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FARMING POTENTIAL OF THE CANADIAN NORTHWEST

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A FARM IN THE CANADIAN NORTHWEST

The methods of raising livestock and growing crops in the Canadian Northwest are similar to those in other areas. The most important differences are caused by the short growing season, which makes the timing of field operations and the selection of the best varieties vital to success.

The advantages of the lower land and higher produce prices compared to the developed southern areas are often outweighed by the lower yields, smaller production units, and higher equipment and supply costs.

There are few agricultural services in the Northwest and success depends on the experience and planning ability of the individual. No two enterprises are entirely alike and the successful farmer must be able to:

- Determine if the local market will accept his product and in what quantity
- Determine the production cost and weigh it against the cost of importing the product
- Ensure that every piece of equipment and all supplies are on hand and ready for use when needed
- Provide his own repair and veterinarian services
- Consistently produce a high-quality product
- Grade and otherwise prepare the product for market
- Market the product.

Many areas of the Canadian Northwest are growing rapidly and, therefore, the opportunities are changing. What is not economically feasible today may be highly profitable next year or the year after.

FARMING POTENTIAL
OF THE CANADIAN NORTHWEST

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INTRODUCTION

Agricultural research establishments in the Canadian Northwest receive many inquiries about farming in the agriculturally undeveloped areas of the north. No one can give a firm answer about the feasibility of many of the proposals without knowing a great many details. This publication attempts to answer many of the questions that are asked about farming in northern Alberta, British Columbia, and the Northwest and Yukon territories. It was prepared to assist prospective farmers to determine the feasibility of their farming plans.

At one time church missionaries raised livestock and had gardens in many parts of the Northwest to supply their missions. With improved transportation facilities, however, the need to provide their own food has almost disappeared. All livestock raising has been discontinued and the gardens have been reduced in size or eliminated.

In the early 1900s, the Canada Department of Agriculture started production research at several locations in the Northwest. In many places there was cooperation with the missionaries. In 1944 an experimental farm was established at Mile 1019, on the Alaska Highway near Haines Junction, Yukon; and in 1948 a farm was organized at Fort Simpson, Northwest Territories. These farms have been closed recently.

This publication contains a summary of the results obtained at the research establishments, and, where available, the experiences of the missionaries and pioneer farmers. Most of what is known about agriculture in the Canadian Northwest is summarized in this publication and those that are listed in the bibliography.

The main attraction of farming in remote areas appears to be the low price of land and the high price of produce. There are, however, many disadvantages. The yields of most crops are only 70 percent of those obtained in the Peace River region, and limited markets restrict the amount of mechanization that can be used economically. The cost of bringing in equipment and supplies is high. In many parts of the Northwest there are no special arrangements for purchasing or taxing land to be used for agricultural purposes. There are no low-interest farm loans or other financial assistance; no agricultural extension or veterinary services; no agricultural machinery, fertilizer, spare parts, feed supplement, or veterinary supply dealers; no agricultural machinery repair services; and no organized marketing.

Many of these disadvantages will change, but until they do the successful farmer must be his own buyer, grower, repairman, veterinarian, processor, and salesman. He must be an experienced manager and ensure that every bit of machinery, fertilizer, and other supplies are on hand when required.

CLIMATE

Climate is the main factor that determines what can be grown in an area. As one goes north, temperatures are generally lower, rainfall is less, and the growing season is shorter. These disadvantages are partially compensated for by the large number of hours of light per day during the growing season.

Cool-season crops can be produced successfully north of 55° latitude if three basic temperature requirements are met.

A killing frost-free period of at least 80 days. Most crops and garden plants are not damaged when the temperature drops to 32°F (0°C) or a degree or two lower, unless they are at a very vulnerable stage. The frost-free period, therefore, is determined from the date of the last killing frost in the spring to the first killing frost in the fall. A killing frost is considered to occur when the temperature in a screened cage 4 feet above the ground is 28°F (-2.2°C) or lower.

A growing season or vegetative period of 110 days. Below 42°F (5.6°C) most cool-season crops will not grow, so the growing season is the period when the mean daily temperature is above 42°F (5.6°C).

An accumulation of 1,000 growing degree-days. Heat for plant growth is measured in terms of heat units or growing degree-days. The basic temperature for cool-season crops is 42°F (5.6°C). This temperature is subtracted from the mean temperature for the day to give the heat units. Thus, a day with a mean temperature of 43°F would have one degree-day and a day with a mean of 64°F would have 22 degree-days.

In addition to these three temperature requirements, the plants must have moisture. Precipitation is generally low during the growing season in the Northwest, but because of low evaporation from the soil and low transpiration from the plants less water is required than further south. Precipitation is usually sufficient to produce a crop, but in many years irrigation will increase the yield of most crops.

To summarize, the climatic requirements for successful crop production north of 55° latitude are:

- A period of 80 days free of a killing frost
- A vegetative period of 110 days
- An accumulation of 1,000 growing degree-days
- Adequate precipitation during the growing season.

