Results from the 1990 Alaska Barley Breeding Program

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INTRODUCTION

The development of improved plant cultivars is accomplished through comprehensive plant breeding programs. Such programs:

1) evaluate genetically-diverse germplasm in order to identify superior-performing genotypes;
2) create new genetic recombinations from crosses or other means using selected parental genotypes;
3) evaluate segregating progeny from these families while exerting selection pressure for desirable characteristics; and
4) identify superior-performing genotypes in yield trials conducted in multiple environments.

This circular documents the current status of research in cultivar development associated with the Alaska barley breeding program.

MATERIALS AND METHODS

Approximately 275 barley genotypes were grown for observation in single-row plots at Palmer in 1990. The purpose of this was to perform an initial screening, based upon early heading, in order to obtain an elite group of cultivars which will be evaluated more thoroughly in four-row plots in 1991. The 150 genotypes were obtained from a variety of sources including the Nordic Gene Bank (Sweden), the Vavilov Institute of Plant Breeding (USSR), the International Center for the Improvement of Maize and Wheat (CIMMYT, Mexico), and numerous plant breeders in the U.S. and abroad.

In addition, 211 other barley genotypes were grown for observation in four-row plots. These genotypes were screened from a larger set grown for observation in single-row plots in 1989. Additional screening and selection based upon heading, maturity, plant height, and lodging was practiced among these genotypes in 1990.

A diagram of the Alaska Barley Breeding Program is given in Figure 1. After the initial cross, families are advanced in bulk to the F_2, F_3, and F_4 generations. Families which demonstrate serious weaknesses in these generations are discarded. Head selection is practiced in F_4 generation, and the selected heads are grown as headrows the following year. Approximately 2-5% of these headrows are harvested to be grown as single-row plots. Promising genotypes are advanced to more intensive stages of testing, with the eventual release of a superior cultivar.

RESULTS AND DISCUSSION

The 34 earliest-heading genotypes grown for observation in single-row plots are presented in Table 1, along with their relative heading date and plant height. Several genotypes had heading dates as early or earlier than 'Otal', the check cultivar. Two of these cultivars, L-421 and K-27058, possess a newly-identified gene for early heading which may be useful in subsequent breeding work. This gene, ea-k_6, is located on chromosome 5, and may not be present in currently-grown cultivars developed in Alaska. These two entries may actually represent different designations of the same genotype.

Data from the earliest-heading genotypes grown for observation in four-row plots, along with data from later-heading genotypes in this trial which possessed desirable characteristics, are presented in Table 2. 'Olli', a Finnish variety released in 1927, was the earliest-maturing cultivar in this group. However, Olli is not high yielding and has fairly weak straw. 'Bode', developed in Norway, was early maturing and had exceptionally strong straw strength. 'Arra' is the most widely-grown cultivar in Finland. While it is early maturing, it is prone to lodging due to its weak straw.

Approximately half of the F_2, F_3, and F_4 families grown in 1990 were harvested, the remainder were discarded due to agronomic weaknesses. The families harvested are shown in Tables 3, 4, and 5. Most of the F_2 families are relatively later maturing, and strong selection will be practiced for early maturity in subsequent generations. The four F_4 families listed in Table 5 appear to have good potential as breeding material. All families are early maturing, and possess short straw. Five hundred heads were selected within each of these families to be grown as headrows in 1991.

Results of the Barley Four-Rep Yield Trial, grown at Palmer and Fairbanks, are presented in Table 6. The purpose of this test is to evaluate the performance of newly-developed experimental lines relative to that of established check cultivars. In 1990, the experimental line '77II-69-63-3-1' (Edda/Sv60718) was compared to three released cultivars. 77II-69-63-3-1 was the highest-yielding cultivar averaged over both locations, although it was later maturing. Its strongest asset, however, appears to be its superior straw strength. At Fairbanks, this experimental line was only slightly lodged, while the other cultivars were severely lodged. No significant lodging occurred at Palmer due to relatively dry conditions and lack of damaging winds. Additional testing over both locations and years is required to provide a more thorough comparison between the performance of this experimental line and previously-released standards.

