SPRING BARLEY VARIETY SCREENING

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Abstract

The Klamath Experiment Station (KES) serves as the initial screening site for the Oregon State University (OSU) spring barley breeding program. Trials to evaluate advanced selections from Oregon and other northwest breeding programs are conducted annually at KES and at an organic soil site in the Lower Klamath Lake (LKL) area. In 1999, 11 named varieties and 9 numbered selections were evaluated at KES and LKL in the Oregon Statewide Spring Barley Trial. Entries included feed and malting types. Baronesse produced the highest yield at the KES mineral soil site in 1999 and over 2- and 3-year means. This two-row feed barley has been intermediate in test weight and percent protein at the KES site. Higher yields, test weights, and percent protein were observed at the organic soil site, as has been experienced in previous years. Gustoe, Gus, and Galena, a malting type, were among the highest-yielding entries at the organic soil site, along with the numbered selection WA 9504-94. Baronesse was not significantly lower in yield than any of these entries, and was among the highest in test weight and percent protein. Gus and Gustoe are the highest-yielding entries at the organic soil site over 2- and 3-year means.

The 1999 Western Regional Spring Barley Trial evaluated 6 named varieties and 28 numbered selections at the KES site. Baronesse and Steptoe were among the highest-yielding entries, with two numbered selections producing yields only slightly higher than Baronesse. As a group, feed type entries averaged 540 lb/acre higher yields than malting type selections. Two Washington malting selections were significantly higher in yield than the standard malting variety Morex. Averaged over 3 years, Harrington, a two-row malting variety, produced significantly higher yields than Morex.

Introduction

Klamath County is the leading spring barley production area in Oregon, with an estimated 38,000 acres produced in 1998. Within the Klamath Irrigation Project, the 1999 barley crop accounted for 37,000 acres. This represents about 50 percent of total barley production in the region. Acreage declined in 1999, as growers substituted oats and wheat because of concerns for barley stripe rust (BSR), which caused considerable yield losses in 1997 and 1998. Local production includes both feed and malting types with feed types, accounting for about

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two-thirds of the acreage. Popular feed varieties include Steptoe, Gus, Gustoe, Baronesse, Sprinter and Boyer. Morex and B1202 are the main malting varieties grown. BSR tolerance is generally better in two-row selections, and growers shifted more acreage to these varieties in 1999. In most years, trials are conducted on mineral soil at KES and an organic soil site in the LKL area. Trials were not conducted at the LKL site in 1998.

Procedures

KES

Western Regional and Oregon Statewide Spring Barley Trials were conducted on a Poe fine sandy loam soil in a 3-year rotation following annual ryegrass and potatoes. Trials were arranged in a randomized complete block design with four replications. Barley was seeded May 5 with a Kincaid plot drill. Seed was planted 1 inch deep at 100 lb/acre. Individual plots were 5 feet wide with 10 rows at 6-inch spacing, 20 feet long. Fertilizer applied included 20 lb N, 12 lb P_2O_5 and 9 lb S/acre banded at planting and 80 lb N, 48 lb P_2O_5, and 35 lb S/ acre broadcast before planting. Weeds were controlled with Buctril (Bromoxynil) at 0.5 lb ai/acre and Romene (MCPA) at 0.5 lb ai/acre applied with a conventional ground sprayer. Irrigation was applied as necessary to meet crop needs with solid-set sprinklers arranged in a 40-by 40-foot spacing.

Six standard varieties, six newly released varieties, and eight numbered selections were included in the Oregon Statewide Trial. The Western Regional Trial included 5 standard varieties, 1 recently released variety (Orca), and 28 numbered selections. Six standard varieties, six newly released varieties, and eight numbered selections were included in the Oregon Statewide Trial. Grain was harvested using a Hege plot combine with a 5-foot header on September 2. Grain yield was recorded for all plots. In the Oregon Statewide Trial, test weight and percent protein were determined for each replication. Samples from all locations were evaluated at Corvallis. Test weight, percent plumps and thins, lodging, and plant height, in the regional trial were determined for one replication only. Statistical analyses were performed using MSUSTAT software. Multi-year analyses for the trials were conducted using a split-plot design with year as the main plot and entry as the split-plot. Least significant differences (LSD) are based on *student's t* at the 5 percent probability level.