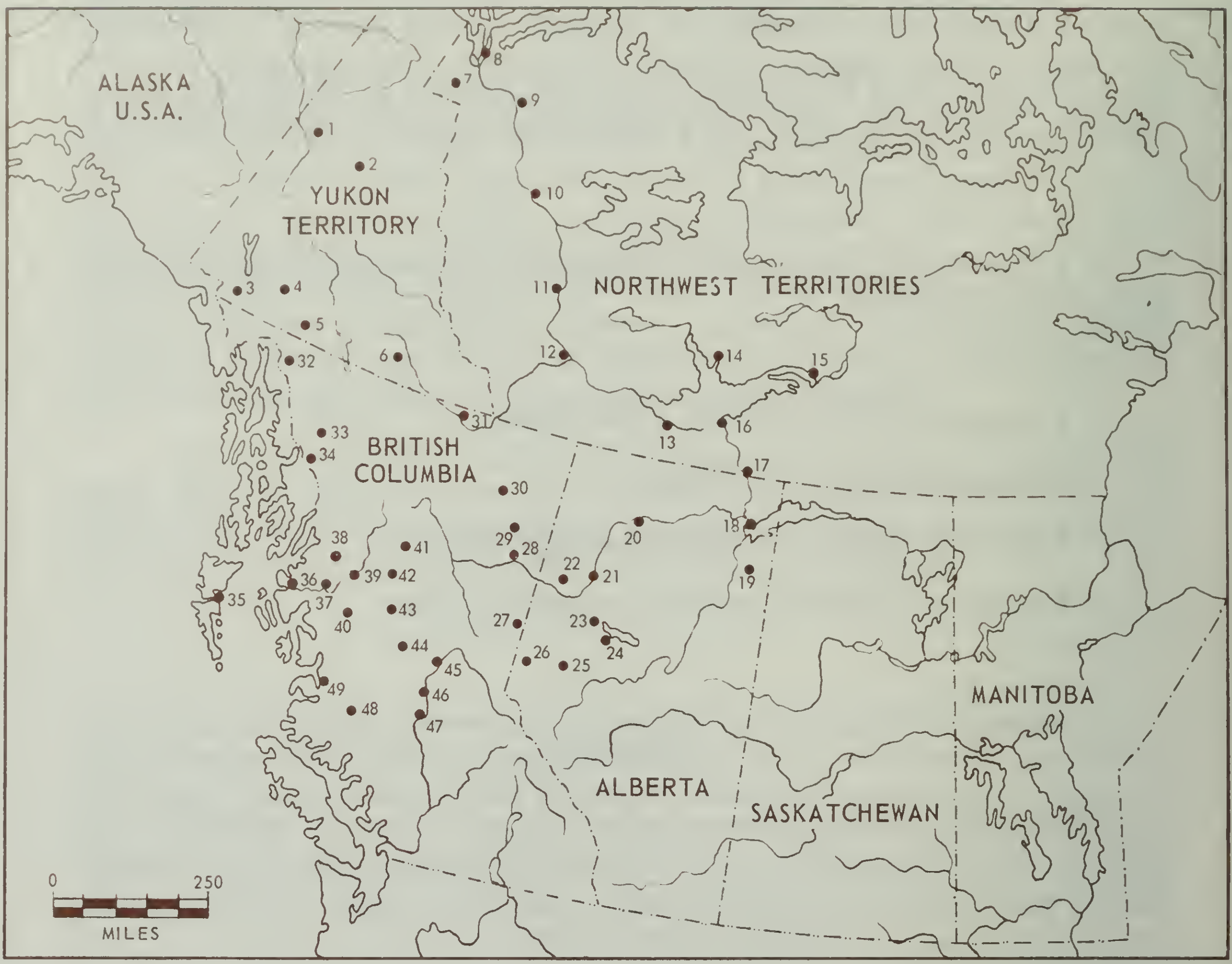
Because of the longer days the above requirements can be reduced slightly as one goes further north. Also, in favorable seasons or with special equipment and care, good crops of some cool-season vegetables can be produced even though the above climatic requirements are not met. For instance, at Inuvik where the killing frost-free period averages 90 days, the vegetative period 96 days, and the number of growing degree-days 964; cabbage, lettuce, cauliflower, broccoli, and other garden produce can be grown successfully (Harris, 1970).

The average length of the growing season, vegetative period, and the number of growing degree-days for 49 locations (Figure 1) are given in Table 1, which shows areas where the production of cool-season crops is possible. The number of frost-free days and the dates of first and last frost on a basis of 32°F (0°C), which are given in Table 2, are useful in determining when to plant in each area. The same measurements are shown for several agricultural areas for comparison.

The climate of a locality is measured by instruments kept in one place for several years. These instruments measure only the conditions in the immediate vicinity, but hills, large rivers, and lakes can induce local effects or microclimates so that a short distance away the climate can be quite different.

Usually, rivers and lakes improve the climate by lessening the frequency of late-summer and early-fall frosts, whereas in deep, narrow valleys frostiness increases. Generally, as one goes up a slope or approaches a range of hills or mountains, the temperature is cooler, but summer frosts may be less frequent. All these factors must be considered when choosing locations for farming or gardening.

Figure 1. Locations of sites for which meteorological data are given in Tables 1 and 2.