Figure 1. *Breeding method used in the Alaska barley breeding program.*

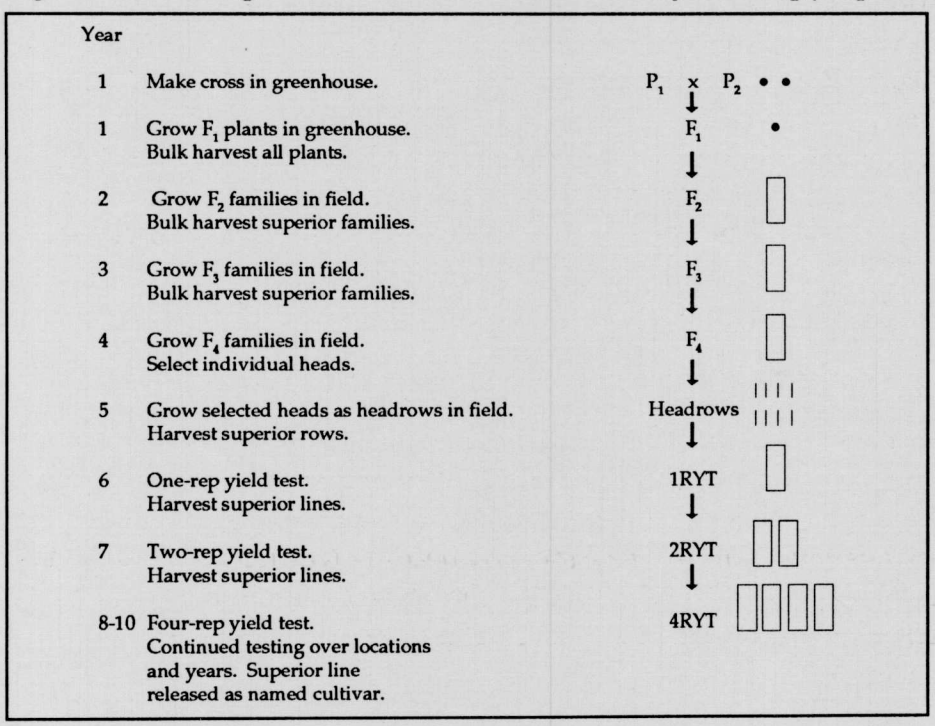

Table 1. *Relative heading date and plant height of the 34 earliest-heading barley genotypes grown for observation in single-row plots at Palmer in 1990.*

Cultivar	Relative heading date[1]	Plant height (in)
Otal (check)	(53)	36
CIMMYT Early barley #1	2	22
CIMMYT Early barley #4	2	28
CIMMYT Early barley #6	2	24
CIMMYT Early Barley #7	3	27
CIMMYT Early Barley #9	3	19
CIMMYT Early barley #11	1	30
CIMMYT Early barley #14	0	24
CIMMYT Early barley #15	0	24
CIMMYT Early barley #17	1	34
CIMMYT Early barley #18	1	29
CIMMYT Early barley #23	-1	35
ND10252	2	31
ND10394	0	30
ND10469	2	28
ND11138	0	31
ND11167	2	32
ND11260	4	27
ND11262	2	29
K-27058	4	32
L-421	7	37
VIR #4363	1	37
VIR #4816	1	38
VIR #4817	1	40
H-716	5	41
H-717	2	37
H-726	2	38
H-739	3	34
Krasnoyarsk Sel. 13	1	34
Lyllapur	-1	31
KVL 736 (naked)	-1	17
Flynn	4	22
HJA 77061	-1	20
Cebada Cervercera	4	28
60-Day	2	36

[1]No. days earlier (+) or later (-) than Otal.

Table 2. *Relative heading date and plant height of barley genotypes grown for observation in four-row plots at Palmer in 1990.*

