PERFORMANCE of CEREAL CROPS in the TANANA RIVER VALLEY of ALASKA 1982

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INTRODUCTION

This is the fourth publication in this format on grain performance trials in the Tanana River Valley. The first, published 3 years ago, included the results of spring cereal-variety tests conducted at Fairbanks and Delta Junction during the 1978 and 1979 growing seasons. The variety-test results from the 1980 and 1981 growing season were annual publications. Included in this report are a weather summary, the 1982 variety-test results, and a plant-disease section.

In 1982, the variety-testing program at Delta Junction was moved from Lee Fett's farm in the Clearwater area to the University of Alaska Research Field in the Delta Barley Project area. The new site is situated on recently cleared land. This should provide a more representative basis for variety evaluation for development of new lands. Many thanks are extended to Mr. Fett for his generosity and cooperation in allowing the Agricultural Experiment Station the use of his land for more than a decade.

Previous work with grain-variety testing has shown that individual varieties do not perform alike when grown under different conditions. The yield a variety produces can be influenced by crop rotation, soil pH, fertilizer rate, tillage practices, rainfall distribution and amount, seeding rate, planting date, and many other factors. Each variety has its own particular set of growing conditions under which it performs best. For example, in the very same field, a variety that performs well on summer-fallow land may do poorly when planted on stubble land.

There is no such thing as a perfect variety. This is why crop-breeding programs around the world continue to develop new varieties and retire old varieties. For this reason, variety testing is a never-ending process. The primary purpose of variety testing is to find varieties that are most adapted to growing conditions in a particular geographic location. Quite often a distance of only a few miles can make a considerable difference in how a variety performs. This is especially so at northern latitudes where a change in elevation of 200 to 300 feet can have a noticeable effect on climatic conditions.

Some varieties have a wide range of adaptation while others have a narrow range of adaptation. It is not uncommon for a variety to perform well at Fairbanks and do poorly in Delta Junction or, conversely, to excel in Delta Junction and be poorly adapted at Fairbanks. A variety may not always be the highest yielding for a particular area. Because of the highly variable growing conditions in the Tanana Valley, varieties are selected for a wide range of adaptation.

Standard varieties, as defined for this report, are varieties that have performed well consistently in tests conducted in at least two Tanana Valley locations over a period of several years. Standard varieties are used as a means for evaluating new entries in the variety trials each year. Comparisons are made with regard to yield, maturity, quality, and growth characteristics.

At the end of each section on barley, oats, and wheat, there is a cumulative list of all varieties tested at Fairbanks and Delta Junction since the program began 12 years ago. This list does not include the names of varieties and experimental lines that were screened in single-row observation plots and were subsequently eliminated for lack of adaptation. Some of the varieties listed were fairly well adapted to the Tanana Valley, but were removed from the testing program to make room for testing of new varieties because they were not quite as good as the standards. Several varieties formerly considered standards, such as Edda, Lidal, and Olli barley; Golden Rain and Cayuse oats; and Saunders, Thatcher, and Canthatch wheat, were replaced by improved varieties.

STANDARD BUSHEL WEIGHTS AND CONVERSION FROM ENGLISH TO METRIC UNITS

The measure most commonly used by farmers to express yield of grain crops is bushels per acre. By law, agricultural commodities of fairly high quality have standard minimum weights per volumetric bushel. One bushel is equal in volume to 2150.42 cubic inches or 8 gallons. Different types of grains have different bushel weights. The standard bushel weights for the grains included in this report are as follows:

Barley	=	48 pounds per bushel
Oats	=	32 pounds per bushel
Wheat	=	60 pounds per bushel

The test-weight apparatus which gives volume weight per bushel is used primarily as an indicator of quality, but the standard weights per bushel are the legal units for purchase and sale. For example, if 100 bushels of barley testing 52 pounds were sold, 4,800 pounds would be delivered, and not 5,200 pounds because the standard bushel weight of barley is 48 pounds.

When a farmer hauls a load of grain to the elevator, it is weighed, and the weight in pounds is divided by the standard bushel weight to determine the number of bushels. Test weights are taken to ascertain quality. A test weight that is lower than the standard can reflect the characteristic of a variety, the presence of foreign material, lack of maturity, disease, excessive nitrogen fertilization, or subjection of the crops to severe drought or high temperatures during critical stages of growth. In the case of barley, a low test weight can also result from incomplete removal of beards during threshing. Test weights of barley can be increased by cleaning and use of a debearding machine. At the elevator, low test weights often result in a reduction in the price paid per bushel.

In the United States, grains are frequently sold in terms of English tons. To express bushels as pounds, multiply the number of bushels by the standard test weight. To express pounds as English tons, divide by 2,000.

On the international markets, grains are often bought and sold on the basis of the metric system of measurement. The most common unit of weight for these transactions is the metric ton. To convert English tons to metric tons, multiply by 0.9072. Similarly, in most countries, yields of crops are expressed as kilograms per hectare. To convert yield from pounds per acre to kilograms per hectare, multiply by 1.121.

The following are some useful relationships between the English and metric systems of measurement:

1 acre	=	43,560 square feet		
1 hectare	=	2.471 acre	=	10,000 square meters
1 meter	=	1.094 yard	=	3.232 feet
1 kilogram	=	2.205 pounds		
1 English ton	=	2,000 pounds	=	907 kilograms
1 metric ton	=	1,000 kilograms	=	2,205 pounds

PART I: CLIMATIC DATA AND GERMPLASM EVALUATION

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Tanana Valley Weather Summary

Climatic data for the 1982 growing season for Delta Junction and Fairbanks are summarized in Tables 1 and 2. Temperature and precipitation values given in parentheses represent long-term averages for each location and are useful in determining the degree of normality of the growing season. The Delta Junction weather station is located in Delta Junction approximately 14 miles from the test site, and the Fairbanks station is located at the University of Alaska Agricultural Experiment Station Farm about 400 yards from the test site.

Table 1. Climatic Data for Delta Junction during the 1982 Growing Season.

	May		June		July		August		September	
Temp. (°F)										
daily max.	51.7	(57.1)*	65.4	(67.1)	68.0	(69.1)	62.0	(64.0)	54.9	(51.8)
daily min.	35.7	(36.9)	47.6	(47.1)	51.0	(50.1)	44.0	(45.6)	39.5	(35.3)
daily mean	43.8	(47.0)	56.5	(57.1)	59.5	(59.6)	52.9	(54.8)	47.2	(43.6)
Precip. (in.)	1.09	(0.86)	2.28	(2.26)	3.57	(2.68)	1.30	(2.00)	0.98	(1.24)

*Values in parentheses represent a 24-year average.

Table 2. Climatic Data for Fairbanks during the 1982 Growing Season.

	May		June		July		August		September	
Temp. (°F)										
daily max.	58.2	(60.2)*	71.1	(71.7)	75.0	(72.7)	66.7	(67.3)	57.7	(55.4)
daily min.	33.4	(33.6)	44.5	(44.1)	49.0	(46.8)	41.9	(43.0)	36.2	(33.6)
daily mean	45.8	(46.9)	57.8	(57.9)	62.0	(59.8)	54.3	(55.2)	46.8	(44.5)
Precip. (in.)	0.68	(0.80)	2.26	(1.48)	3.87	(2.10)	1.23	(2.44)	0.61	(1.36)

*Values in parentheses represent a 34-year average.

The Delta Junction recording station received near-normal total precipitation for the 1982 growing season. For the period May through September, Delta Junction received 9.22" compared to 9.04" for the long-term average. Above-normal rainfall was recorded in May and July, but deficits occurred in August and September. Precipitation for June was within 0.02" of the

long-term average. Several areas in the Delta Barley Project received significant amounts of rainfall in the form of heavy isolated showers during late April and early May. This, together with water from melting snow, caused flooding and delayed planting operations on some farms. Farmers were plagued with wet spots in the fields well into June, making it difficult to use large equipment. These problems existed to a much greater extent on newly cleared land than on land that had been in production for several years. Overall, the precipitation pattern provided good growing conditions early in the season and was beneficial for ripening and harvesting late in the season.

With the exception of September, growing-season temperatures for Delta Junction were cooler than long-term averages. Daily maximum temperatures for May, June, July, and August were cooler than normal by 5.4, 1.7, 1.1, and 2.0 degrees, respectively. The cool May temperatures were damaging from the standpoint that soil warming and soil drying were delayed, resulting in some grains' being planted late. Daily maximum temperatures for September averaged 3.1 degrees above normal. The warm September temperatures, in combination with low rainfall, provided good conditions for field drying of grains and harvesting.

