.

Dimorphotheca aurantiaca, Cape Marigold:—Excellent. One of the hardiest, and most conspicuous.

Gypsophila elegans, Common Gypsophila:—Very good.

Godetia viminea, Orchid Godetia:—Very good.

**Helichrysum bracteatum,* Straw flower:—Fair, and worthy trial. Flowers keep as everlasting.

Linum grandiflorum var. Scarlet Flowering Flax:—Excellent.

Lobelia erinus, dwarf, Snowball:—Very good, particularly for borders.

Mignonette:—Excellent.

**Tropaeolium,* Common nasturtium:—Good. Like sunny spot, house front.

Nemesia strumosa, Nemesia:—Very good.

Nigella damascena, Love-in-a-Mist:—Very good. Excellent for cutting.

Viola tricolor hortensis, Garden Pansy:—Excellent. Good culture gives monster blooms.

Petunia, Hybrida, Common petunia:—Very good.

Eschscholtzia california, California Poppy:—Excellent. Most varieties respond and bloom profusely. The California poppy, Eschscholtzia, highly recommended.

Portulaca grandiflora, Common Portulaca:—Fair. Brilliant coloring but extremely tender. A favored location recommended.

Salpiglossis sinuata:—Very good.

Salvia splendens, Scarlet Salvia:—Worthy a trial.

Schizanthus pinnatus, Wingleaf Butterflyflower:—Recommended.

Lathyrus odoratus, Sweet Peas:—Very good, particularly when started indoors, and transplanted to site; a south-side wall site is desirable. The Cuthbertson strain is excellent.

**Tagetes erecta,* African Marigold:—Really a dwarf marigold. Attractive edging. Good.

Tagetes patula, French marigold:—Fair to good.

Zinnia elegans, Common zinnia:—If started indoors, and transplanted carefully to warm, favored spot, then worthy of trial. Otherwise not recommended.

Sprinkling of tender vine growth to protect from frost injury

A plot of potatoes was set aside for this test in 1951, and again in 1952; it was proposed to spray the tender foliage during the short early morning when freezing temperatures were recorded.

The sprinklers were the rotating type now commonly used for irrigation purposes. The water was provided by a small stream flowing past the garden area, and some 600 feet from the designated plot. A centrifugal pump, powered by a small gasoline unit, forced the water up to the sprinklers.

A signal bell, thermostatically controlled, warned the gardener in his quarters when a lowering frost blanket was threatening. At a recording of 32° Fah. the unit was activated and the sprinklers commenced spraying the potato vines. Until the thermometer again registered a frost-free recording the sprinklers continued to function.

This occurred upon a number of occasions each year; in each instance the protected vines revealed no sign of injury. The vines of other plots, adjacent, yet not so protected, were obviously injured in varying degrees.

Upon the last two occasions in 1952, during early September, the recordings were of six and of thirteen degrees of frost. During the latter visitation the sprinklers continued to spray for hours before relief readings were recorded. By that time the vines were completely encased in ice. Later, as the morning sun became effective, the icicles fell away; subsequent observation during the day revealed no frost injury to the potato vines.

POULTRY

In 1947 facilities were devised for the establishment of poultry. At this latitude winter temperatures posed the problem of housing with or without supplementary heat. Poultry had been maintained in the territory heretofore, small flocks as a rule, and not as commercial enterprises but as ventures contributory to frontier tables.

Housings in these cases, generally quite primitive, were as a rule, equipped with wood-burning heaters; types of installations varied but the purpose was one—to provide supplementary heat through the coldest winter months.

This method, and the results of the application thereof, appeared somewhat controversial. The danger from fire, the chore of management, the regulatory control of supplementary heat units, and so forth, were immediate considerations. Further, from a hygienic point of view, it was not known what the effect would be on the flock of a highly fluctuating temperature, inevitable with this system.

On the other hand, since temperatures at this latitude are but briefly more frigid than are those customarily encountered at poultry establishments in the northern mid-west, it was thought that an insulated building, substantially constructed, and with a ventilation system scientifically installed, might be practicable and equally efficient. Eventually the latter method was adopted.

In May of 1947 the first batch of chicks was received and placed in a small building secured and converted into a brooder house; this house was equipped with a wood-burning brooder stove and a canopy hover. In the meantime a poultry-house was under construction. Only the outer walls were non-con-

ventional. Two-by-four studdings were used, yet wall spacings were three-cell as it were, as distinct from one. The siding material was dry, trimmed spruce slabs, then two-ply tar paper over one-inch rough lumber, then two-by-four studding with interstices packed with dry shavings; then one ply rough lumber, then two-by-four studding, then one-inch rough lumber—these interstices were not filled; then two-by-four studding and again rough lumber; these interstices were also filled with dry shavings. On the inside face of the last ply of rough lumber was a two-ply sheathing of tarpaper, and over that an inside wall finish of used donnaconna wallboard. Thus the main walls. The ceiling was finished with tarpaper sheathing under donnaconna. Over the ceiling a layer of shavings 12 inches deep was packed.