1. Dawson City
2. Mayo Landing
3. Mile 1019
4. Whitehorse
5. Teslin
6. Watson Lake
7. Fort McPherson
8. Inuvik
9. Fort Good Hope
10. Norman Wells
11. Wrigley
12. Fort Simpson
13. Hay River
14. Yellowknife
15. Fort Reliance
16. Fort Resolution
17. Fort Smith
18. Fort Chipewyan
19. Fort McMurray
20. Fort Vermilion
21. Peace River
22. Fairview
23. High Prairie
24. Wagner
25. Grande Prairie
26. Beaverlodge
27. Dawson Creek
28. Fort St. John
29. Beatton River
30. Fort Nelson
31. Smith River
32. Atlin
33. Dease Lake
34. Telegraph Creek
35. Sandspit
36. Prince Rupert
37. Terrace
38. New Hazelton
39. Smithers
40. Wistaria
41. Germansen Landing
42. Babine Lake
43. Fort St. James
44. Vanderhoof
45. Prince George
46. Quesnel
47. Williams Lake
48. Kleena Kleene
49. Bella Coola

Modifying the Microclimate

Man cannot change the climate over a large area, but he can modify it in local areas:

- The danger of frost can be reduced by clearing a path through the trees at the bottom of a slope to allow the heavy cold air to move down.
- Shelterbelts on the windward side of an area reduce wind. In tests a single row of white spruce 25 feet (7.6 m) high reduced wind velocity 50 feet (15.3 m) away by 80 percent, and 250 feet (76.2 m) away by 25 percent. This resulted in a 40 percent reduction in evaporation 50 feet (15.3 m) away and a 10 percent reduction 250 feet (75 m) away. The reduction in wind also results in increased air temperatures; less soil and snow drifting; reduced bruising, abrasion, and lodging; and increased yields (Harris and Carder, 1969).
- Sprinkler irrigation applied while the temperature is 32°F (0°C) and lower protects plants from frost damage. As little as 0.12 inch (0.30 cm) of water per hour prevents freezing of peas with air temperatures as low as 19°F (-7.2°C).
- Clear polyethylene mulches raise the soil temperature as much as 12°F (6.6°C).
- Clear polyethylene mulches over ridges of soil raise the soil temperature as much as 16°F (8.8°C).
- Plastic and glass shelters raise air temperatures and protect plants from some frosts.

TABLE 1. KILLING FROST-FREE PERIOD, VEGETATIVE PERIOD, AND NUMBER OF DEGREE-DAYS AT 49 LOCATIONS IN THE CANADIAN NORTHWEST

Station	Killing frost-free period, 28°F						Vegetative period, 42°F				Degree-days	
	No. of years	Longest in days	Shortest in days	Average in days	Average date of frost Last	Average date of frost First	No. of years	Average no. days	Average date started	Average date ended	No. of years	No. of degree-days
Yukon Territory												
Dawson	29	142	63	119	May 17	Sept. 12	10	136	May 5	Sept. 18	29	1,636
Mile 1019	22	86	16	52	June 21	Aug. 14	21	122	May 19	Sept. 19	20	605
Mayo Landing	30	121	32	96	May 25	Aug. 28	10	138	May 6	Sept. 21	30	1,349
Teslin	20	126	74	94	June 2	Sept. 3	10	138	May 9	Sept. 24	20	1,159
Watson Lake	28	145	76	118	May 19	Sept. 13	10	144	May 6	Sept. 27	28	1,574
Whitehorse	20	143	94	118	May 19	Sept. 13	10	143	May 6	Sept. 26	20	1,437
Northwest Territories												
Fort Good Hope	20	123	32	91	May 28	Aug. 26	10	119	May 19	Sept. 15	20	1,269
Fort McPherson	17	129	65	104	May 28	Sept. 10	10	93	May 31	Sept. 1	—	—
Fort Reliance	17	145	95	118	June 2	Sept. 27	10	107	June 3	Sept. 18	17	1,199
Fort Resolution	20	148	104	126	May 26	Sept. 29	10	130	May 17	Sept. 24	20	1,658
Fort Smith	20	137	48	100	June 2	Sept. 8	10	141	May 6	Sept. 24	20	1,563
Fort Simpson	20	149	86	119	May 18	Sept. 13	10	138	May 8	Sept. 23	20	1,825
Hay River	20	154	99	126	May 23	Sept. 25	10	130	May 19	Sept. 26	20	1,633
Inuvik	20	123	37	90	June 12	Sept. 9	11	96	June 1	Sept. 4	20	964
Norman Wells	20	145	84	115	May 22	Sept. 13	10	124	May 16	Sept. 17	20	1,598
Wrigley	18	147	75	110	May 26	Sept. 12	10	130	May 10	Sept. 16	—	—
Yellowknife	20	151	100	127	May 23	Sept. 26	10	125	May 19	Sept. 21	20	1,656

TABLE 1 CONT.

