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Alternative Grain and Oilseed Crops for Interior Alaska

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INTRODUCTION

Barley is the principal grain crop in Interior Alaska. Oats are second in importance but are often harvested for hay rather than grain. Due to the short growing season (83–100 frost-free days), options for alternative crops are limited and producers have little opportunity to rotate crops for weed and disease control or to switch crops as prices fluctuate. Wheat, triticale, buckwheat, canola, flax, sunflowers, meadowfoam, faba beans, and field peas have all been grown on a small scale in Alaska. However, little information is available on the climatic, nutrient, or cultural requirements, the probability of a successful harvest, the quality of the harvested product, or the potential markets for these crops. This study was initiated in 1993 to evaluate several niche crops for Interior Alaska.

METHODS AND MATERIALS

Alternative crops were tested at three locations in 1993: the UAF Experiment Farm west of Fairbanks; Dan Coben's farm in the Eielson Agricultural Project south of North Pole; and the UAF Experiment Field near mile 1408 Alaska Highway east of Delta Junction. The fields at Delta and Fairbanks had been planted to barley the previous year, and the field at Eielson had been planted to buckwheat. The fields at all locations were fertilized and tilled once with a disk and once with a roterra prior to planting. Fertilizer consisted of ammonium sulfate, urea, monoammonium phosphate, potassium chloride, and sodium borate, blended to provide an equivalent of 16% N, 20% P_2O_5, 16% K_2O, 6% S, and 0.33% B. Rates of fertilization varied among crops (Table 1). Since fertilization rates were unknown for several of the crops, an assumed high and low rate was compared on each crop. All crops were planted with a cone seeder in rows spaced eight inches apart in plots eight feet by 50 feet. Seeding rates in pounds of pure live seed per acre were: barley 90; oats 95; wheat 90; canola 7; flax 80; sunflower 6; field peas 60; canarygrass 40; and buckwheat 50. Plots were replicated four times in a randomized complete block design at each location. A majority of the crops were planted May 6 at Delta, May 17 at Fairbanks, and May 19 at Eielson. However, late arriving seed of polish canola and field peas were planted at Delta on May 21. The selection of crops and varieties tested in 1993 was limited by the availability of seed. Some seeds arrived too late for planting.

During the growing season, plots were tended weekly at each location and data were collected on percent ground cover, stage of maturity, and biomass accumulation. Biomass was determined by clipping all above ground plant tissue from a 4.4 square foot area along one side of each plot each week. The biomass sample was dried in a forced air dryer at 110°F to determine dry weight. At maturity, a four-foot wide swath was harvested with a plot combine from each plot to determine seed yield.

RESULTS AND DISCUSSION

The Eielson Agricultural Project is relatively close to Fairbanks and its 1993 weather patterns were similar to the Fairbanks Experiment Station, so weather records are shown only for Fairbanks and Delta (Fig. 1). Precipi-

tation was near normal at Fairbanks during May and June, however, during the 54 days from June 28 to August 20, only 0.72 inch of rain fell as compared to a long-term average of 2.26 inches. On August 21, when crops were about ready to harvest, it started to rain and continued for 21 of the next 32 days delaying harvest. At Delta, rainfall remained below normal throughout the growing season. Volunteer barley at both the Fairbanks and Delta sites also provided moisture competition for the alternative crops.

Cumulative heat units, growing degree days (GDD), were recorded in 1993 by calculating the average temperature each day in degrees celsius (°C) and totaling those degrees above freezing (0°C) for the growing season (GDD=total °C above freezing). Temperature was warmer than normal at all locations in 1993. With GDD by August 20 (the approximate date of maturity for most crops) totaling 115 above normal at Fairbanks and 94 above normal at Delta. This equates to crop maturity approximately eight days earlier than normal at Fairbanks and six days earlier than normal at Delta.

From only one year's results, the following observations are noteworthy:

Barley—Performed well at all locations. *Otal* was the earliest maturing variety. *Eero* yielded highest at two locations. *Thual*, CDC *Buck*, and CDC *Richard*, are all hulless varieties producing naked kernals. The hulless varieties were slightly later in maturity than hulled varieties. The variety CDC *Richard* yielded highest of the hulless varieties at two locations.