Total precipitation for the 1982 growing season, May through September, was slightly above normal at the Fairbanks recording station. Fairbanks received 8.65" as compared to 8.18" for the long-term average. The distribution of precipitation which occurred in 1982 was quite similar to 1981. June and July received nearly double the normal rainfall, which compensated for deficits occurring in May, August, and September. The major abnormality for the growing season was a cloudburst, which occurred on July 12. In only a few minutes, Fairbanks received 1.52" of rainfall. This flattened many of the grains and caused severe soil erosion.

In 1982, the growing-season temperatures at Fairbanks regained some normality, in contrast to the record-breaking cold of 1981. Daily maximum temperatures for May, June, and August were cooler than normal by 2.0, 0.6, and 0.6 degees, respectively. However, the months of July and September were 2.3 degrees warmer than long-term averages.

Barley Performance Trials

Barley, because of its ability to grow to maturity at cool temperatures and its short growing-season requirement, must be considered the grain most adapted to far-north environments. Several of the earliest-maturing varieties have ripened at Fairbanks when planted as late as the second week of June.

Barley belongs to the genus *Hordeum* and two species are widely cultivated: *H. vulgare* (6-rowed barley) and *H. distichum* (2-rowed barley). The two species differ primarily in head character (shape of spike and orientation of kernels on the spike). The 6-rowed barleys, because of the availability of several very early varieties, have been the most widely grown in Alaska. The 2-rowed barleys are also highly adapted even though most varieties have a longer growing-season requirement. The earliest 2-rowed variety matures about 9 days later than the earliest 6-rowed variety. Both species have varieties suitable for malting and pearling, but in general, most 6-rowed barleys are classified as feed barleys, while most 2-rowed barleys are classified as malting or pearling barleys.

Barley may also have a winter or spring growth habit. Only those varieties having a spring growth habit are important to Alaska. Barley varieties having a winter growth habit lack hardiness, and therefore have a very low rate of winter survival.

Galt, Otra, Weal, Otal, and *Datal* are the standard barley varieties for the Tanana Valley. These are all 6-rowed barleys and the grain is grown primarily for use as a feed. Yield data for Galt and Weal have been collected at Fairbanks since 1971 and Delta Junction since 1972. Otra was included in the testing program at both locations beginning in 1973. Otal and Datal are newcomers to the list of standards and have been evaluated for only 4 years. Otal and Datal are both very early maturing barleys which have been elevated to standard varieties to replace Lidal, an old standard. Otal is the earliest maturing of the standards, with Datal, Otra, Weal, and Galt maturing 1, 3, 7, and 12 days later, respectively. Long-term average yeilds and ranges in yields for each of the standards are given in Table 3.

Table 3. Long-Term Average and Range of Yields for Barley Standard Varieties Grown at Fairbanks and Delta Junction, 1971-1982 (bu/acre).

Location	Galt	Otra	Otal	Weal	Datal
Fairbanks					
Average Yield	92	81	69	78	78
Range of Yields	59-127	50-100	49-95	43-125	56-97
Delta Junction					
Average Yield	71	82	84	64	78
Range of Yields	30 - 101	48 - 123	74-97	31-96	72-87
Fairbanks and Delta Junction					
Average Yield	81	82	76	71	78
Range of Yields	30 - 127	48 - 123	49-97	31-125	56-97

Table 4 gives the results of barley variety trials conducted at Fairbanks and Delta Junction during the 1982 growing season. For both tests, fertilizers were applied in the spring with a gravity-flow, broadcast spreader and tilled into the soil during seedbed preparation. Seed was

treated with Vitavax and planted at the rate of 72 lbs/acre, in rows 7" wide, at a depth of 1.5", with a V-belt seeder equipped with a press wheel. Weeds were controlled with a post emergence application of Brominal. The following is a brief description of the test sites.

Fairbanks, University Farm, 1982 – Fallow Land:

The test was conducted on a Tanana silt loam soil (pH 7.2) which had been cleared and in production for over 50 years. The land was summer fallowed the previous year. Plant nutrients were supplied from urea and 10-20-20 fertilizer materials at a rate of 66 lbs/acre N, 30 lbs/acre P_2O_5, and 30 lbs/acre K_2O. The plots were planted on May 12.

Delta Junction, University Research Field, 1982 – Fallow Land:

The test was conducted on a Nenana silt loam soil (pH 5.6) which had been cleared for 3 years. The land was summer fallowed the previous year. Plant nutrients were supplied from urea, 10-20-20, and borax fertilizer materials at a rate of 80 lbs/acre N, 40 lbs/acre P_2O_5, 40 lbs/acre K_2O, and 0.5 lb/acre B. In addition, 1000 lbs/acre of agricultural limestone were incorporated into the soil during seedbed preparation. The plots were planted on May 19.

Table 4. Barley Variety Trials Conducted at Delta Junction and Fairbanks During the 1982 Growing Season.

Variety or Experimental Line	Delta Junction University Research Field		Fairbanks University Farm	
	Yield (bu/acre)	Test Weight (lbs/bu)	Yield (bu/acre)	Test Weight (lbs/bu)
Bode	87	47	89	46
Datal*	87	49	97	50
Edda	87	49	93	50
Etu	71	51	95	48
Fairfield	74	53	81	51
Galt*	87	48	110	49
Gateway 63	86	52	81	52
Hankkija's Aappo	68	51	88	52
Hankkija's Eero	83	48	100	47
Hankkija's Pokko	95	49	118	50
Hankkija's 72802	96	48	91	49
Jokioinen 1103	92	49	92	47
Jokioinen 1184	104	50	94	48
Jokioinen 1315	81	49	91	48
Melvin	66	48	119	48
Olli	68	47	78	48
Otal*	97	51	95	51
Otra*	102	48	100	48
Paavo	95	48	111	49
Polaris	78	50	106	49
Triumph	62	50	83	52
Weal*	96	44	92	45
Average	85	49	96	49

*Standard variety.

Variety Descriptions

Standard Varieties:

DATAL is a new 6-rowed barley release from the U. S. Department of Agriculture breeding program at Palmer, Alaska. Datal was selected from a cross between Edda and an unnamed, early maturing 2-row selection from Sweden. Edda is a 6-rowed Swedish cultivar which has been grown in Alaska for many years. Datal was previously tested in the Tanana Valley as an experimental line which was designated as 71II-67-22-5. Datal is a very early barley, maturing 2 days earlier than Otra and 1 day later than Otal. It is highly adapted to growing conditions in the Tanana Valley, particularly the Fairbanks area. Inquiries on the availability of seed should be directed to the Plant Materials Center or the Alaska Crop Improvement Association.

GALT is a 6-rowed variety developed at the Research Station, Lethbridge, Alberta, through a cooperative project with the Experiment Farm at Swift Current, Saskatchewan. Galt matures 12 days later than Otal, the earliest of the five standards. Galt has consistently produced good yields in variety trials at Fairbanks and Delta Junction since testing began in 1971. Recent data indicate that Galt performs best when planted on fallow land. Galt planted on stubble land is often outyielded by other varieties. Galt has demonstrated excellent resistance to lodging and head shattering. It also appears to have greater tolerance to drought than most other varieties. Galt is recommended where early planting is possible (before May 21 and definitely no later than May 24) and in areas subject to high winds. Galt is still a popular variety in Alberta and should be widely available from seed suppliers in that province. Alaska seed producers have encountered some problems of low germination for locally grown Galt.

OTAL is a new 6-rowed barley developed by the U. S. Development of Agriculture breeding program at Palmer, Alaska. Otal was selected from a cross between Otra and an unnamed, early maturing, 2-row selection from Sweden. Otra is a 6-rowed Finnish cultivar which has shown considerable adaptation to interior Alaska. Otal was previously tested in the Tanana Valley as an experimental line which was designated as 71II-67-18-57. Otal is the earliest-maturing standard barley variety. It is highly adaped to growing conditions in the Tanana Valley, particularly the Delta-Clearwater area. In 1981 and 1982, Otal was the third highest yielding variety in the Delta Junction trials and had excellent test weights. Inquiries on the availability of seed in Alaska should be directed to the Plant Materials Center or the Alaska Crop Improvement Association. Otal has also been released for use by farmers in the Peace River Region of Alberta and British Columbia. Seed should be available from suppliers in these two provinces.

