



Results from the 1991 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 promising germplasm to identify superior-performing genotypes for use as parents;
- 2) create new genetic recombinations from these selected parental genotypes using crossing or other means;
- 3) evaluate segregating progeny from the resulting families while exerting selection pressure for desirable characteristics; and
- 4) identify superior-performing cultivars in yield trials conducted across multiple environments.

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

MATERIALS AND METHODS

A diagram of the methodology used in the breeding program is given in Figure 1. After the initial cross is made between two parental genotypes ($P_1 \times P_2$), F_1 plants are grown and harvested in bulk. Progeny are advanced without selection to the F_4 generation, which is grown as a selection block. The earliest-maturing heads in this block are harvested. These selected heads are grown as headrows in the F_5 generation, and the earliest maturing, agronomically desirable rows are harvested.

The selected families are then evaluated sequentially for the next three years in one-, two-, and three-replication trials, with superior-performing families advanced to the next level of testing. Superior families are again grown in a selection block in the F_9 generation, and the earliest-maturing heads are harvested. Selected heads are grown as headrows in the F_{10} generation, and the earliest-heading, agronomically desirable rows are harvested. These families are then evaluated in yield trials for the next several years to determine potential candidates for varietal release.

RESULTS AND DISCUSSION

Parental Screening Trials

Forty-five entries were evaluated in an initial screening trial as single-rows in 1991, and six of these entries were harvested for additional testing in 1992. The performance of these entries is given in Table 1. Of particular interest is the genotype 'Arupo 'S''. This entry was received from CIMMYT (Centro Internacional Mejoramiento Maiz y Trigo), and it demonstrated extreme earliness under Alaskan conditions. Compared to Ota, Arupo 'S' headed 6 days earlier and matured 9 days earlier. However it is a two-

row type, and its plant height is probably too short for direct use. It is being used currently as a parent in crosses.

Twenty-nine entries, representing elite cultivars which had already been evaluated in single rows were grown in a four-rep yield trial in 1991. Results from this trial are presented in Table 2. All results are presented as percentages of Otal, and ranked by increasing time to maturity. Percentages greater than 100 indicate better performance than Otal. JO 1632, received from the Jokioinen Institute of Plant Breeding (Finland), showed particular promise, maturing several days earlier than Otal. 'Nord', 'Nordyls', and 'Olli', all of Scandinavian origin, also matured earlier than Otal. However, with the exception of Nordyls, these early-maturing cultivars yielded less than Otal. The top-performing cultivars from this trial, together with new entries from preliminary trials, will be evaluated in 1992 in order to add to this database.

In Table 3 are presented results of the 1991 Northwestern Canada Barley Trial grown at Palmer. Because of unusually dry May and June, yields were below average. The occurrence of significant rainfall in early July resulted in the formation of large numbers of tillers, many of which either matured very late or failed to mature at all.

Evaluation of Segregating Families

Four F₂, four F₃ and four F₄ families were grown in 1991 (data not shown). In addition, over 1,900 F₅ headrows from F₄ heads selected in 1990 were grown, and superior rows were harvested for evaluation in single plots in 1992. Several of these headrows demonstrated both early maturity and short plant height.

Advanced Yield Trials

Results from the 1991 Elite Variety Yield Trial are presented in Table 4. This test comprises varieties which have been developed in Alaska. The experimental variety 77II-69-63-3-1 generally performed poorer than Otal, 'Datal', and 'Lidal', as it was both later maturing and lower yielding. Otal was the highest yielding variety in this trial, although it suffered the most lodging.

Long-term results from the Elite Variety Yield Trial are presented in Table 5. Values in this table result from paired comparisons of means between a variety and Otal where they appeared in a common test. Percentages greater than 100 indicate superior performance relative to Otal, while percentages less than 100 indicate poorer performance than Otal. These results over four tests (two locations x two years) indicate that Datal is the earliest-maturing and highest-yielding of the three varieties listed. The experimental variety 77II-69-63-3-1, although the latest maturing, is characterized by very strong straw strength and resistance to lodging. However, will likely not be released as a variety because of its relative late maturity.