Oats—*Cascade* yielded highest at all locations. *Freedom* and *Pennuda* are hulless varieties and both were very late in maturing. *Freedom* yielded highest, but of the two *Pennuda* would have a much higher probability of reaching maturity.

Wheat—*Ingal* was the earliest variety to mature but shattered badly if not harvested immediately. *Cutler* yielded highest at all locations.

Argentine canola—All varieties matured very late. *Westar* yielded highest at two locations.

Polish canola—Matured much earlier than Agrentine. *Reward* was the first variety to emerge in

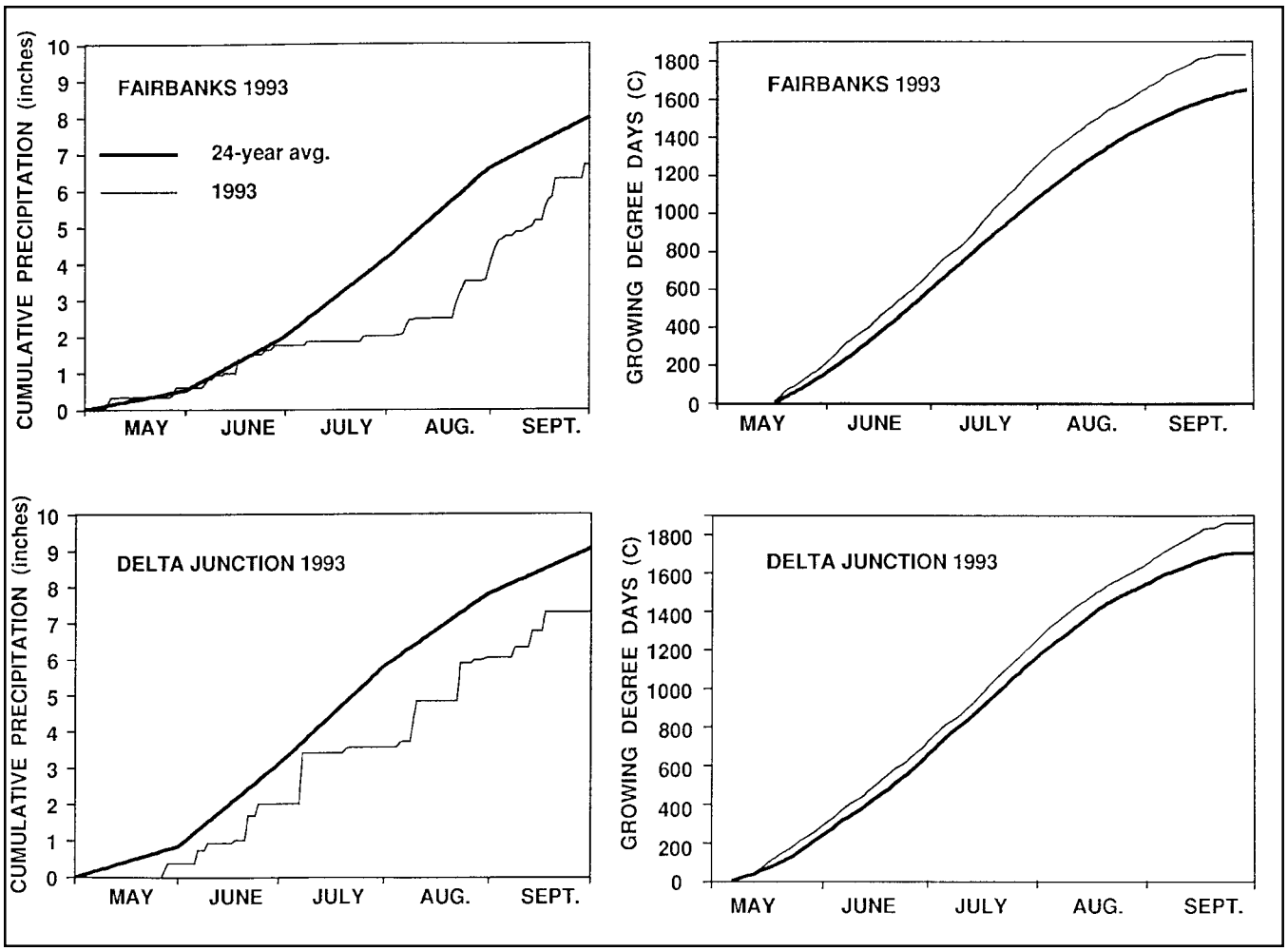

Figure 1. Weather records for Interior Alaska, 1993.