Northern Alberta												
Beaverlodge*	22	166	111	134	May 8	Sept. 19	10	155	April 30	Oct. 2	10	2,085
Fairview*	29	176	109	136	May 7	Sept. 19	20	154	May 2	Oct. 3	29	2,000
Fort Chipewyan	6	171	110	136	May 13	Sept. 26	6	139	May 10	Sept. 27	–	–
Fort Vermilion*	29	147	80	116	May 20	Sept. 11	10	155	April 27	Sept. 29	29	1,862
Grande Prairie*	20	170	98	131	May 8	Sept. 15	22	155	May 2	Oct. 4	20	1,931
Fort McMurray	19	146	28	103	May 27	Sept. 6	10	151	May 1	Sept. 29	19	1,659
Peace River*	15	153	111	130	May 14	Sept. 21	14	148	May 3	Sept. 29	5	2,120
Wagner	21	165	83	123	May 20	Sept. 20	10	150	May 1	Sept. 28	21	1,819
High Prairie*	9	159	65	127	May 16	Sept. 19	7	156	May 1	Oct. 4	7	2,122
Northern British Columbia												
Atlin	–	–	–	–	–	–	–	–	–	–	–	–
Beatton River	19	138	62	107	May 21	Sept. 4	19	137	May 10	Sept. 23	19	1,337
Dawson Creek*	11	148	101	122	May 14	Sept. 14	10	143	May 6	Sept. 26	5	2,200
Dease Lake	20	128	45	85	June 7	Aug. 30	10	134	May 12	Sept. 24	20	991
Fort Nelson	22	156	113	133	May 11	Sept. 21	10	152	April 30	Sept. 29	10	2,169
Fort St. John*	20	162	121	142	May 2	Sept. 19	10	145	May 7	Sept. 28	20	1,989
Germansen Landing	14	128	80	109	May 27	Sept. 12	10	145	May 7	Sept. 28	–	–
Smith River	20	126	61	90	June 1	Aug. 29	10	126	May 14	Sept. 17	20	1,217
Telegraph Creek	–	–	–	–	–	–	–	–	–	–	–	–
North Central British Columbia												
Babine Lake	12	123	73	95	June 4	Sept. 6	12	133	May 14	Sept. 24	12	1,128
Bella Coola	30	267	127	184	April 18	Oct. 19	22	208	April 4	Oct. 29	30	2,570
Fort St. James	26	134	66	108	May 28	Sept. 12	21	151	May 6	Oct. 5	26	1,511
Kleena Kleene	19	106	27	68	June 20	Aug. 27	21	147	May 10	Oct. 4	19	908
New Hazelton	20	166	96	134	May 16	Sept. 27	10	176	April 18	Oct. 11	–	–
Prince George*	20	146	76	114	May 23	Sept. 12	10	162	April 30	Oct. 9	20	1,602
Prince Rupert	26	302	189	252	Mar. 19	Nov. 25	10	213	April 12	Nov. 11	26	2,152

TABLE 1 CONT.

Quesnel*	29	179	117	146	May 10	Oct. 2	22	177	April 22	Oct. 16	29	2,342
Sandspit	18	339	200	255	Mar. 21	Nov. 30	18	211	April 18	Nov. 15	18	2,239
Smithers*	29	137	61	95	June 1	Sept. 5	10	163	April 29	Oct. 9	29	1,292
Terrace*	18	251	168	200	April 21	Nov. 7	19	185	April 17	Oct. 19	5	2,385
Vanderhoof*	17	126	77	97	June 4	Sept. 11	10	170	April 26	Oct. 13	–	–
Williams Lake*	9	163	104	138	May 9	Sept. 24	8	167	April 26	Oct. 11	–	–
Wistaria	30	134	78	111	May 28	Sept. 15	22	143	May 11	Oct. 3	30	1,314

*Established agricultural areas for comparison

TABLE 2. ELEVATIONS AND PRECIPITATION DURING FROST-FREE PERIOD AT 49 LOCATIONS IN THE CANADIAN NORTHWEST

Station	Elevation in feet	Precipitation May – Sept. 65-69	No. of years	Frost-free period, 32°F: Longest in days	Shortest in days	Average in days	Average date of frost: Last	First
Yukon Territory								
Dawson	1,062	7.10	30	126	28	83	June 1	Aug. 24
Mile 1019	2,000	6.00	22	38	4	21	July 11	July 31
Mayo Landing	1,625	6.74	30	107	20	62	June 9	Aug. 11
Teslin	2,300	6.19	17	96	43	69	June 16	Aug. 25
Watson Lake	2,248	8.38	22	127	46	96	May 29	Sept. 2
Whitehorse	2,289	5.77	26	127	26	87	June 5	Aug. 31

TABLE 2 CONT.

Northwest Territories								
Fort Good Hope	214	7.24	15	97	45	70	June 6	Aug. 17
Fort McPherson	150	4.24	30	104	9	75	June 9	Aug. 23
Fort Reliance	539	6.37	12	123	63	89	June 20	Sept. 17
Fort Resolution	549	5.15	30	121	41	101	June 4	Sept. 13
Fort Smith	680	7.98	30	94	15	70	June 15	Aug. 24
Fort Simpson	415	7.60	30	120	42	90	June 2	Aug. 31
Hay River	529	5.91	30	118	41	96	June 8	Sept. 12
Inuvik	50	5.99	4	90	13	66	June 20	Aug. 26
Norman Wells	290	7.73	18	131	51	91	May 31	Aug. 30
Wrigley	511	7.39	17	116	26	76	June 7	Aug. 23
Yellowknife	682	4.46	20	136	89	111	May 30	Sept. 18
Northern Alberta								
Beaverlodge*	2,400	10.53	30	140	27	109	May 23	Sept. 9
Fairview*	2,160	8.16	29	146	78	107	May 24	Sept. 6
Fort Chipewyan	714	8.84	30	118	26	75	June 14	Aug. 28
Fort Vermilion*	950	6.73	30	121	5	77	June 6	Aug. 22
Grande Prairie*	2,140	7.95	22	145	81	115	May 17	Sept. 9
Fort McMurray	1,216	11.72	27	101	29	62	June 17	Aug. 25
Peace River*	1,820	6.91	30	164	39	89	June 3	Aug. 31
Wagner	1,915	11.56	18	117	50	96	June 4	Sept. 8
High Prairie*	1,968	–	9	152	60	95	June 3	Sept. 6
Northern British Columbia								
Atlin	2,240	†6.92	30	106	6	87	June 7	Sept. 2
Beatton River	2,755	–	16	112	51	71	June 9	Aug. 19
Dawson Creek*	2,160	–	11	102	47	81	June 3	Aug. 22
Dease Lake	2,678	8.32	15	82	10	46	July 2	Aug. 16
Fort Nelson	1,230	9.26	23	136	62	106	May 20	Sept. 4
Fort St. John*	2,275	9.40	19	142	63	112	May 19	Sept. 8

TABLE 2 CONT.