Lower Klamath Lake

The Oregon Statewide Trial was conducted on Algoma silt loam soil in a continuous grain rotation. Algoma silt loam is a very deep, poorly drained, lake bottom soil with high organic matter content. Experimental design, plot size, and planting procedures were as described for the KES site. Barley was planted on May 11. Fertilizer applied included 40 lb N/acre and 50 lb P_2O_5 banded at planting, and 35 lb N/acre broadcast prior to planting. Weeds were controlled with a tank mixture of 2,4-D and Express (tribenuron-methyl) applied at labeled rates. Irrigation was applied as needed with a Zimatic overhead linear move system. Grain was harvested on September 20 with a Hege plot combine

with a 5-foot header. Grain yield was recorded for all plots. Test weight and percent plumps and thins were measured in only one replication. Three-year summaries were developed using 1996, 1997, and 1999 data.

Results and Discussion

Oregon Statewide Trial: KES

Frosts in early June and on July 4 slowed early season development and resulted in very serious yield loss in some fields in the Lower Klamath Lake area. Frost injury probably accounts for lower yields in this trial at both sites in 1999 compared with previous years. Barley stripe rust did not affect crops in the area in 1999. The only infections observed occurred too late in the season to affect production.

Baronesse was among the highest entries in yield and test weight in 1999 but had the lowest percent protein of all entries (Table 1). Steptoe and Xena were nearly equal to Baronesse in yield. Steptoe had relatively low test weight and both varieties were low in protein content. Gustoe, Gus, and Orca were significantly lower in yield than several selections. The performance of Orca is disappointing, since this variety has good tolerance for BSR. Gustoe and Gus was significantly lower than all other entries in test weight. MT 920073 was the highest yielding numbered selection. The four malting types were very similar in yield, test weight, and protein content.

Averaged over 3 years, Baronesse, Idagold, Bancroft, and Gallatin produced the highest yields at KES. Ocra was intermediate in yield, while Gus and Gustoe were lowest, at more than 1,000 lb / acre less than all other entries except Orca. Better performance for Orca in 1998 was probably related to BSR affects on susceptible varieties. Over 2 years, Xena, Baronesse, and Steptoe produced high yields.

Oregon Statewide Trial: Lower Klamath Lake

Average yields, test weight, and protein content were higher at the organic soil site, which is true in most years. The yield performance differences between varieties are interesting and important. Gustoe and Gus are among the highest yielding varieties in 1999 and averaged over 2 and 3 years (Tables 3 and 4). However, they were among the lowest in test weights and protein content. Baronesse was third highest in yield over years and among the highest in 1999. Orca and Xena were intermediate in yield in 1999. The new Oregon release, Tango was significantly lower in grain yield than over one-half of the entries. WA 9504-94 produced high yield, test weight, and protein content. Bancroft was among the lowest-yielding entries in each year at the organic soil site. Galena was the highest-yielding malting line in 1999 but was not tested at this site in previous years. Steptoe has not performed well at this site.

Western Regional Trial: KES

Mean yield in this trial was about the same as in the KES Oregon Statewide Trial (Table 5). The performance of Baronesse, Steptoe, and Orca was similar to their relative performance in the 1999 Oregon Statewide Trial. High yields were observed in the malting selections WA

11825-95 and WA 7642-92, and the feed quality selections ID 93Ab688 and UT 5724. Test weights were generally high in the malting lines but low in a few of the feed types. Averaged over 2 years, UT 5724, WA 7642-92, and Harrington ranked 1, 2, and 3, respectively in yield (Table 6). Harrington, SK CDC Dolly, and WA 7642-92 ranked 1, 2, and 3 averaged over 3 years. Orca ranked last in yield in both 2- and 3-year means.