Table 1. Performance of alternative crops at three locations in Interior Alaska in 1993.

				Fairbanks			Eielson			Delta		
Crop	Variety	Origin	Fert. Rate[1]	50% Maturity (GDD)[2]	Test Wt. (lb/bu)	Yield (lb/ac)	50% Maturity (GDD)	Test Wt. (lb/bu)	Yield (lb/ac)	50% Maturity (GDD)	Test Wt. (lb/bu)	Yield (lb/ac)
Barley	*Otal*	Alaska	2	1078	49	3038	1062	50	1216	1041	52	1698
			3	1078	48	3445	1081	51	3339	1085	51	2179
	Eero	Finland	2	1132	48	4103	1070	49	1493	1128	52	1783
			3	1161	46	4555	1156	50	2935	1111	50	2687
	Svendal	Alaska	2	1087	47	3084	1106	50	1754	1128	51	1580
			3	1142	46	2796	1156	50	3044	1136	50	2140
	Thual	Alaska	2	1140	56	3166	1166	60	1083	1196	58	1859
			3	1150	52	3107	1194	62	3066	1188	58	1631
	CDC *Buck*	Canada	2	1122	54	3795	1109	59	1529	1173	54	1857
			3	1161	48	2753	1156	60	2714	1088	53	2619
	CDC *Richard*	Canada	2	1152	57	3335	1156	59	1908	1177	56	1757
			3	1170	55	3601	1202	59	3442	1159	54	2161
Oat	*Cascade*	Canada	2	1199	40	3662	1369	43	2621	1266	45	1852
			3	1236	40	4048	1390	44	4201	1268	45	2310
	Athabasca	Canada	2	1160	41	3073	1262	44	1632	1205	46	1778
			3	1199	42	3174	1329	44	2894	1230	45	1879
	Toral	Alaska	2	1160	41	3207	1343	44	1802	1247	45	1849
			3	1180	40	3214	1356	44	2907	1240	44	2005
	Calibre	Canada	2	1236	40	3271	1369	44	1716	1193	46	1770
			3	1246	41	3390	1384	45	3368	1032	46	2085
	Freedom	Maine	2	1271	38	1855	1403	44	1315	1736	47	1551
			3	1279	37	1717	1403	44	1643	1406	46	1882
	Pennuda	Pennsylvania	2	1189	40	2029	1254	45	608	1247	48	1306
			3	1180	40	1233	1349	45	1272	1226	46	1523
Wheat	*Ingal*	Alaska	2	1140	55	2253	1202	57	932	1144	56	1293
			3	1187	54	1233	1229	58	1649	1136	53	1476
	Vidal	Alaska	2	1279	49	2607	1342	52	411	1342	55	1701
			3	1219	49	1558	1369	53	1238	1328	55	1903
	Culter	Canada	2	1228	55	2737	1350	58	844	1300	50	1937
			3	1199	52	1854	1384	58	1912	1306	50	1895
	Nogal[3]	Alaska	2	1288			1362			1377	52	1467
			3	1236			1384			1356	52	1920
Canola (Argentine)	*Legend*	Canada	2	1521	43	1509	1553	42	645	1492	48	352
			3	1565	44	1671	1582	46	1219	1486	47	386
	Trident	Canada	2	1610	44	1315	1564	44	398	1531	22	33
			3	1600	45	1593	1589	41	564	1564	48	181
	Alto	Canada	2	1529	44	1417	1493	47	1080	1421	48	152
			3	1591	46	1641	1553	47	1731	1479	47	172
	Westar	Canada	2	1521	45	1941	1487	47	1006	1411	48	122
			3	1541	44	1248	1564	47	1880	1479	47	116
	Delta	Canada	2	1556	47	1143	1509	48	1415	1446	48	151
			3	1583	49	1345	1589	47	1680	1486	48	229
Canola (Polish)	*Tobin*	Canada	2	1424	44	1541	1308	50	930	1393	50	234
			3	1424	47	1590	1308	51	1749	1353	50	399
	Eldorado	Canada	2	1424	49	1825	1322	50	885	1255	50	298
			3	1443	48	1570	1322	50	1785	1353	50	174
	Reward	Canada	2	1403	50	2044	1322	49	808	1370	51	572
			3	1376	48	1495	1336	50	1920	1335	51	806
Flax	*Norlin*	Canada	2	1390	49	498	1553	46	148	1381	50	66
			3	1279	49	342	1466	46	419	1346	54	196
Sunflower	*Sunwheat 101*	North Dakota	2	1349	28	2447	1534	22	897	1680	20	215
			3	1462	26	1938	1466	22	1411	1680	20	146
	Sunwheat 103	North Dakota	2	1342	25	3157	1390	26	1090	1680	20	156
			3	1376	26	2638	1403	25	1678	1680	20	140
Field pea[4]	*Orb*	Canada	2	1160			1481			1436		
			3	1199			1295			1436		
	Patriot	Canada	2	1199			1403			1219		
			3	1253			1316			1226		
	Express	Canada	2	1253		1262	1403		863	1197		20
			3	1316		2258	1390		797	1247		266
Canarygrass	*Elias*	Minnesota	1	1228	45	588	1342	47	238	1314	43	176
			2	1243	44	107	1363	47	198	1342	45	120
Buckwheat	*Winsor royal*	Minnesota	1	1465	25	261	1349	42	411	1436	25	146
			2	1449	25	360	1349	42	507	1436	25	108