OTRA is a 6-rowed variety that originated in Finland and is still widely grown in that country. It is early maturing and has performed satisfactorily even when the planting season is extended into June. Otra has produced good yields under a wide range of growing conditions. Otra has only fair resistance to lodging and head shattering. Field losses from head shattering can be substantial if high winds occur after Otra has ripened fully. Swathing when the grain is at high moisture levels (25-30%) can greatly reduce or eliminate these losses. Inquiries on the availability of seed should be directed to the Alaska Crop Improvement Association or the Plant Materials Center.

WEAL is a 6-rowed variety developed by the U. S. Department of Agriculture at Palmer. It is a hooded variety which was originally developed primarily for use as a component of annual forage mixtures. Weal can be grown in combination with field peas to produce a silage equivalent in nutritive value to an oat-pea mixture. Forage dry-matter yields of Weal have been slightly less than the best oat varieties. Weal has performed well as a grain variety for some areas of the

Tanana Valley. It matures about 7 days later than Otal and has good resistance to lodging and head shattering. Weal, because it is earlier than Galt and can withstand fairly strong winds, has become a popular variety with some farmers in the Delta Junction area. One problem with Weal is that bushel weights are frequently lower than most other varieties. This could result in a reduction in price at the elevator. Weal also appears to have less tolerance to drought than other varieties, resulting in considerable fluctuation in yields and bushel weights from year to year and between locations. Inquiries on the availability of seed should be directed to the Alaska Crop Improvement Association or the Plant Materials Center.

Test Varieties:

BODE is a Swedish variety which was introduced to Alaska by a Delta Junction farmer. It is 6-rowed, medium height, and matures about the same time as Weal, or about 7 days later than Otal. In 1982, Bode produced near-average yields at both test sites, but had test weights 1 to 2 pounds below the standard test weight of 48 pounds per bushel. Testing of this variety will not be continued in 1983.

EDDA is an old Swedish barley which had been the major variety grown in Alaska for many years. Edda was retired from use by farmers in the mid-1970s primarily because of its susceptibility to disease and a head-shattering characteristic. It is a 6-rowed, early-maturing variety that ripens about the same time as Otra. It is periodically included in the testing program as a means of evaluating newer varieties in which Edda is a parent line. Seed for this variety is no longer available to farmers.

ETU is a Swedish variety which was introduced to Alaska by a Delta Junction farmer. It is 6-rowed, below average in height (31 inches), and matures about 3 days later than Galt. In 1982, yield of Etu was well below average at Delta Junction and near average at Fairbanks. Etu had good test weights at both sites. Because of its late maturity, testing of Etu will not be continued in 1983.

FAIRFIELD is a 2-rowed malting barley developed at Lethbridge, Alberta, from a cross betweeen Firlbecks III and Betzes. During 4 years of Tanana Valley testing, Fairfield has been the earliest of the 2-rowed types, maturing about the same time as Galt. It has good resistance to lodging and shattering. It has consistently produced good bushel weights, but yields have frequently been mediocre. In 1982, yields of Fairfield were well below average at both test sites. This variety should be considered by farmers if quality, as measured by test weights, is a more-important factor than yield. Seed for Fairfield should be available from suppliers in the western provinces of Canada.

GATEWAY 63 is an older Canadian variety that is still grown on small acreages in the Peace River region of Alberta and British Columbia. It is 6 rowed, taller than average height, and matures about 7 days earlier than Galt. It consistently produces good test weights, but yields are often lower than average. This variety was tested in the Tanana Valley for several years during the early 1970s and was outyielded by Galt, Otra, Lidal, Edda, and Weal. Gateway 63 should be considered as a Canadian alternative if seed for higher-yielding varieties is not available.

HANKKIJA'S AAPPO is a new barley introduction received from the Hankkija Plant Breeding Institute in Finland. It is 6-rowed, semidwarf, very stiff strawed, and very late maturing. In 1982, this variety produced below average yields at both Fairbanks and Delta Junction. Testing of Hankkija's Aappo will not be continued in 1983.

HANKKIJA'S EERO is a 6-rowed barley developed by the Hankkija Plant Breeding Institute in Finland. It has been included as an entry in the Tanana Valley testing program for the past 5 years. Its performance has been impressive in most of the tests. At Delta Junction, yield of this variety has ranked first, third, and second in 1979, 1980, and 1981 respectively. However, performance of Hankkija's Eero was below expectations in 1982 when yields were 4 bushels above average at Fairbanks and 2 bushels below average at Delta Junction. It is a semidwarf variety, averaging only 24 inches in height, or about 13 inches shorter than Otra. It matures about 4 days later than Otra. It responds to high fertility without lodging. The low straw yield, because of height, and response to high levels of fertilization may make Hankkija's Eero a key variety for future implementation of minimum-tillage and no-tillage farming practices in the Delta Junction area.

HANKKIJA'S POKKO is a new barley introduction received from the Hankkija Plant Breeding Institute in Finland. It is 6 rowed, medium height (34 inches), and matures about 2 to 3 days earlier than Galt. In 1982, Hankkija's Pokko was the second highest yielding variety at Fairbanks and ranked sixth at Delta Junction. It produced good test weights at both locations. Testing of this variety will continue in 1983.

HANKKIJA'S 72802 is a new barley introducion received from the Hankkija Plant Breeding Institute in Finland. It is 6 rowed, tall growing (38 inches), and matures about the same time as Weal. In 1982, Hankkija's 72802 produced yields that were 11 bushels per acre above average at Delta Junction and 5 bushels per acre below average at Fairbanks. Test weights were good at both locations. Testing of this variety will continue in 1983.

JOKIOINEN 1103 is a new barley introduction from Jokioinen, Finland. It is 6-rowed, tall growing (39 inches), and very early maturing (several days ahead of Otra). In 1982, it produced yields that were slightly above average at Delta Junction and slightly below average at Fairbanks. Testing of this experimental line will continue in 1983.

JOKIOINEN 1184 is a new barley introduction from Jokioinen, Finland. It is 6-rowed, tall growing (39 inches), and very early maturing (several days ahead of Otra). In 1982, it was the highest-yielding barley at Delta Junction, but was near average at Fairbanks. Jokioinen 1184 produced good test weights at both locations. Testing of this experimental line will continue in 1983.

JOKIOINEN 1315 is a new barley introduction from Jokioinen, Finland. It is 6-rowed, medium height (35 inches), and very early maturing (several days ahead of Otra). In 1982, yields of Jokioinen 1315 were slightly below average at both locations, but test weights were good. Testing of this experimental line will continue in 1983.

MELVIN is a 6-rowed feed barley from the University of Saskatchewan. It matures about 2 days later than Galt, a parent variety. In 1979, Melvin was outperformed by Galt in the Tanana Valley tests. However, in 1980, the exact opposite occurred when yield of Melvin exceeded Galt at both the Fairbanks and Delta Junction test sites. In 1981, Melvin was the highest-yielding variety at Delta Junction, but its test weight was substandard. In 1982, Melvin was the highest-yielding variety in the Fairbanks trials, but ranked second lowest at Delta Junction. Melvin has good resistance to lodging and shattering. Farmers who want to try this variety for the first time should exercise caution. Melvin should be planted early, preferably before mid-May, and only on small acreages.

OLLI is a very old Finnish variety that is still grown in the Peace River region of Alberta and British Columbia. It is 6 rowed, tall growing (38 inches), and susceptible to lodging. Yields of Olli are generally well below most other varieties. Olli is also susceptible to head shattering which can

cause considerable losses if the crop is exposed to high winds or prolonged rainfall. Olli is one of the earliest-maturing barley varieties available anywhere. Olli should be considered as a Canadian alternative if seed for higher-yielding varieties is not available.

PAAVO is a 6-rowed variety from Finland that has been evaluated in the Tanana Valley since 1978. Paavo far outyielded all other varieties at Delta Junction in 1978 and has produced respectable yields in 1979, 1980, 1981, and 1982. It is a fairly early variety, maturing about 2 days later than Otra. Paavo appears to be a slight improvement over Otra for resistance to lodging and head shattering. At this time, seed of Paavo is not available to farmers.

POLARIS is a 6-rowed feed barley developed at Beaverlodge, Alberta, from a cross between Jubilee and Olli. This variety has produced outstanding yields in the Peace River Region of Alberta and appears to have some tolerance to acid soils. Polaris has been tested in the Tanana Valley for the past 3 years. Under Tanana Valley conditions, Polaris requires about the same length of time to mature as Galt, but ripens more uniformly than Galt. Polaris has been outperformed by Galt in 2 of the last 3 years. Testing of Polaris will continue in 1983.