Table 1. Oregon Statewide Spring Barley Variety Trial; mineral soil site: agronomic and quality data of spring barley varieties and lines established May 5, at KES, Klamath Falls, OR, 1999.

Variety / lines	Row	Yield	Test weight	Protein	1,000 Kernel weight	Lodging	Height	50% heading
		lb/acre	lb/bu	%	grams	%	inches	Julian
Malt Varieties								
Bancroft (78Ab10274)	2	4200	51.7	11.2	47.9	4	26	192
C-32	2	4160	52.4	11.7	49.0	0	20	190
Galena	2	4010	51.7	11.8	47.5	0	23	192
Chinook	2	4000	53.0	11.8	48.3	0	26	191
B 1202	2	3980	51.1	11.9	49.2	0	26	190
Mean		4070	52.0	11.7	48.4	1	24	191
Feed Varieties								
Baronesse	2	5050	52.8	10.5	48.0	0	24	188
Steptoe	6	4680	48.8	10.7	51.7	0	26	181
Xena (BZ594-19)	2	4620	52.8	10.5	50.3	0	27	187
Tango	6	4280	48.3	11.0	45.5	0	30	181
Gallatin	2	4070	53.1	11.0	46.4	0	29	189
Idagold	2	4050	51.1	12.1	48.2	0	20	193
Gustoe	6	3490	46.0	11.7	42.2	0	18	188
Orca	2	3450	50.3	11.9	53.3	0	26	182
Gus	6	3230	46.8	11.9	43.2	0	20	188
Mean		4100	49.6	11.3	47.8	0	24	186
Other Varieties								
BCD 47	2	4150	52.1	11.7	49.1	0	19	190
BCD 22	2	4110	52.3	12.2	46.9	0	21	190
BCD 12	2	3900	49.3	12.0	48.2	0	19	189
MT 920073	--	4410	52.7	10.8	51.0	0	26	187
MT LB30	--	4150	52.8	11.4	47.0	0	26	190
WA 9504-94	--	4070	51.5	11.8	43.3	0	21	192
Mean		4130	52.0	11.6	47.4	0	23	190
Overall Mean		4100	51.0	11.5	47.8	0	24	189
LSD (p = 0.05)		740	0.8	0.6	--	--	--	--
CV (%)		11	1.0	3	--	--	--	--

Table 2. Three-year summary of Oregon Statewide Spring Barley Variety Trial; mineral soil site: grain yield of spring barley established at KES, Klamath Falls, OR, 1997-99.

Variety / lines	Row	Use[1]	Yield			2-year average		3-year average	
			1999	1998	1997	yield	rank	yield	rank
				lb/acre		lb/acre		lb/acre	
B1202	2	M	3980	4430	5080	4210	12	4500	8
Bancroft (78Ab10274)	2	M	4200	4670	5280	4440	7	4720	3
Baronesse	2	F	5050	4730	5390	4890	2	5060	1
Chinook	2	M	4000	4860	5160	4430	8	4670	5
Galena	2	M	4010	4400	5230	4210	13	4550	7
Gallatin	2	M	4070	4720	5270	4400	10	4690	4
Gus	6	F	3230	3470	3410	3350	18	3370	11
Gustoe	6	F	3490	3760	3160	2630	17	3470	10
Idagold	2	F	4050	4800	5370	4430	9	4740	2
Orca	2	F	3450	4940	4470	4200	14	4290	9
Steptoe	6	F	4680	4710	4500	4700	3	4630	6
BCD 12	2	FM	3900	3890		3900	16		
BCD 22	2	FM	4110	4400		4255	11		
BCD 47	2	FM	4150	4140		4150	15		
C-32	2	M	4160	5030		4600	4		
MT 920073	--	--	4410	4750		4580	5		
Tango	6	F	4280	4720		4500	6		
Xena (BZ594-19)	2	F	4620	5690		5160	1		
MT LB30	--	--	4150						
WA 9504-94	--	--	4070						
Mean			4100	4560	4760	4330		4430	
LSD (p = 0.05)			740	700	730	--		--	
CV (%)			11	9	11	--		--	

[1]F denotes a feed barley variety, M denotes a malting line.