Germansen Landing	2,450	7.71	8	70	44	58	June 23	Aug. 21
Smith River	2,208	9.16	17	75	13	48	June 24	Aug. 11
Telegraph Creek	550	†5.02	8	123	90	106	May 28	Sept. 11
North Central British Columbia								
Babine Lake	2,230	9.79	30	147	15	69	June 12	Aug. 20
Bella Coola	10	31.59	30	217	95	145	May 10	Oct. 2
Fort St. James	2,280	7.93	30	121	2	61	June 19	Aug. 19
Kleena Kleene	2,950	—	19	51	2	23	July 4	July 27
New Hazelton	1,150	9.01	30	128	17	79	June 12	Aug. 30
Prince George*	2,218	10.55	30	120	13	80	June 13	Aug. 31
Prince Rupert	170	34.62	30	252	153	200	April 20	Nov. 7
Quesnel*	1,787	9.23	30	145	12	113	May 29	Sept. 19
Sandspit	25	11.20	14	254	178	204	April 16	Nov. 6
Smithers*	1,700	7.44	23	94	20	53	June 23	July 9
Terrace*	225	12.73	30	180	81	139	May 20	Oct. 6
Vanderhoof*	2,210	—	30	98	4	52	June 24	Aug. 15
Williams Lake*	1,945	7.46	10	150	93	119	May 21	Sept. 17
Wistaria	2,900	6.30	30	174	7	66	June 20	Aug. 26

*Established agricultural areas for comparison
†3-year mean

SOILS

The soils of the most promising agricultural areas in the Canadian Northwest have been surveyed. The reports and maps give a general description of the area, the soil formation and type, the agricultural rating, and other useful information. The areas listed below comprise approximately 4 million acres (1.6 million ha) of arable land.

Reconnaissance soil survey of the Takhini and Dezadeash valleys in the Yukon Territory. The surveyed area lies along the Alaska Highway from Whitehorse to Haines Junction, a distance of approximately 100 miles (160 km). There are 280,200 acres (113,440 ha) of arable land in the area.

Reconnaissance soil survey of the Liard River valley, Northwest Territories. The surveyed area lies along the Liard River from the British Columbia – Northwest Territories border north to the Mackenzie River, a distance of approximately 130 miles (209 km). This area contains 766,200 acres (310,202 ha) of arable land.

Soils of the upper Mackenzie River area, Northwest Territories. In the south, the surveyed area extends along the Mackenzie Highway from Alexandra Falls north to Hay River and then west along Slave Lake and Mackenzie River to Green Island, east of Fort Simpson. In the north, the surveyed area extends from Fort Rae south along the Yellowknife Highway to the Mackenzie River and then west along the river to Green Island. Approximately 42 percent or 2,000,000 acres (809,717 ha) are rated as arable. Climate is the main limitation.

Reconnaissance soil survey of the Slave River lowland in the Northwest Territories of Canada. The surveyed area extends from Fort Smith on the Alberta–Northwest Territories border north to Slave Lake and contains 1,696,000 acres (686,640 ha) of arable land.

Soils of the Fort Nelson area of British Columbia. The surveyed area contains approximately 770,000 acres (412,000 ha).

In addition to the arable land in the above areas there is a large acreage of land suitable for native pasture. Also, some lands that are considered nonarable due to low moisture-holding capacity can be made arable by irrigation.

The arable soils vary in texture from sandy loam to clay loam. The sandy and silt loams warm up more quickly and are generally warmer throughout the summer than clay soils. However, the coarse-textured sandy soils dry out rapidly and require irrigation for satisfactory crop production, especially during dry years. Organic matter retards the warming and thawing of the soil, and permafrost develops where the surface layer of raw organic matter is deep. The sandy and silt loams are best suited for growing vegetables but require irrigation for good productivity. The clay soils, which retain moisture, are better for grain and forage production.

Nitrogen and phosphorus are too low in most soils for optimum growth of field crops and potassium may also be needed for vegetable crops. Because fertilizer requirements differ with the soil and the crop and may be markedly affected by proper management, it is advisable to have the soil analyzed to determine the best fertilizer mixture to use.

The Alberta and British Columbia Departments of Agriculture will analyze your soil and recommend a fertilizer for your soil and crop. For information on how to take a soil sample and the cost write to:

Alberta Department of Agriculture
Soil & Feed Testing Laboratory
O.S. Longman Building
6909-116 Street, Edmonton 62, Alberta.

or

Field Crops Branch
Soil Testing Laboratory
British Columbia Department of Agriculture
Court House, Kelowna, B.C.

ACQUISITION OF LAND

Regulations regarding the acquisition of land vary with each province and territory. For information regarding land policy and availability write to the following:

Northwest Territories

Regional Manager
Water, Lands, and Forests
Department of Indian Affairs and Northern Development
Federal Building
Yellowknife, N.W.T.

Yukon Territory

Regional Manager
Water, Lands, and Forest
Department of Indian Affairs and Northern Development
Whitehorse, Yukon

Alberta

Director of Lands
Department of Lands and Forests
Natural Resources Building
Edmonton, Alberta

British Columbia

Director of Lands
Department of Lands, Forest, and Water Resources
Victoria, British Columbia

CROPS

In general, follow the cultural practices recommended for the Peace River region. When special techniques are needed they are outlined in either this publication or in those in the bibliography.