TRIUMPH is a 2-rowed barley that was bred in East Germany. It has produced exceptionally high yields in tests conducted in England and Scotland. Triumph has been included in the Tanana Valley trials for 3 years. Its performance has been inconsistent with regard to yield and it is very late maturing. Testing of this variety will not be continued in 1983.

Table 5 provides a cumulative list of all the barley varieties and experimental lines tested at Fairbanks and Delta Junction during the 12-year period from 1971 to 1982. It also provides the number of years of testing for each variety at these locations.

Table 5. Barley Varieties Tested at Fairbanks and Delta Junction, 1971-1982.

Variety or Experimental Line	Years of Testing	
	Fairbanks	Delta Junction
Advance	1	1
Amy	1	1
Balder	3	2
Beacon	1	1
Bedford	1	1
Belle	1	1
Betzes	6	5
Bode	1	1
Bonanza	3	3
Bonus	2	3
Brock	2	0
Br 6505-5	2	0
Br 6505-21	2	0
Br 6505-31-1	2	0
BT 334 (Johnston)	2	2
Carlsberg II	1	1
Cathy	1	1
Centennial	1	2
Conquest	2	0
Cree	1	1
Datal	4	4
Dickson	1	0
Dolores	1	1
Early Carlsberg II	1	1
Early Freja	1	1
Early Hannchen	1	1
Edda	8	7
Erbet	1	1
Ershabet	2	2
Etu	1	1
Exp HV No. 9	1	1
Exp HV No. 14	1	1
Fairfield	3	4
Fergus	2	0
Firlbecks III	2	1
Freja	1	1
Frontier	1	0
Galt	12	11
Gateway 63	5	5
Hankkija's 72802	1	1
Hankkija 673	1	2
Hankkija's Aappo	1	1
Hankkija's Eero	4	5
Hankkija's Pokko	1	1
Hannchen	1	1
Herta	1	0
Hiland	1	0
Hyproly	1	0
Hyproly Normal	1	0
Jokioinen 1103	1	1
Jokioinen 1184	1	1
Jokioinen 1315	1	1
Jubilee	4	4
Karl	1	1
Klondike	1	2
Larker	1	1
Lidal	11	10
Lot EX 1-N	1	1
Lud	2	2
Mari	2	2
Massey	1	1
Melvin	3	4
Mingo	1	1
Moravian III	1	1
NRGB 79-2	1	1
Olli	7	6
Onda	1	1
Otis	2	0
Otal	4	4
Otra	8	10
Paavo	4	5
Palliser	4	2
Paragon	2	0
Parkland	2	0
Piroline	3	2
Polaris	3	3
Prilar	1	0
Primus II	2	1
Rovaniemi Sel. 70-B (Finnaska)	6	5
Shabet	5	6
Stanka	3	1
Steptoe	3	3
Strom	1	1
Summit	2	3
Tibet Hulless	3	1
Trebi	1	0
Triumph	3	3
Trophy	1	0
Unitan	1	0
Vale 70	1	1
Weal	12	11
Windsor	2	3
62 II-62-2-378-411	3	3
66 II-62-1-209-204	1	1
66 II-62-2-174-191	3	3
66 II-62-3-9-9	2	2
66 II-62-3-12-12	1	1
67-38	1	1
67-488-999	3	3
67-942-241	2	2
68-3	1	1
70-1591-14-11	1	0
71-584-58	1	0
71-991-63	1	0
71 II-67-18-1	1	0
71 II-67-19-91	1	0
71 II-67-21-111	1	0
71 II-67-22-6	1	0
71 II-67-22-18	1	0
71 II-67-22-125	1	0
71 II-67-22-149	1	0
74 Ab 4302	1	1

Oat Performance Trials

Common oats (*Avena sativa*) must be ranked as the second most-adapted grain crop for the Tanana Valley. Although most oat varieties generally have a longer growing-season requirement than barley, they will grow to maturity at cool temperatures. The earliest-maturing oat varieties frequently require 7 to 10 days longer to reach maturity than do the earliest-maturing barley varieties. Oats are more tolerant to acid soils than barley or wheat. High oat yields can still be produced when soil pH values range between 5.0 and 5.5.

Oats have traditionally served as a dual-purpose crop for Alaska. They can be harvested for forage at an immature growth stage or harvested for grain at maturity. If oats are harvested for grain, the remaining straw can provide a significant secondary crop. Oats that are to be grown for grain should be planted fairly early, preferably before May 24. When oats are grown for hay, or as a component of forage mixtures, planting date is not so critical. Oats planted between June 1 and June 15 often grow taller and produce more forage than earlier plantings.

Nip, Pendek, Rodney, and *Toral* are considered the standard varieties for Tanana Valley. Yield data for these varieties have been collected at Fairbanks since 1971 and at Delta Junction since 1972. Rodney, Nip, and Toral have been included in the tests since 1971. Pendek was added in 1972. Long-term average yields and ranges in yields for each of the standards are given in Table 6.

Table 6. Long-Term Average and Range in Yields for Oat Standard Varieties Grown at Fairbanks and Delta Junction, 1971-1982 (bu/acre).

Location	Nip	Pendek	Rodney	Toral
Fairbanks				
Average Yield	126	120	142	140
Range of Yields	52 - 159	50 - 167	63 - 178	67 - 204
Delta Junction				
Average Yield	106	122	106	120
Range Yields	45 - 145	53 - 208	51 - 170	52 - 179
Fairbanks and Delta Junction				
Average Yield	116	121	124	130
Range of Yields	45 - 159	50 - 208	51 - 178	52 - 204

Table 7 gives the results of oat variety trials conducted at Fairbanks and Delta Junction during the 1982 growing season. For both tests, fertilizers were applied in the spring with a gravity-flow, broadcast spreader and tilled into the soil during seedbed preparation. Seed was planted at the rate of 100 lbs/acre, in rows 7" wide, at a depth of 1.5", with a V-belt seeder equipped with a press wheel. Weeds were controlled with a postemergence application of Brominal. Following the table is a brief description of the test sites.

Table 7. Oat Variety Trials Conducted at Delta Junction and Fairbanks During the 1982 Growing Season.

Variety	Delta Junction University Research Field		Fairbanks University Farm	
	Yield (bu/acre)	Test Weight (lbs/bu)	Yield (bu/acre)	Test Weight (lbs/bu)
Athabasca	155	40	139	39
Cascade	159	39	172	39
Nip*	121	36	157	35
Pendek*	172	38	140	35
Pol	111	33	147	34
Puhti	135	35	158	35
Rodney*	150	40	177	38
Toral*	100	39	204	38
Valko	75	35	159	36
Vouti	118	38	147	37
Average	130	37	160	37

*Standard variety

Fairbanks, University Farm, 1982 – Fallow Land:

The test was conducted on a Tanana silt loam soil (pH 7.0) which had been cleared and in production for over 50 years. The land had been summer fallowed the previous year. Plant nutrients were supplied at a rate of 66 lbs/acre N, 30 lbs/acre P_2O_5, and 30 lbs/acre K_2O from urea and 10-20-20 fertilizer materials. The plots were planted on May 10.

Delta Junction, University Research Field, 1982 – Fallow Land:

The test was conducted on a Nenana silt loam soil (pH 5.6) which had been cleared for 3 years. The land was summer fallowed the previous year. Plant nutrients were supplied from urea, 10-20-20, and borax fertilizer materials at a rate of 80 lbs/acre P_2O_5, 40 lbs/acre K_2O, and 0.5 lb/acre B. In addition, 1000 lbs/acre of agricultural limestone were incorporated into the soil during seed bed preparation. The plots were planted on May 19.

Variety Descriptions

Standard Varieties:

NIP is a black-hulled oat of Swedish origin that has been grown in Alaska since the late 1950s. Nip is probably the best all-purpose oat variety for Alaska. It performs well under a wide range of growing conditions. It is very early maturing and has fairly good resistance to lodging and grain shattering. It produces a fairly tall growth and can be grown for forage. Nip has been popular among some farmers because it can be planted almost a week later than most other varieties and still reach maturity. It appears to be more tolerant than other varieties to late-summer and early-fall frosts, particularly with regard to seed germination. A major problem with growing this oat is

that volunteers appear in other grain crops following Nip in the crop rotation. Seed for this variety is available only in Alaska and, in recent years, local suppliers have been scarce. Inquiries on the availability of seed should be directed to the Alaska Crop Improvement Association.