Table 3. Oregon Statewide Spring Barley Variety Trial; organic soil site: agronomic and quality data of spring barley varieties and lines established May 11 at Klamath County, OR, 1999.

Variety / lines	Row	Yield	Test weight	Protein	1,000 Kernel weight
		lb/acre	lb/bu	%	grams
Malt Varieties					
Galena	2	5600	54.4	13.1	44.5
B 1202	2	4980	53.5	14.6	48.2
Chinook	2	4250	54.8	14.2	47.0
Bancroft (78Ab10274)	2	4140	54.0	14.3	48.8
Mean		4740	54.2	14.1	47.1
Feed Varieties					
Gustoe	6	5940	50.7	12.0	43.6
Gus	6	5740	51.2	12.6	45.3
Baronesse	2	5430	54.7	14.0	48.9
Orca	2	5170	53.0	14.7	55.6
Xena (BZ594-19)	2	4930	54.3	12.6	49.8
Steptoe	6	4590	50.5	11.9	50.0
Tango	6	3730	48.8	12.6	43.6
Mean		5080	51.9	12.9	48.1
Other Varieties					
WA 9504-94	--	5830	53.8	13.7	45.1
BCD 22	2	5280	53.8	14.2	46.1
MT LB30	--	4920	53.9	13.7	42.7
BCD 12	2	4610	51.9	14.0	50.2
MT 920073	--	4550	54.9	13.4	45.6
Gallatin	2	4504	54.9	13.4	45.6
Mean		4950	53.9	13.7	45.9
Overall Mean		4950	53.1	13.5	47.5
LSD (p = 0.05)		800	1.0	0.7	---
CV (%)		10	1	3	---

Table 4. Three-year summary of Oregon Statewide Spring Barley Variety Trial; organic soil site: grain yield of spring barley established at Klamath County, OR, 1996, 1997, and 1999.

Variety / lines	Row	Use[1]	Yield			2-year average		3-year average	
			1999	1997	1996	yield	rank	yield	rank
				lb/acre		lb/acre		lb/acre	
B1202	2	M	4980	5210	4210	5100	4	4800	4
Bancroft (78Ab10274)	2	M	4140	4750	2680	4450	8	3860	6
Baronesse	2	F	5430	5130	4430	5280	3	5000	3
Gus	6	F	5740	5980	5460	5860	2	5730	1
Gustoe	6	F	5940	6330	4520	6140	1	5600	2
Steptoe	6	F	4590	4500	4520	4550	6	4540	5
Chinook	2	M	4250	4670		4460	7		
Gallatin	2	F	4500	4950		4730	5		
BCD 12	2	FM	4610						
BCD 22	2	FM	5280						
Galena	2	M	5600						
MT 920073	--	--	4550						
MT LB30	--	--	4920						
Orca	2	F	5170						
Tango	6	F	3730						
WA 9504-94	--	--	5830						
Xena (BZ594-19)	2	F	4930						
Mean			4950	5190	4300	5070		4920	
LSD (p = 0.05)			800	930	840	--		--	
CV (%)			10	11	12	--		--	

[1]F denotes a feed barley variety, M denotes a malting line.

Table 5. Western Regional Spring Barley Nursery: agronomic data for spring barley lines established May 5 at KES, Klamath Falls, OR, 1999.