In future years, newly-developed experimental lines will be included in this trial to identify superior-performing varieties under Alaskan conditions.

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

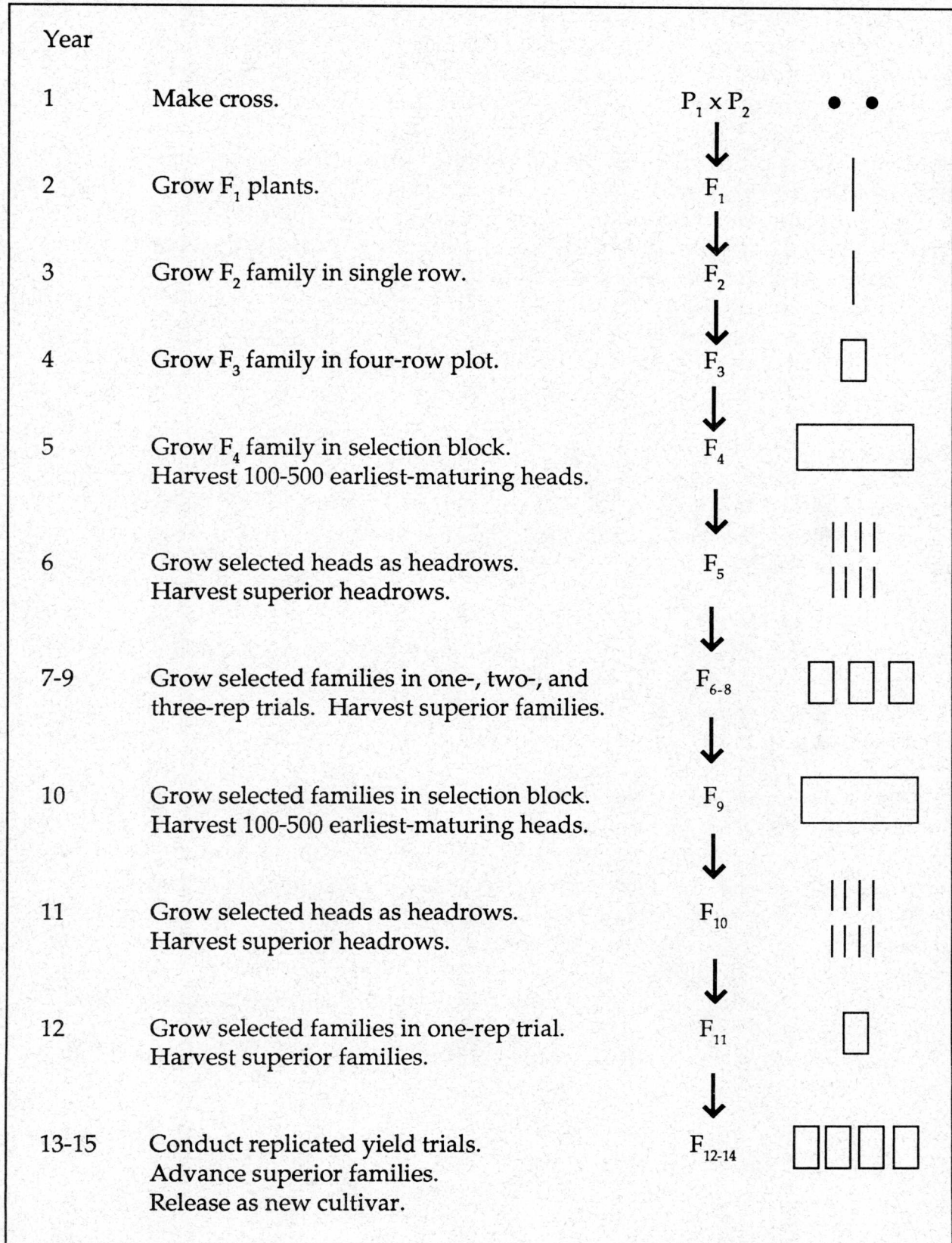


Table 1. Performance of entries in single-row observation which were harvested in 1991.