PENDEK was developed in Holland and has become popular in several areas of Canada. It is a short, stiff-strawed variety that matures 3 to 5 days later than Nip. It has very good resistance to lodging and grain shattering. Pendek has yielded exceptionally well when grown under high fertility. Its height averages 6 to 7" shorter than Rodney, Nip, and Toral. Pendek is recommended for grain production only. Pendek has been the highest yielding oat variety in the Delta Junction trials for 2 out of the last 3 years. Pendek's performance at Fairbanks has been inconsistent. Pendek seed is available from Canadian seed suppliers.

RODNEY is a fairly old variety developed in Winnipeg, Manitoba. For nearly 20 years it has been a popular oat in grain-producing areas of Canada, the Rocky Mountain states, and North Dakota. Many of the newer varieties have been developed from crosses with Rodney. It is a medium- to late-maturing variety which has produced very high grain and forage yields at Fairbanks and Delta Junction. In 1982, Rodney produced the second highest grain yield at Fairbanks, and ranked fourth at Delta Junction. It is resistant to grain shattering, but some lodging may occur on highly fertile soils. Rodney grows to about the same height as Nip, but matures 7 to 10 days later. Since Rodney is of borderline maturity for parts of the Tanana Valley, use of this variety for grain production involves a greater degree of risk than for earlier-maturing varieties. Early planting greatly reduces this risk. Rodney is recommended primarily for forage production. Seed for this variety is usually available from Canadian and West Coast seed suppliers.

TORAL was developed by the U. S. Department of Agriculture at Palmer, Alaska. It has proved to be an outstanding variety in the Tanana Valley. Toral matures about 5 days later than Nip but usually produces higher grain and forage yields. Kernels of Toral have a higher test weight than Nip. It is very resistant to lodging, but slight grain shattering may occur as a result of strong winds or persistent rainfall. Toral, like Nip, is a dual-purpose variety that is suitable for both grain and forage production. In 1982, grain yields of Toral ranked first at Fairbanks and ninth at Delta Junction. Seed for this variety is available only in Alaska. Seed inquiries should be directed to the Alaska Crop Improvement Association.

Test Varieties:

ATHABASCA is a very early maturing, Canadian variety. It is a fairly new release and was first included as an entry in the Tanana Valley trials in 1979. It is the first yellow-oat variety to mature as early as Nip and shows promise of yielding as much as Nip. In 1981, Athabasca yielded 11 bushels per acre more than Nip at Delta Junction, but produced 38 bushels per acre less than Nip at Fairbanks. In 1982, Athabasca yielded 35 bushels per acre more than Nip at Delta Junction but produced 18 bushels per acre less than Nip at Fairbanks. Athabasca is several inches shorter than Nip and has greater resistance to lodging and shattering. *Athabasca should be considered as a highly suitable, early-maturing variety for Delta Junction.* Its performance at Fairbanks has been inconsistent. Athabasca should be widely available from seed suppliers in the Peace River Region of Alberta.

CASCADE is a new, high-yielding oat variety developed at the Canada Research Station, Lacombe, Alberta. This oat has been an entry in the Tanana Valley testing program for the past 2 years. At Delta Junction, yield of Cascade ranked first in 1981 and second in 1982. At Fairbanks Cascade was the fourth highest yielder in 1981 and was the third highest yielder in 1982. Cascade is similar to Rodney in height and maturity, but has greater resistance to lodging. Seed for this variety should be widely available from western Canadian seed suppliers.

POL is a Swedish variety which was introduced to Alaska by a Delta Junction farmer. It is a very early yellow oat, maturing 2 to 3 days ahead of Nip and Athabasca. Pol is similar to Pendek in height, averaging about 32 inches. It has good resistance to lodging and shattering. In 1982, yield and test weight of Pol was below average at both test sites. Because early maturity is so important for Alaska, testing of Pol will continue in 1983.

PUHTI is a Swedish variety which was introduced to Alaska by a Delta Junction farmer and tested for the first time in 1982. It is a tall-growing oat which is similar to Rodney in height and maturity date. However, Puhti was out performed by Rodney at both locations. This variety can be described as mediocre in overall performance. In yield, Puhti ranked fifth out of the ten varieties evaluated at both Fairbanks and Delta Junction. Testing of Puhti will not be continued in 1983.

VALKO is a new oat introduction received from the Hankkija Plant Breeding Institute in Finland. In 1982, Valko was the lowest-yielding variety in the Delta Junction trials but ranked fourth at Fairbanks. It is intermediate in height, between Pendek and Rodney, averaging 37 inches. Because of its late maturity, testing of Valko will not be continued in 1983.

VOUTI is a new oat introduction received from the Hankkija Plant Breeding Institute in Finland. It is a short-growing variety, averaging only 31 inches in height. Vouti is medium to late in maturity, about 2 days later than Rodney. In 1982, yields of Vouti were below average at both locations. Testing of this variety will not be continued in 1983.

Table 8 provides a cumulative list of all the oat varieties and experimental lines tested at Fairbanks and Delta Junction during the 12-year period from 1971-1982. It also gives the number of years of testing for each variety at these locations.

Table 8. Oat Varieties Tested at Fairbanks and Delta Junction, 1971-1982.

Variety or Experimental Line	Years of Testing		Variety or Experimental Line	Years of Testing	
	Fairbanks	Delta Junction		Fairbanks	Delta Junction
Astro	1	1	Orbit	2	2
Athabasca	3	4	Pendek	11	11
Cascade	2	2	Pol	1	1
Cavell	6	5	Puhti	1	1
Cayuse	6	5	Random	6	5
Ceal	6	5	Rapida	1	0
Cherokee	1	0	Rodney	12	11
Chief	1	1	Rovaniemi Sel. (Orion)	2	2
Cody II	1	0	Russell	2	1
Eagle	3	3	Sioux	4	3
Foothill	2	3	Spear	1	1
Frazer	5	5	Terra	1	2
Garry	2	1	Toral	12	11
Gemini	0	1	Valko	1	1
Glen	5	4	Vicland	1	0
Golden Rain	3	2	Victory	5	5
Grizzly	4	4	Vouti	1	1
Harmon	6	5	61 II-55-21-25-8	1	1
Hinoat	0	1	61 II-55-21-58-14	1	1
Hudson	4	3	61 II-55-21-15-5	6	5
Kelsey	4	3	65 II-58-10-4-3	1	1
Laurent	2	2	65 X-58-26-3-2	1	1
Markton	1	0	65 X-58-33-2-2	1	1
Nip	12	11			

Spring Wheat Performance Trials

Wheat belongs to the genus *Triticum* and two species are widely cultivated: *T. aesitivum* subspecies *vulgare* (bread wheat) and *T. durum* (macaroni wheat). The bread wheats are subdivided into categories based on growth habit: hard red spring wheat and hard red winter wheat. Most macaroni wheats have a spring growth habit. To date, hard red spring wheats have shown the greatest adaptation to Alaska. Hard red winter wheats frequently have poor survival which results in greatly reduced yields. Macaroni wheats usually yield less than hard red spring wheats in Alaska and require a longer growing season.

Existing varieties of hard red spring wheats have a narrower range of adaptation than barley or oats. Wheat is more sensitive to cool temperatures, particularly during the maturation stages of growth. If weather conditions during the 30-day period following pollination (usually mid-July to mid-August) are warm and dry, wheat matures about 10 days later than barley. If weather conditions are cool and wet during this period, an additional 10 to 15 days may be required for ripening. For wheat, early maturity far outweighs yield and other growth factors when evaluating new varieties.

For successful wheat production, grain-drying facilities are necessary and early planting is mandatory. Late plantings may fail to mature or may result in low test weights. Wheat should always be the first crop planted and seeding should begin as soon as the soil can be tilled in late April or early May. To have a high assurance of maturity and good quality, wheat should be planted no later than mid-May.

Gasser, Park, Chena, Ingal, and *Nogal* are the standard wheat varieties for the Tanana Valley. These are not the highest-yielding varieties tested, but they have consistently matured in variety tests over a period of two years at two locations. Yield data for Gasser and Park have been collected at Fairbanks since 1971 and at Delta Junction since 1972. Chena was included at both locations, beginning in 1973. Ingal and Nogal are newcomers to the list of standards. Ingal has been evaluated for 6 years and Nogal has been tested for only 2 years. Long-term average yields and ranges in yields for each of the standards are given in Table 9.

Table 9. Long-Term Average and Range in Yields for Wheat Standard Varieties Grown at Fairbanks and Delta Junction, 1971-1982 (bu/acre).