Fruit and Vegetables

A great many fruits and vegetables can be grown in areas of the Canadian Northwest where cereals and other field crops do not thrive. Because of the high value of these crops, special cultural techniques can be used economically.

Figure 2. Strawberries grown at "Paradise Gardens" near Hay River, Northwest Territories.

If residents of the Northwest consume as much as the average Canadian and yields are 70 percent of those obtained further south, then a population of 5,000 could be supplied by 40 acres (16.2 ha) of potatoes, 5 acres (2.0 ha) of cabbages and other greens, 3 acres (1.2 ha) of carrots, and smaller acreages of rutabagas, salad crops, cauliflowers, beets, broccoli, strawberries, raspberries, greenhouse tomatoes, and cucumbers. It is unlikely, however, that local growers could capture the whole market in an area.

Crops that can be stored will supply the market longer and allow for larger production units and more mechanization. Because of the freight costs and losses in transit, highly perishable crops, such as lettuce, may give a higher profit in remote areas.

Cold soils and short, cool, frost-free seasons limit fruit and vegetable production. In some places, such as Inuvik, cold soil is the main limiting factor, but many crops can be grown if mulching and terracing are used to increase soil temperatures (Harris, 1970).

In other places, such as Haines Junction, Yukon, a short frost-free period is the main limitation. Here unheated crop shelters, row coverings, cloches, cold frames, and irrigation for frost protection can be used to increase the number of crops that can be grown and to extend the season of other crops. Much useful information will be found in the publications on gardening that are listed in the bibliography.

Greenhouse Crops

There is a ready but limited market for bedding plants, tomatoes, cucumbers, and lettuce in all major population centers, and the demand should increase. Greenhouses require artificial light during the short days and periods of low light intensity in winter. Because of the high cost of electricity and heating fuels, greenhouses are probably not economical to operate. Bedding plants in spring, followed by lettuce, tomatoes, and cucumbers, which are harvested by early winter, offer the best possibility of success.

Glass lasts longer than plastics, but high freight rates increase construction costs. There are several plastics that can be used. Polyethylene is the cheapest but has a relatively short life, and there is danger that winds in late summer or fall will tear it off. The more durable plastics are more expensive.

Grains and Oilseeds

Early-maturing spring cereals can be grown in favored locations. Barley is the most reliable and new early varieties are being developed for marginal areas.

Fall rye and, to a lesser degree, winter wheat have been grown with limited success. These crops must be planted in midsummer and may be killed or severely injured during the winter or spring.

Figure 3. A field of wheat, Fort Simpson, Northwest Territories.

Polish rapeseed can be produced in many areas, but it is not economical to ship the seed to markets. Other common oilseeds are not generally suitable.

Early-fall frosts, which frequently damage the grain, make it extremely important to test locally grown seed for germination before planting it.

Cultural practices are similar to those used in the Peace River region (Kusch et al., 1971) and other grain-growing areas, but adjustments must be made for differences in the growing season and for the higher cost of materials. Because of the short growing season seeding must be done as early as possible, but late enough to reduce the risk of damage from late-spring frosts and from planting into cold soil. Exposing seed in the soil to 45°F (7.2°C) and lower for more than 10 days will reduce stands and yield. With soil temperatures of 38 to 44°F (3.3 to 6.7°C) the germination was: barley 95 percent, wheat 85 percent, rye 84 percent, and oats 72 percent; but at 36 to 37°F (2.2 to 2.8°C) germination was reduced to 31 percent in barley, 40 percent in wheat, 41 percent in rye, and 0 in oats.

Fertilizer application rates may have to be adjusted because of much higher costs. Remember, however, that nitrogen is usually deficient in cold soils and that phosphorus not only increases yield but also hastens maturity.

The recommended grain crops with an average yield at Mile 1019 are:

- Barley of the Olli variety yielded 41.3 bushels per acre.
- Oats of the Abegweit variety yielded 67.7 bushels per acre.
- Winter rye of the Antelope variety yielded 57 bushels per acre.

Wheat is not recommended.

More information on yield and seed quality for three varieties of barley, oats, and wheat grown at six locations is given by Guitard *et al,* 1965.

Forage

A large acreage of native grass is suitable for grazing, but native legumes are not prevalent. Many areas have no grazing restrictions and domestic livestock must compete for the available feed with moose, sheep, deer, caribou, buffalo, and herds of pack horses.

In many areas native ranges provide very short pasture seasons. At Mile 1019, Alaska Highway, the season starts in early June and ends in late September.

Many cultivated grasses produce satisfactorily in the Northwest including bromegrass; intermediate, slender, western, and crested wheatgrass; Russian wild ryegrass; creeping red fescue; Kentucky bluegrass; reed canarygrass; and timothy.

Samples of bromegrass hay at Mile 1019, Alaska Highway, Yukon, averaged 8 percent protein, but the amount of protein varied considerably.

Cultivated legumes are not reliable in many areas and often do not survive for more than a few seasons. In parts of the Yukon, and possibly in other areas, root rot is the main cause of poor survival. Siberian alfalfa (*Medicago falcata* L.) is resistant to the disease, but seed is not available in Canada.

Legumes usually increase hay yields. At Mile 1019, a hay mixture of 50 percent bromegrass, 20 percent alfalfa, and 30 percent sweetclover produced 1.4 tons per acre (3,136 kg/ha) compared to 0.8 ton (1,782 kg/ha) for a 90 to 10 percent bromegrass-alfalfa mixture and 0.7 ton (1,568 kg/ha) for a 95 to 5 percent mixture. In other tests at Mile 1019, the legumes became progressively weaker; hay yields decreased from 1.0 ton per acre (2,240 kg/ha) the first year to 0.9 ton (2.016 kg/ha) the second, and 0.6 ton (1,344 kg/ha) the third year. At Fort Simpson, Northwest Territories, however, the alfalfa-bromegrass hay yield increased from 0.8 ton per acre (1,782 kg/ha) the first year to 1.1 tons (2,640 kg/ha) in both the second and third years.