Entry	Heading*	Plant Height (in)	Maturity*
CC XXXII-527	-1	15	3
CC XXXII-640	-1	15	3
CC XXXII-727	2	15	4
Arupo 'S'	6	14	9
HJA 82137	0	26	-2
HJA 83125	0	27	-6

*No. days earlier (+) or later (-) than Otal.

*Table 2. Performance of varieties evaluated in the Elite Variety Yield Trial expressed relative to Otal.**

Variety	No. Tests	Heading	Maturity	Plant Height	Lodging	Yield
JO 1632	1	100.5	106.6	129.3	—	84.9
NORD	1	97.2	102.6	117.6	—	88.7
NORDYLS	1	98.1	102.6	107.6	—	103.1
OLLI	1	101.9	102.1	103.1	—	91.5
JO 1474	1	98.6	101.8	122.4	—	76.0
ARVE	1	100.0	100.3	126.3	—	73.7
JO 1490	1	94.9	99.5	115.8	—	92.6
ARRA	1	95.3	99.0	108.9	—	102.8
POTRA	1	97.2	99.0	112.1	—	90.9
JO 1599	1	96.7	98.5	118.8	—	111.3
BODE	1	94.4	97.7	112.9	—	94.8
JO 1465	1	100.5	96.7	109.0	—	68.7
RIPA	1	94.4	96.6	118.4	—	98.0
HJA 673	1	93.0	96.3	—	—	113.7
KARIN	1	95.3	94.0	122.0	—	92.4
SV N 8282	1	93.9	93.7	115.7	—	99.2
AGNETA	1	92.0	91.6	119.2	—	107.3
SV N 84120	1	96.2	91.6	132.8	—	89.3
EERO 80	1	98.6	90.3	136.5	—	116.9

*Values greater than 100 indicate better performance (earlier heading, earlier maturity, shorter plant height, or higher yield) than Otal.

Table 3. Results of the 1991 Northwestern Canada Barley Trial grown at Palmer.

Cultivar	Days to Heading	Days to Maturity	Plant Height (in)	Yield (bu/A)
UBJ-46	54	95	31.5	40.8
U97-2	53	96	30.2	31.1
77II-69-63-3-1	55	97	32.9	29.0
SD801	52	97	27.1	24.7
OTAL	54	98	37.3	37.6
USM-3	54	98	30.1	38.5
U89-73	52	98	30.4	36.5
BT670	57	99	34.6	40.8
UP7-65	56	100	31.2	34.7
SM90036	52	101	24.5	30.5
U97-30	56	101	34.7	43.1
ULX-69	57	101	36.0	37.2
BT671	53	102	31.8	39.6
BT672	55	103	32.8	36.1
U70-61	54	103	33.1	38.4
U3M-18	60	103	33.2	40.4
ULQ-48	59	104	33.7	40.6
BRIER	59	105	33.4	40.1
BT634	58	105	34.7	36.6
UB7-28	59	108	32.3	36.5
STEIN	59	109	28.4	38.9
UREN-76	63	113	38.7	38.4
BT636	68	121	41.1	47.8
SM90480	58	121	25.5	36.2
Mean	56.5	103.1	32.5	37.3
LSD 0.05	1.3	3.2	2.7	6.1

Table 4. Performance of varieties evaluated in the Advanced Yield Trial at Palmer and Fairbanks.

Variety	Days to Heading	Days to Maturity	Plant Height (in)	Lodging	Yield (bu/A)
77II-69-63-3-1	49	89	35.3	1.0	55.4
DATAL	48	84	33.5	1.0	76.0
LIDAL	49	85	37.5	2.0	70.5
OTAL	48	85	38.5	2.5	72.0
LSD 0.05	0.5	1.2	1.8	-	8.2

Table 5. Long-term performance of varieties evaluated in the Advanced Yield Trial expressed relative to Otal.*

Variety	No. Tests	Plant Heading	Maturity	Height	Lodging	Yield
DATAL	4	99.8	102.2	109.0	134.4	98.6
LIDAL	4	97.3	100.1	100.0	111.5	91.5
77II-69-63-3-1	4	97.4	93.4	102.4	166.8	92.8

*Values greater than 100 indicate better performance (earlier heading, earlier maturity, shorter plant height, or higher yield) than Otal.

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