Location	Gasser	Park	Chena	Ingal	Nogal
Fairbanks					
Average Yield	54	59	72	54	60
Range of Yields	33-75	25-76	46-87	18-74	59-61
Delta Junction					
Average Yield	38	33	45	40	44
Range of Yields	21-51	16-55	27-62	26-55	36-52
Fairbanks and Delta Junction					
Average Yield	45	45	57	48	52
Range of Yield	21-75	16-76	27-87	18-74	36-61

Table 10 gives the results of wheat-variety trials conducted at Fairbanks and Delta Junction during the 1982 growing season. For both tests, fertilizers were applied in the spring with a gravity-flow, broadcast spreader and tilled into the soil during seedbed preparation. Seed was treated with Vitavax and planted at the rate of 90 lbs/acre, in rows 7" wide, at a depth of 1.5", with a V-Belt seeder equipped with a press wheel. Weeds were controlled with a post-emergence application of Brominal. The following is a brief description of the test sites.

Fairbanks, University Farm, 1982 – Fallow Land :

The test was conducted on a Tanana silt loam soil (pH 7.0) which had been cleared and in production for over 50 years. The land was summer fallowed the previous year. Plant nutrients were supplied at a rate of 66 lbs/acre N, 30 lbs/acre P_2O_5, and 30 lbs/acre K_2O from urea and 10-20-20 fertilizer materials. The plots were planted on May 10.

Delta Junction, University Research Field, 1982, – Fallow Land:

The test was conducted on a Nenana silt loam soil (pH 5.6) which had been cleared for three years. The land was summer fallowed the previous year. Plant nutrients were supplied from urea, 10-20-20, and borax fertilizer materials at a rate of 80 lb/acre N, 40 lbs/acre P_2O_5, 40 lbs/acre K_2O, and 0.5 lb/acre B. In addition, 1000 lbs/acre of agricultural limestone were incorporated into the soil during seedbed preparation. The plots were planted on May 19.

Table 10. Wheat Variety Trials Conducted at Fairbanks and Delta Junction During the 1982 Growing Season.

Variety	Delta Junction University Research Field		Fairbanks University Farm	
	Yield (bu/acre)	Test Weight (lbs/bu)	Yield (bu/acre)	Test Weight (lbs/bu)
Arabian	43	53	98	63
Chena*	61	57	84	60
Gasser*	51	56	75	59
Ingal*	49	59	60	57
Neepawa	36	54	80	61
Nogal*	52	58	61	57
Park*	38	57	76	62
Taava	52	58	109	63
Tapio	59	56	114	63
Ulla	54	53	107	63
Average	50	56	86	61

* Standard variety.

Variety Descriptions

Standard Varieties:

CHENA is the result of a single-head selection from material originating at the Rovaniemi Agricultural Experiment Station in Finland in 1970. The Rovaniemi station is located on the Arctic Circle in the farthest-north farming area of Finland. The parent line from which Chena was selected is uncertain. In variety trials conducted at various sites in interior Alaska, Chena has been previously referred to as 'Rovaniemi Selection 70-W.' Chena is a bearded variety. When ripe, straw and spike vary in color from a light tan to almost white. Chena is medium tall in height, averaging about 1" taller than Gasser. Under most circumstances, Chena germinates well in cold soils, tillers early in growth, and ripens uniformly. At Fairbanks, Chena matures about one day later than Gasser. Chena has a wide range of adaptation, particularly for interior Alaska. Preliminary milling and baking analyses indicate that Chena is suitable for use as a bread wheat.

Although Chena has not been offically released, a few farmers have been growing it on a limited scale for several years. Inquiries on the availability of seed should be directed to the Plant Materials Center or the Alaska Crop Improvement Association.

GASSER was developed in Alaska by the USDA research programs and released in 1955. Until the release of Ingal and Nogal, Gasser had been the earliest-maturing standard wheat variety included in the Tanana Valley testing program. Although yields frequently are low, Gasser has been maintained as a standard variety primarily because of its earliness. Under adverse weather conditions such as early frost or below-average growing season temperatures, Gasser will reach maturity while other varieties fail. Grain shattering of Gasser can be severe if strong winds occur during and after ripening. Lodging can also be a problem, particularly on bottomland soils or under conditions of high fertility. Gasser is a small-seeded variety that frequently has protein contents in the 18 to 20% range. Gasser does not meet quality standards established by commercial millers for flour production, but small patches are often grown by individuals for grinding whole-wheat flour. Also, in the past, some acreage has been grown for use as a feed grain. Seed for this variety is available only in Alaska and, in recent years, local suppliers have been scarce. Inquiries on the availability of seed should be directed to the Alaska Crop Improvement Association.

INGAL is a fairly new spring wheat variety developed by the U. S. Department of Agriculture breeding program at Palmer, Alaska. Ingal is the result of a cross between Gasser and Morin No. 16. Ingal averages 8 inches shorter in height than Gasser and should be considered a semidwarf variety. This variety was previously tested in the Tanana Valley as an experimental line which was designated as 61 II-55-12-62-10. Ingal is the earliest wheat ever tested at Fairbanks, maturing 6 to 7 days ahead of Gasser. In 1982, Gasser outyielded Ingal by 15 bushels per acre at Fairbanks, and by 2 bushels per acre at Delta Junction. Ingal is satisfactory for home use in milling and baking, but has not been evaluated for commercial use. It should be considered as a feed grain at present. Inquiries on the availability of seed should be directed to the Plant Materials Center or the Alaska Crop Improvement Association.

NOGAL is a fairly new spring wheat variety developed by the U. S. Department of Agriculture breeding program at Palmer, Alaska. One of the parent lines for Nogal is Gasser. At Delta Junction, during 1982, Nogal matured about 5 days earlier than Gasser and outyielded Gasser by 1 bushel per acre. Yield of Gasser exceeded Nogal by 14 bushels per acre at Fairbanks. Nogal is satisfactory for home use in milling and baking but has not been evaluated for commercial use. It should be considered as a feed grain at present. Inquiries on the availability of seed should be directed to the Plant Materials Center or the Alaska Crop Improvement Association.

PARK was registered in 1968 by the Canada Agriculture Research Station at Lacombe, Alberta. It is an early variety, maturing about 4 days later than Gasser. Park is usually the first variety to have seedlings emerge in cold soils and the first variety to flower. Park has fair resistance to lodging and shattering. Grain test weight of Park is often higher than other varieties, particularly when ripening occurs under less-than-favorable conditions. Yields of Park have been inconsistent, with a wide range when grown under different conditions. During the past 3 years, yields of Park have often been low in relation to other varieties. Park seed should be available from western Canadian sources.

Test Varieties:

ARABIAN is a new entry which was introduced to Alaska by a Delta Junction farmer. It is a stiff-strawed semidwarf variety that averages only 24 inches in height. Arabian is a late-matur-

ing variety, requiring 10 to 12 days more growing season than Gasser. In 1982, Arabian produced the fourth highest yield at Fairbanks and ranked eighth at Delta Junction. Because of its late maturity, testing of this variety will not be continued in 1983.

NEEPAWA is a Canadian wheat variety that is widely grown in the Peace River Region of Alberta and British Columbia. It has been an entry in the Tanana Valley trials since 1979. During the past four years, Neepawa's overall performance has been average, particularly with regards to yield and maturity. In 1982, Neepawa outyielded Gasser and Park at Fairbanks. However, the reverse occurred at Delta Junction. Neepawa is stiff strawed, resistant to shattering, and continues to ripen under cool-wet conditions. It is a beardless variety that matures about 5 days later than Gasser and grows to about the same height. Seed for Neepawa should be available from suppliers in western Canada.

TAAVA is a new wheat introduction received from the Hankkija Plant Breeding Institute in Finland. Taava is a stiff-straw variety that averages 37 inches in height. It matures about 6 days later than Gasser. In 1982, Taava produced the second highest yield at Fairbanks and ranked fourth at Delta Junction. Testing of this variety will continue in 1983.

TAPIO is a new wheat introduction received from the Hankkija Plant Breeding Institute in Finland. This variety has good straw strength even though it averages nearly 40 inches in height. Tapio is a medium- to late-maturing variety, requiring 8 to 9 days more growing season than Gasser. In 1982, Tapio was the highest yielding variety at Fairbanks and ranked second at Delta Junction. Testing of this variety will continue in 1983.