Figure 4. Bailing hay in a mountain valley near the Yukon—British Columbia border.

Lack of moisture is the main cause of low yields in many parts of the Yukon. In 1954, at Mile 1019, 1.5 inches (3.8 cm) of water applied June 15 increased the yield of bromegrass from 2.5 to 3.5 tons per acre (5,600 to 7,840 kg/ha) and Siberian alfalfa from 0.7 to 0.9 ton (1,568 to 2,016 kg/ha). Similarly, a mixed hay produced 0.5 ton per acre (1,120 kg/ha) on an upland soil, whereas in a low swale, where snow melt accumulated, the same mixture yielded 2.5 tons (5,600 kg). At Fort Simpson the summer rainfall is usually sufficient to produce yields equivalent to those obtained in the Peace River region, but in many years irrigation increases the yield.

Nitrogen fertilizers are needed for the production of grasses. At Mile 1019, 33 pounds of nitrogen per acre (37 kg/ha) increased the yield of forage of four varieties of bromegrass and timothy, and the seed yield and protein content of timothy.

Recommended hay and pasture mixtures are:

Mixture	*Variety*	*Seed*		*Adaptation*
		lb/acre	*kg/ha*	
Bromegrass	Manchar	6	6.7	All but dry and very
Alfafa	Roamer*	4	4.5	wet areas
Russian wild ryegrass	Sawki	6	6.7	Dry areas
Alfalfa	Rambler*	1	1.1	
Reed canarygrass	Frontier	6	6.7	Wet areas
Alsike clover	Aurora	2	2.2	

*In some areas of the Yukon where root rot is a problem, replace Rambler and Roamer with yellow-flowered alfalfa (*Medicago falcata* L.) if seed can be obtained.

Oats and barley have shown considerable promise for producing a quick crop of forage in the year of planting. Use them to ensure an adequate feed supply for livestock.

LIVESTOCK

In livestock production the probability of loss by wild animals must be considered in all areas. Wild game in the Canadian Northwest is a valuable asset and guiding hunters is an important industry. To prevent a conflict of interest between agriculture and recreation in the future, these two sectors must work with provincial or territorial authorities to develop a mutually suitable approach.

In the more competitive areas, profit in the meat-packing industry depends on volume slaughtering, year-round operation, and the utilization of hides and waste. Year-round, volume slaughtering and the use of waste is not yet practical in the Canadian Northwest.

Dairying

No research on dairy cattle has been done by the Canada Department of Agriculture in the far north, but private herds were raised for many years. One herd of 20 to 30-head of Holstein-Shorthorn cattle was kept for nearly 50 years in the

Klondike Valley, but was disposed of when the farm was sold about 1950. With modern methods there should not be any problem producing fluid milk in many areas, but with improved transportation locally produced milk would have severe competition from sterile, canned milk, and milk powder imports.

Beef Cattle

At the Experimental Farm, Mile 1019, Alaska Highway, cattle were introduced in 1948, but the following year they were found to have brucellosis. A new herd was procured in 1951 and it increased and remained disease free until sold in 1968.

Experimental results from this small herd of Shorthorn-Hereford cross animals indicate production possibilities, but the experimental rations and the management used must not be considered as recommended practices. Animal management in the Northwest differs very little from that further south and recommended management practices should be followed. The most important difference is the long feeding period, which in most areas lasts from October to May.

Figure 5. Hereford cattle grazing near Haines Junction, Alaska Highway, Yukon Territory.

The animals were maintained outside during the winter and the cattle in a spruce thicket or behind a high board shelter wintered as well as those given the additional protection of an open-faced barn.

Bred cows were wintered on 16 pounds (7.3 kg) per day of locally grown bromegrass–crested wheatgrass–alfalfa hay plus bonemeal and salt. The hay mixture contained 8 percent protein. All the cows calved without loss; the calves averaged 86 pounds (39 kg) at birth.

The calves were weaned in August and wintered on 12 pounds (5.4 kg) of bromegrass hay plus a mineral supplement. The hay was gradually increased to 16 pounds (7.3 kg) by March.

During 7 years 71 calves made an average gain of 2.4 pounds (1.1 kg) per day from birth to weaning. At 170 days, five exceeded 600 pounds (272 kg) and 19 exceeded 500 pounds (227 kg) in weight. After 1 year the 43 animals retained had made an average daily gain of 1.5 pounds (0.7 kg). The average daily gain of steers on pasture was also 1.5 pounds (0.7 kg).

In Canada, the annual per capita consumption of beef is 80 pounds (36 kg). However, Studt in 1965 in an unpublished manuscript (An Economic Appraisal of Proposed Agricultural Development and Cattle Ranching in the Slave River Lowlands, Northwest Territories) estimated that in the Northwest where wild game is plentiful, the annual per capita consumption of beef is about 45 pounds (20.4 kg). Assuming an average dressed weight of 500 pounds (227 kg), an annual slaughter of 450 head of cattle would provide 45 pounds (20.4 kg) each for a population of 5,000.