[1]Fertilizer rates - (lbs/acre n, P_2O_5, K_2O, S, and B) - 1 = 24-30-23-9-0.5); 2 = (48-60-47-19-1); 3 = (96-120-94-38-2).
[2]Cumulative growing degree days to the point that 50% of the plants were fully mature (total average daily temperature °C above freezing).
[3]Nogal wheat seed had poor germination and the resulting poor stands were not harvested at Fairbanks and Eielson in 1993.
[4]Field peas matured but due to damage from severe lodging and migratory waterfowl feeding data were not collected on two varieties.

spring and yielded the highest at all locations. *Eldorado* was early and set more pods than other varieties, but showed greater drought stress than other varieties.

Flax—*Norlin*, the only variety tested, didn't compete well with weeds or volunteer barley.

Sunflower—*Sunwheat 103* was the earliest to mature and produced the highest yield. However, it was very slow to dry after maturity and it never dried enough in the field to combine harvest.

Field peas—All varieties grew well but they lodged on the ground precluding mechanical harvest. Migratory waterfowl fed on the peas at all locations destroying most of them. *Express peas* showed the most promise, and small areas of that variety were hand harvested for yield estimates.

Canarygrass—*Elias* was the only variety tested. It matured early and looked promising. However, the fertilizer rates selected were too low.

Buckwheat—*Winsor Royal* was the only variety tested. It was late maturing and many seeds never reached maturity but it showed good yield potential. Migratory waterfowl harvested most of the plots.

Soil fertility was much higher at Fairbanks than on the newly cleared soils at Eielson and Delta. At Fairbanks, crops showed very little—if any—response to fertilization rates. However, at Eielson, yields approximately doubled when doubling the fertilizer applications. At Delta, yields also improved with increased fertilization, however, due to drought conditions, plant response to fertilizers was not as great. Additional studies will be required to identify the nutrient requirements of these alternative crops.

FUTURE GOALS

Additional crops and varieties will be evaluated each year. By determining the GDD requirements of each crop over a period of years and comparing these to historical weather records, we should be able to predict the probability of each crop reaching maturity at each location. Also, the data will enable us to predict the effect of possible global warming on potential crops for Alaska's future. Percent ground cover and biomass accumulation data will be used to determine the value of these crops in reducing soil erosion.

In 1993, sunflowers matured much faster around the perimeter of plots than in the middle of plots. This appeared to be a result of less moisture stress. In 1994, a portion of this study will be irrigated to determine the effects of supplemental water on yield and maturity of the alternative crops.

In some plots, sunflowers and canola will be seeded in mixed stands then swathed and combine harvested together to determine if sunflowers can be dried for an earlier harvest in this manner.

Field peas will also be seeded in mixed stands with other crops to prevent lodging of the peas and facilitate harvesting.

Canarygrass will be fertilized at the same rate as barley in 1994.

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