ULLA is a new wheat introduction received from the Hankkija Plant Breeding Institute in Finland. Ulla has excellent straw strength and grows to a height of 37 inches. It is a medium-maturing variety, requiring about 5 days more growing season than Gasser. In 1982, Ulla produced the third highest yields at both test sites. Testing of this variety will continue in 1983.

Table 11 provides a cumulative list of wheat varieties and experimental lines tested at Fairbanks and Delta Junction during the 12-year period from 1971-1982. It also gives the number of years of testing for each variety at these locations. The list does not include durum wheats or winter wheats.

Table 11. Wheat Varieties Tested at Fairbanks and Delta Junction, 1971-1982.

Variety or Experimental Line	Years of Testing	
	Fairbanks	Delta Junction
Anza	1	0
Arabian	1	1
Butte	1	1
Canthatch	6	4
Capa	1	0
Carpo	1	0
Colano	2	1
Crim	2	0
Dundas	2	2
ECM 316	1	0
Fletcher	1	0
Fortuna	1	0
Garnet	1	0
Gasser	12	12
Glenlea	0	1
Idaed	1	0
Ingal	6	6
Kharkov (spr.)	2	1
Kitt	1	0
Lemhi 66	1	0
Manitou	4	2
Mexipak	2	1
MN 7083	1	0
MN 70113	1	0
MT 676 (Isoline)	1	0
MT 671 (Isoline)	1	0
MT 677 (Isoline)	1	0
MT 6711 (Isoline)	1	1
MT 6717 (Isoline)	1	0
MT 6721 (Isoline)	1	0
MT 6722 (Isoline)	1	0
MT 6723 (Isoline)	1	0
MT 6725 (Isoline)	1	0
MT 6727 (Isoline)	1	0
MT 6728 (Isoline)	4	4
Napayo	0	1
Neepawa	3	4
Nogal	2	2
Norana	1	1
Opal	1	0
Pac. Triple Dwarf	1	0
Park	12	12
Peak 72	0	1
Pitic 62	7	5
Polk	1	1
Rovaniemi Se. 70-W (Chena)	10	10
Ruso	8	6
Saunders	7	6
Selkrik	2	1
Sheridan	2	0
Siberian Bearded	3	2
Siberian Beardless	3	2
Sinton	2	2
Sonora 64	1	0
Springfield	0	1
Taava	1	1
Tapio	1	1
Thatcher	7	6
Thatcher (insens.)	1	0
Ulla	1	1
Vernon	2	2
WS 1502	1	0
6WA 637	3	2
6WA 666	1	0
6WA 675	1	0
6WA 679	1	0
6WA 688	1	0
6WA 693	1	0
6WA 699	2	1
6WA 701	1	0
6WA 725	1	0
6WA 735	2	1
6WA 746	5	3
6WA 748	1	0
5560 II-53-1-45-2	4	4

PART II: PLANT-DISEASE EVALUATION

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Plant-disease surveys were conducted during the 1982 growing season. Observations were made periodically to determine types and frequency of occurrence of plant diseases infecting grain crops in the Delta-Clearwater area and in the Agricultural Experiment Station (AES) plots in Delta and Fairbanks. Diseases of barley, oat, spring wheat, winter wheat, and rapeseed were observed in experimental plots and in farmer's fields.

Because snow mold is a very serious disease problem on winter wheat in Alaska, a performance trial was conducted to evaluate the susceptibility of various winter wheat germplasms (varieties and breeding lines) to snow mold disease. In this experiment, six winter wheat germplasms, reputed to be resistant to snow mold diseases, were collected from the state of Washington and Montana and planted in test plots at the AES farm at the University of Alaska, Fairbanks, in the fall of 1981. Five varieties of early-maturing, winter-hardy, hard red winter wheat were also planted. A disease survey to assess the presence of snow mold was conducted in the spring of 1982, and the susceptibilities of these winter-wheat germplasms to the disease were evaluated.

Observations on the occurrence and severity of plant diseases on various crop and the results of the snow mold experiments with winter wheat are summarized as follows.

Barley Diseases

Barley diseases such as scald (*Rhynchosporium secalis*), stripe (*Helminthosporium gramineum*), net blotch (*Helminthosporium teres*), speckled leaf blotch (*Septoria avenae f. sp. triticea*), loose smut (*Ustilago nuda*), and spot blotch (*Helminthosporium sativum*) were found both in the Fairbanks and Delta areas. Barley yellow dwarf virus disease, found in Fairbanks in 1981, was not found in 1982. In Delta, scald was the disease most often found on barley; net blotch and speckled leaf blotch were also common. In Fairbanks, although barley scald was not a serious disease problem on the AES farm, it was very common in farmers' fields.

A wide range of resistence to various diseases has been observed in the performance trials on barley varieties conducted at the AES farm in Fairbanks and the AES experiment plots in Delta. Table 12 presents a list of diseases observed on barley varieties grown in experimental plots. It also provides an estimate of the degree of disease manifestation, shown here as percentage of plants displaying symptoms of diseases.

Seed of barley varieties obtained from Sweden and used in the performance trials with barley varieties were all treated with fungicides upon acquisition. Thus, no trials were conducted on untreated seeds, and consequently no information is available on the performance of fungicide-treated seeds in comparison with untreated seeds. Another effect of this fungicide treatment was that reduction of the disease potential of the seed resulted in low initial infection on the seedlings. Furthermore, barley variety performance trials in Delta were conducted this year on newly cleared land with relatively little disease potential in the environment. Therefore, the low

Table 12. Summary of Diseases Observed on Barley Varieties under Field Conditions in the Delta-Clearwater Area.

Barley Variety	Degree of Disease Manifestation*	Disease Observed**
Bode	++	scald, net blotch, loose smut
Datal	+	scald, net blotch
Edda	++	scald, speckled leaf blotch, net blotch
Etu	++	scald, net blotch, loose smut
Fairfield	+++	scald, net blotch
Galt	+	scald, net blotch, loose smut
Gateway	++	scald, net blotch
Hankkija's Aappo	++	scald, speckled leaf blotch, net blotch, loose smut
Hankkija's Eero	+++	speckled leaf blotch, scald, net blotch, stripe
Hankkija's Pokko	+++	scald, net blotch
Hankkija's 72802	++	scald, net blotch
Jokioinen 1103	+	scald, net blotch
Jokioinen 1184	+++	scald, net blotch
Jokioinen 1315	+++	scald, net blotch
Melvin	+	scald, net blotch
Olli	+	scald, net blotch
Otal	+	scald, net blotch
Otra	+	scald, net blotch
Paavo	+	scald, net blotch
Polaris	++	scald, net blotch
Triumph	+++	scald, net blotch
Weal	+	scald, net blotch

*+++: nearly 60% of plants show symptoms of diseases; ++: 40%; +: 20%.

**Listed in order of frequency of observance.

percentage of disease manifested on many of the varieties does not reflect their true genetic resistance to diseases; instead, it is a reflection of the new land on which the varieties were planted and the resistance imposed by the fungicide treatment.

Except for an unseasonably cool spring, the weather conditions of the 1982 growing season were fairly warm and dry (Part I, climatic data). The coolness of April and early May resulted in slow warming of soil temperature, which remained cool at the time of planting, greatly favoring the development of barley stripe disease. Barley stripe is spread mainly by contaminated seeds. In those fields where untreated seeds or seeds not properly treated with gungicides were used, the incidence of barley stripe was quite high.

Other diseases, such as scald, net blotch, speckled leaf blotch, spot blotch, loose smut, can all be transmitted by using contaminated seeds. Treating barley seeds properly with fungicide, i.e., using the recommend concentration and proper mixing, has produced beneficial effects.

Development and dissemination of scald and net blotch fungi depend on cool and humid weather conditions. The warm and dry summer of 1982 largely accounted for the slow spread of these diseases in the field. In our loss-assessement studies conducted, highest yield loss found anywhere caused by barley scald and net blotch diseases, were found to be 23% compared to 60% in 1981.

Loose smut was found in farmers' fields on Galt and Lidal varieties of barley. It was also common on a Finnish barley variety, Hankkija's Aappo, and on two Swedish barley varieties, Bode and Etu. Yield loss caused by this disease has not been significant. Cover smut was not found in 1982.

Ergot (*Claviceps purpurea*) was found on the Galt variety in 1982. This disease was found on old farm lands but not on barley crops on newly cleared land. The number of ergot-infected barley plants remained very small. However, ergot was a severe disease problem on rye and triticale, Ergot sclerotia (a hard fungal mass) contains compounds harmful to the circulatory systems of humans and animals, and grain marketed through the United States is designated "Ergoty" in the Federal grading system when it contains more than 0.3 per cent ergot sclerotia by weight.