A small window aperture, six feet from floor level, at the west end of the building was converted into a fresh air intake; a simple arrangement by which a sliding panel could be regulated to various spaced openings, from a quarter-inch to a six-inch aperture. Inside, at the east end, ten inches from floor level, an outlet was constructed. This was a seven-inch stove pipe, boxed and fitted with a conventional damper; the boxed pipe extended up through the roof, and out some 24 inches above peak level.

To maintain a fairly constant inside temperature through extremely cold weather, it was eventually determined that a circulatory ratio of, roughly, one to three was more or less satisfactory; that is, an intake aperture of a 6-inch area was comfortably co-ordinative with an outlet of about 18-inch area. Some experimental adjustments would be necessary in any event with each individual installation. The outlet pipe exposed above the peak of the building was eventually insulated to prevent frost accumulation inside the pipe. This is vital in cold weather since outlet dimension decreases rapidly with progressive crystalization inside the flue.

It is understood of course that the bird population is more or less maintained at the maximum level, i.e., one bird per three and a quarter square foot of floor space. That would depend, in slightly varying degree, upon bird, or breed size.. It was found adaptable on the substation with Barred Plymouth Rocks. With the smaller Leghorns a three-foot spacing might be found adequate. Through winter periods of low recording, the inside temperature, one foot above floor level in the substation poultry-house, has seldom fallen below the low plus twenties, Fah. Fractional adjustment of intake or outlet vent can effectively alleviate discomfort inside. Storm sash are now winter fixtures on all south-side windows.

The prospective poultry husbandman of the territory should plan to raise, or otherwise economically secure, local-grown feed; at any rate all his forage and coarse grains. While the prices of eggs and poultry here are relatively high, so are all freight tariffs into the territory. Importation costs of feed may, and probably would, dissipate the profits of the venture. Excellent coarse grain and forage feeds have been raised on the substation for seven successive years.

Fresh eggs and poultry meats find ready sale in the territory.

The flock at the substation has not yet reached the higher levels of winter production, possibly because of a dietary deficiency. A 60 to 70 per cent production figure is aimed at. Experimental feeding programs and varying diets are being investigated. Some feather-picking has been encountered and infrequently a trend to cannibalism, otherwise each successive chick flock has achieved content and productivity.

Owing to the substation's frontier location on an international highway, some member of the staff remains on duty during the week-ends and holidays, through the active months of the summer for the convenience of highway travellers who seek information regarding the substation's activities.

OFF-STATION CO-OPERATIVE ACTIVITIES

Commencing in 1947, a certain amount of co-operative experimentation was undertaken in the territory, between student staff members on the one hand, and resident agricultural operators on the other.

It should be made clear at once that none of the territorial resident operators is wholly engaged in, and dependent for his living solely upon the returns from agriculture. Invariably each operator's interests are multiple, thus his revenue from the land is contributory to his main source of income which may be trapping, freighting, guiding, or even a town business.

At strategic points circumscribed blocks of this cultivated land, by mutual arrangement, were set aside for small-plot experimentation by members of the substation staff. A staff member journeyed to each selected site during the spring months, and established small plots of cereals and forage. In late August the same staff member again visited the sites, harvested the cereal, and secured notes on the forage plots. In this manner, through the years, fundamental information has been revealed. For instance, it has been determined what forage varieties were adaptable, and what cereals matured. On the other hand, yield figures, particularly of cereals, are still incomplete, since predatory rodents, foraging stock, and incursions of native and noxious weeds, all threaten a small and isolated block of field crops.

Briefly summarizing, mature wheat, oats, and barley have been harvested from these co-operative ventures at Mayo Landing, the Pelly River valley, the Stewart valley and the Klondyke; samples occasionally frost blemished. Forage legumes have survived and produced at similar interior points in the territory. Most of the hardy forage grasses, i.e., brome, slender wheat grass, crested wheat grass, creeping red fescue and Kentucky blue, at any rate have proved hardy and adaptable.

An old claim in the Stewart valley was examined a few years ago; it had been sown to brome grass in 1917, and harvested as horse feed for three years thereafter, then abandoned. When examined in 1947 the brome crop, lush and thrifty, was still in control, despite young poplar and willow growth then incursive in the area.

ACTIVE PROJECTS

Cereals

Testing Spring and Winter Wheat Varieties and Strains in Replicated Plots; Physiological Studies with Spring Wheat. Testing Oat Varieties and Barley Varieties in Replicated Plots.

Forage

Alfalfa, a Comparative Test of Varieties; Plant Introduction and Testing of New Species.

Field Husbandry

Chemical Fertilizer Trials for Wheat; Manure and Commercial Fertilizer Combinations for Grain; Dates and Methods of Plowing; Rotation Experiments; Farm and Garden Tractor Operating Costs and Utility.

Horticulture

Adaptability trials for Annual Flowers; Herbaceous Perennials; Roses, Trees and Shrubs; Bush and Tree Fruits; Strawberry Trials; Perennial, Root, Leafy and Leguminous Vegetable Trials; Frost Prevention by Sprinkler Irrigation.

EDMOND CLOUTIER, C.M.G., O.A., D.S.P.
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