Swine

From 1957 to 1960 swine overwintered satisfactorily at Mile 1019 in a log barn without supplementary heat. The animals were self-fed on a ration of five parts locally grown barley, three parts locally grown oats, and two parts pig supplement. Daily feed consumption during the winter was 9 pounds (4 kg) per sow.

Litters ranged in size from four to nine and were marketed when 6 to 7 months old. Better facilities would improve the performance.

The average Canadian consumes 52 pounds (23.7 kg) of pork per year, which requires one pig for every four people. Consumption is probably lower where wild game is prevalent.

Sheep

No records are available on the performance of sheep, but they should thrive in many areas if they are protected against predators.

The annual consumption of mutton in Canada is 4 pounds (1.8 kg) per person but is probably lower where wild game is plentiful.

Poultry

Between 1953 and 1959 at Mile 1019, poultry was housed in a log house that was heated with 250-watt heat lamps during very cold weather. The poultry was fed mixed home-grown grain and a 40 percent-protein concentrate. Under these conditions yields were up to 800 eggs a day per 1,000 hens but dropped to 200 a day in cold weather.

After 1959, the hens were housed in a modern laying house and fed laying mash prepared from locally produced grain and a 40 percent-protein concentrate. Under the improved conditions, daily production increased to an average of 848 eggs per 1,000 hens from October to May 1969.

The average Canadian eats 43 pounds (19.5 kg) of poultry meat, mainly chicken and turkey, and 257 eggs per year. The average hen lays 206 eggs per year so that one and one-quarter hens per person can be used to estimate the egg requirements of a given population. However, some of the eggs consumed, particularly in remote areas, are in the form of egg powder and the number of eggs imported into each area must be determined to estimate the size of the market.

Beekeeping

A few colonies of bees have been raised at Norman Wells, Dawson City, Whitehorse, and many other areas in the Northwest. The main requirements for successful honey production are willows and wild flowers in the spring, and fireweed, clovers, and other legumes in July and early August.

Most of the beekeepers kill the bees after the main flow of honey ends in August and buy 2-pound (907 g) packages of bees the following spring. A limiting factor is the cost of air freight. The Alberta Honey Producers Ltd., 16650 111 Avenue, Edmonton 42, Alta. is the main supplier of package bees and equipment in the north and will send catalogues and price lists.

SUMMARY

Crops and livestock can be raised in many of the present nonagricultural areas in the Canadian Northwest. There are many difficulties to overcome, but there are also opportunities for the experienced, efficient farmer. The high costs of producing for small markets a long distance from equipment and supplies must be weighed against the increased cost of shipping and possible spoilage of fresh food. Each situation is different and the rapid development of many areas is constantly changing the economics of production. A farming enterprise that is not economical now, might be next year or the year after, or *vice versa.*

There are opportunities for producing vegetables, small fruits, beef, and pork in some areas. Although the production of pigs, cows, and poultry in modern barns is equal to that produced elsewhere, the cost of housing is higher and the availability of low-priced processed products limits the size of the market. There is a small market for grains and hay for pack horses, but the development of these crops will have to go hand in hand with livestock production.

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CONVERSION FACTORS FOR METRIC SYSTEM

Imperial units	Approximate conversion factor	Results in:	
LINEAR			
inch	x 25	millimetre	(mm)
foot	x 30	centimetre	(cm)
yard	x 0.9	metre	(m)
mile	x 1.6	kilometre	(km)
AREA			
square inch	x 6.5	square centimetre	(cm^2)
square foot	x 0.09	square metre	(m^2)
acre	x 0.40	hectare	(ha)
VOLUME			
cubic inch	x 16	cubic centimetre	(cm^3)
cubic foot	x 28	cubic decimetre	(dm^3)
cubic yard	x 0.8	cubic metre	(m^3)
fluid ounce	x 28	millilitre	(mℓ)
pint	x 0.57	litre	(ℓ)
quart	x 1.1	litre	(ℓ)
gallon	x 4.5	litre	(ℓ)
bushel	x 0.36	hectolitre	(hℓ)
WEIGHT			
ounce	x 28	gram	(g)
pound	x 0.45	kilogram	(kg)
short ton (2000 lb)	x 0 9	tonne	(t)
TEMPERATURE			
degree fahrenheit	°F-32 x 0.56 (or °F-32 x 5/9)	degree Celsius	(°C)
PRESSURE			
pounds per square inch	x 6.9	kilopascal	(kPa)
POWER			
horsepower	x 746	watt	(W)
	x 0.75	kilowatt	(kW)
SPEED			
feet per second	x 0.30	metres per second	(m/s)
miles per hour	x 1.6	kilometres per hour	(km/h)
AGRICULTURE			
bushels per acre	x 0.90	hectolitres per hectare	(hℓ/ha)
gallons per acre	x 11.23	litres per hectare	(ℓ/ha)
quarts per acre	x 2.8	litres per hectare	(ℓ/ha)
pints per acre	x 1.4	litres per hectare	(ℓ/ha)
fluid ounces per acre	x 70	millilitres per hectare	(mℓ/ha)
tons per acre	x 2.24	tonnes per hectare	(t/ha)
pounds per acre	x 1.12	kilograms per hectare	(kg/ha)
ounces per acre	x 70	grams per hectare	(g/ha)
plants per acre	x 2.47	plants per hectare	(plants/ha)

Examples 2 miles x 1 6 = 3 2 km, 15 bu/ac x 0 90 = 13 5 hℓ/ha

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IF UNDELIVERED, RETURN TO SENDER EN CAS DE NON-LIVRAISON, RETOURNER À L'EXPÉDITEUR