Scab, a disease caused by *Fusarium graminearum* was not found on barley planted in 1982. However, *Fusarium* fungi were isolated last spring from barley kernels overwintering in the field. Low levels of two toxins produced by this fungus, trichothecene and zearolenone, were found in grain samples collected from the field. Although the level of toxins present in barley grains was very low, grain appeared unsavory. The concentration of toxins in the grain could increase to a level harmful to animals (especially swine) if the grains were stored in a warm and humid place.

Snow Mold on Winter Wheat

Two snow mold fungi, *Sclerotinia borealis* and a sclerotial Low Temperature Basidiomycetes (sLTB), were found to be very destructive to winter wheat in places where a heavy snow cover, conducive to growth of snow mold, is available through winter. The early-maturing, winter-hardy, hard red winter wheats tested in the past all seemed to be very susceptible to this disease.

In the fall of 1981, a winter wheat performance trial on the susceptibility of winter wheat to *S. borealis* and sLTB infection was initiated. Three winter wheat varieties (McCall, Sprague, Windrage) and three winter wheat breeding lines (CI14106, PI16782, PI73467), all reputed to be resistant to snow mold disease caused by fungi *Typhula* and *Fusarium* in the states of Washington and Montana, were planted on experimental plots at the AES farm at Fairbanks. Five early-maturing, winter-hardy, hard red winter wheat varieties (Capitan, Froid, Norstar, Roughride, and Sundance) were also planted. Three planting dates (mid-July, early August, and mid-August) were selected in order to test the relationship between plant size and disease resistance.

In the spring of 1982, a snow mold survey was conducted. It covered the number of winter wheat plants germinated, the number of plants which survived snow mold infection in the winter of 1981-1982, and the number of tillers. The number of tillers which survived snow mold infection were counted and computed. The susceptibility or resistance of a winter wheat germplasm was evaluated based on its percentage of survival. The formula for the calculation of the percentage of survival is as follows:

$$\% \text{ of survial} = \% \text{ of survived plant} \times \% \text{ of survived tiller}$$

Table 13 presents the results of the winter wheat performance trial conducted at the experiment farm at Fairbanks in 1981-1982.

Table 13. Resistance of Winter Wheat Germplasms to Snow Mold Infection, 1981-82

	Germplasms										
	Germplasms resistant to *Typhula* & *Fusarium*						Germplasms resistant to cold (winter hardy)				
Planting Date	CI14106	PI16782	PI73467	McCall	Sprague	Windrage	Capitan	Froid	Norstar	Roughrider	Sundance
Mid-July	1*	9	0.4	13	8	22	6	7	0.8	10	1.5
Early August	**	7	**	4	5	5	5	5	3	3	0
Mid-August	**	**	**	2	0.2	4	7	1	5	3	10

*All numbers given indicate % survival; the higher the number, the more resistant the plant to snow mold infection
**No seeds available

Although Windrage and Roughrider varieties showed a slight tolerance to snow mold disease, none of the germplasms tested possessed substantial resistance to *S. borealis* and sLTB infection. The earlier the planting date and the larger the plant size before overwintering, the more tolerant the plant to infection by snow mold.

Diseases on Other Crops

A heavy infection of loose smut was observed on the Ulla variety of spring wheat in the performance trial. An estimated 15% of seeds were contaminated with this disease.

Bacterial mosaic (*Corynebacterium tessellaria*), a new disease found in 1980, was observed again this year on spring wheat in the experimental farms at Fairbanks and Palmer. Results of our experiments indicate that this disease can be spread by contaminated seeds. This bacteria was found both on the surface and inside of the seed. The economic significance of this disease is still unknown.

On oat, leaf blotch (*Scolecotrichum graminis*) and Alternaria blotch (*Alternaria sp.*) were also found this year. Yield loss due to these diseases seemed minimal.

On rapeseed, grey leaf spot (*Alternaria brassicae*) was found again this year. The disease became most serious at the end of the season. Dark spots caused by this disease have been observed on leaves, stems , and seed pods of rapeseed plants. Thid disease is spread by contaminated seeds.

An epidemic of needle rust (*Chrysomyxa ledicola*) was observed on white spruce trees in the Tanana River Valley. Massive amounts of reddish-orange spores were released from the needle from mid-July to mid-August. The infected needles then gradually shriveled and eventually fell from the branches. Spruce needle rust disease does not kill the tree, but is weakens it by depleting nutrients and by reducing reserves of the tree.

Diseases Observed on Crops during the 1982 Growing Season

Bacterial mosaic of spring wheat (*Corynebacterium tessellaria,* Alaska strain)

A large number of small lesions (spots) on the leaves and sheath of the wheat plant is the first indication of bacteria mosiac disease. The color of these lesions varies from beige to orange depending on the susceptibility of the variety to this disease. As the disease progresses, these lesions grow together and form long, brown-colored streaks.

Barley loose smut (*Ustilago nuda*)

Barley plants infected by loose smut are usually the first to head in the field. The kernels are replaced by greenish-black bodies within a delicate, silvery membrane. The membranes soon break, releasing masses of medium-brown to dark-brown powdery spores. Presence of sooty, naked spikes in the field is also an indication of loose smut infestation.

Barley net blotch (*Helminthosporium teres*)

The leaf spot varies in size and shape. Individual spots do not have definite margins. Their color is light brown; and faint, dark-brown, net-like patterns can be detected in these blotches.

Barley scald (*Thynchosporium secalis*)

The first symptom on the leaf blades and sheaths is the appearance of oval or diamond-shaped, water-soaked blotches. The color of these scald-like blotches changes from bluish green to brown and finally to a bleached-straw color with brown margins. Sometimes the spots have a ringed appearance.

Barley speckled leaf blotch (*Septoria avenae f.* sp. *triticea*)

Leaf blotch appears first as light-green to yellow spots between the veins of the leaves. The lesions spread rapidly to form light-brown, irregular blotches with a speckled appearance as the very small, dark-brown fruiting bodies develop.

Barley spot blotch (*Helminthosporium sativum*)

The leaf spot varies in size and shape. Individual spots are round or oblong with well-defined margins. Their color is uniformly dark brown. The spots later coalesce to form irregular brown stripes. Heavily infected leaves dry out and mature early.

The brown spots also appear on flowers, stems, crowns, and kernels of barley plants.

Barley stripe (*Helminthosporium gramineum*)

Barley stripe appears first as a yellow striping on the leaf blades and sheaths of barley plants. The yellow stripes soon turn brown and finally dry out and become gray as the leaves mature. During the period of culm elongation, the symptoms are distinctive: as the young leaves unfold, they exhibit yellow striping; the older leaves show browning.

Ergot (*Claviceps purpurea*)

The first symptom of this disease is a sticky exudate which appears in the spikes. A blue-black, compact, hard mass of fungus develops next instead of the kernel. These hard bodies resemble the kernel but are longer and darker and are very conspicuous.

The ergot sclerotia contain several chemical compounds, most of which are harmful to man and animals.

Grey leaf spot of rapeseed (*Alternaria brassicae*)

Development of round or oval chlorotic spots on the leaves of seedlings is the first sign of the disease. As the disease progresses, elongated blotches appear on the stem and branches of the rapeseed plant. These blotches are usually bleached straw in color with a dark border. When the relative humidity is high, these blotches frequently turn black. Black spots also appear on seed pods.

Grey mold (*Botrytis cinerea*)

This disease attacks leaves, stems, and flower parts of most varieties of sunflower. The first symptom of this disease is the appearance of large water-soaked blotches on plant tissue. As the disease progresses, these blotches turn dark brown. Whitish-grey fungal masses (mycelium) and massive, dark-grey spores found on these patches at the later stages of grey-mold infection area good indication of this disease.

Scab (*Fusarium graminearum*)

This disease can be recognized readily by the pinkish-red mycelium mass produced by this fungus on the barley heads. It not only can reduce yields, but produces a toxin in the grain itself which can be very harmful when ingested by man or animals (particularly swine).

Snow-mold fungi (*Sclerotinia borealis* and sclerotial Low-Temperature *Basidiomycetes*)

The symptoms caused by these two fungi on winter wheat are similar: after the snow melts, the infected plants are yellow in color. These plants eventually wither and die.

Spruce needle rust (*Chrysomyxa ledicola*)

Massive amounts of reddish-orange spores were released from the needle from mid-July to mid-August. The infected needles then gradually shriveled and eventually fell from the branches.