Cultivar	Relative heading date[1]	Relative maturity date[1]	Plant height (in)	Cultivar	Relative heading date[1]	Relative maturity date[1]	Plant height (in)
Otal (check)	(53)	(84)	36	KVL 452	0	-5	43
Iuzhnii	0	-7	36	KVL 475	2	-9	28
Krasnodarskij 35	1	-9	29	KVL 620	0	-9	30
Hankkija 673	-1	0	36	Advance	1	-9	32
Olli	3	7	39	Gateway	0	3	37
467624	1	3	39	Brockilli	0	-9	18
Bode	-1	2	38	Trapmar	-6	-13	42
Nordlys	2	4	35	Bowman	2	0	30
Otra	1	1	46	Akka	-1	0	29
Etu	-3	4	28	Betzes	-6	-16	36
Paavo	-3	-5	33	Hector	-4	-20	30
Pirkka	-1	-4	42	HJA 80138	-2	-8	32
Suvi	-1	-5	30	Pohto	-3	-8	24
PI 483237	0	-8	31	Gunilla	-4	-7	28
OR 8623	0	-7	19	Ripa	-1	-3	32
Potra	-1	-3	36	Karin	-1	0	33
Eero 80	-1	-13	22	Bamse	-2	-5	42
HJA 63912	-4	-4	34	Agneta	-2	-5	35
HJA 78003	-3	-9	29	SV N 8282	-1	-5	34
Loviisa	-2	-2	37	SV N 84120	1	-2	28
HJA 78104	-2	-5	25	IB (naked)	2	1	24
Ershabet	1	-19	30	IB//Gat/ Pri/Menz (naked)	-1	0	26
H 3211	-4	-5	34	Aprizaco/ Russian Line	3	0	30
Arra	-1	2	35	Tammi	1	-4	31
KVL 49	0	-7	40				
KVL 80	0	0	40				
KVL 343	3	-9	30				

[1]No. days earlier (+) or later (-) than Otal.

Table 3. Relative heading date, relative maturity date, and plant height of F_2 families grown at Palmer in 1990.

Family	Relative heading date[1]	Relative maturity date[1]	Plant height (in)
Otal (check)	(53)	(84)	36
BT637/Eero	-8	-9	30
Otal/BT637	-7	-8	42
BT636/Otra	-5	-7	42
Datal/Hazen	-3	-7	34
Olli/Robust	-2	-9	37
Glenn/Datal	-3	-7	36
Datal/ACA 2564	-3	-8	37
uc2 Kindred/Eero	-3	-7	33
uc2 Kindred/Datal//Datal	-3	-4	40
uc2 Otra//Otra	-4	-7	42
uc2 Kindred/ACA 2654//ACA 2564	4	-9	43

[1]No. days earlier (+) or later (-) than Otal.

Table 4. Relative heading date, relative maturity date, and plant height of F_3 families grown at Palmer in 1990.

Family	Relative heading date[1]	Relative maturity date[1]	Plant height (in)
Otal (check)	(53)	(84)	36
CCXXXVIII-B-315/Advance// 71II-67-21-120/8176-382-761-85-1	2	0	32
CCXXXVII-A-122/68II-63-8-34-28// Olli/CCXXXVI-698	0	1	36
CCXXXVIII-B-382/Pioneer// CCXXXVIII-A-122/68II-63-8-34-28	2	1	36
CCXXXVI-857/CCXXXII-727// CCXXXVII-A-170/71-1591-mat 8	1	1	34
uc2 Kindred/Otra	-1	-4	36
uc2 Kindred/Otal	-3	-7	40
uc2 Kindred/ACA 2564	-4	-8	38
uc2 Kindred/Datal	-3	0	38

[1]No. days earlier (+) or later (-) than Otal.

Table 5. Relative heading date, relative maturity date, and plant height of F_4 families grown at Palmer in 1990.

Family	Relative heading date[1]	Relative maturity date[1]	Plant height (in)
Otal (check)	(53)	(84)	36
71II-67-21-120/ 8176-382-761-85-1	1	2	29
86CCXXXII-31-121/2228	1	0	28
86CCXXXII-159-81/2228	2	0	27
86CCXXXII-176-98/2228	2	4	23

[1]No. days earlier (+) or later (-) than Otal.

Table 6. Combined results of the Barley Four-Rep Yield Trial grown at Palmer and Fairbanks Alaska in 1990.

Cultivar	Days to heading	Days to maturity	Plant height (in)	Lodging (1-9)[1]	Yield (bu/A)	Test weight (lbs/bu)
Otal	48	78	34.8	4.8	64.3	52.1
Datal	48	76	33.3	4.4	58.5	49.9
Lidal	49	78	35.5	4.6	53.9	48.7
77II-69-63-3-1	49	83	36.0	1.6	73.3	51.7
Average	49	79	34.9	3.9	62.5	50.6
LSD (0.05)	0.6	1.2	2.3	0.5	6.5	1.0

[1] 1=completely upright, 9=completely lodged.

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