Variety / lines	Row	Yield	Test weight	Thins			Height	50% heading
				6/64	5.5/64	pan		
		lb/acre	lb/bu	%			inches	Julian
Malting Varieties								
WA 11825-95	2	4760	55.0	98.1	1.4	0.5	24	189
WA 7642-92	2	4500	54.5	97.5	1.7	0.8	26	188
Harrington	2	4090	55.0	97.5	2.1	0.4	30	190
MT 910189	2	4080	55.5	98.5	1.0	0.5	26	188
BA 6B93-2978	6	4070	53.0	97.6	2.0	0.3	35	186
ID 93Ab859	2	4000	54.5	98.7	0.8	0.4	26	191
BA 2B95-4553	2	3980	54.5	98.1	1.4	0.5	28	189
Morex	6	3900	52.5	96.4	2.9	0.8	33	182
Stander	6	3880	54.0	97.9	1.5	0.6	28	185
SK TR150	2	3850	55.5	98.3	1.1	0.6	24	191
BA 2B95-4047	2	3790	54.0	98.6	1.1	0.3	26	188
WA 9508-94	2	3770	54.5	87.8	11.7	0.5	26	191
BA 6B94-8253	6	3760	54.0	97.4	2.0	0.6	35	185
ND 16092	2	3630	54.5	98.5	0.9	0.6	26	184
OR 2967102	2	3450	54.0	98.2	1.4	0.4	18	190
Mean		3970	54.2	97.3	2.1	0.5	27	188
Feed Varieties								
ID 93Ab688	6	4930	53.5	95.9	3.2	0.9	31	184
UT 5724	6	4780	50.5	93.4	5.2	1.4	26	178
Baronesse	2	4730	55.0	99.1	0.7	0.3	26	188
Steptoe	6	4590	52.0	98.3	1.1	0.5	31	181
UT 4467	6	4550	52.0	90.5	7.3	2.2	28	184
MTLB-05	6	4420	56.0	98.4	1.2	0.4	26	188
SK CDC Dolly	2	4370	55.0	99.0	0.8	0.3	24	188
UT 3757	6	4210	50.5	95.0	4.0	1.1	30	184
MTLB-30	6	4050	55.0	98.7	0.9	0.3	24	189
UT 5742	6	4020	51.0	95.7	2.9	1.4	24	180
Orca	2	3300	52.5	98.3	1.1	0.6	28	183
Mean		4360	53.1	96.4	2.7	0.9	27	184
Other Varieties								
PB1-95-2R-517	--	4380	55.5	98.3	1.2	0.5	26	188
OR 2967007	--	4320	50.5	93.8	4.8	1.4	35	180
PB1-95-2R-A629	--	4060	56.0	98.6	0.9	0.4	28	187
ND 15477	6	3960	54.0	97.4	2.1	0.5	31	183
WA 9504-94	--	3820	55.0	98.5	1.0	0.5	22	193
UCD 15B XT (KES)	--	3790	46.5	97.6	1.8	0.6	22	190
UCD 35B XT (KES)	--	3250	46.0	97.3	2.2	0.4	20	193
WPB-BZ594-35	2	3330	61.5	91.0	7.2	1.7	24	187
Mean		3860	53.1	96.6	2.7	0.8	26	188
Mean		4070	53.6	96.9	2.4	0.7	27	187
LSD (p = 0.05)		480	---	---	---	---	---	2
CV (%)		8	---	---	---	---	---	1

Table 6. Western Regional Spring Barley Nursery: grain yield of spring barley lines planted at KES, Klamath Falls, OR, 1997-1999.

Variety / lines	Row	Use[1]	Yield			2-year average		3-year average	
			1999	1998	1997	yield	rank	yield	rank
				lb/acre		lb/acre		lb/acre	
Steptoe	6	F	4590	3695	5000	4140	7	4430	4
Morex	6	M	3900	3940	5140	3920	9	4330	5
Stander	6	M	3880	3960	4370	3920	10	4070	6
Harrington	2	M	4090	4840	5380	4470	3	4770	1
Orca	2	F	3300	3970	4820	3640	12	4030	8
WA 7642-92	2	M	4500	4440	5040	4470	2	4660	3
BA 6B93-2978	6	M	4070	3670	4430	3870	11	4060	7
SK CDC Dolly	2	F	4370	3890	5870	4130	8	4710	2
WA 9504-94	--	--	3820	4520		4170	6		
OR 2967007	--	--	4320	4270		4300	4		
UT 5724	6	F	4780	4730		4760	1		
MT 910189	2	M	4080	4390		4240	5		
Baronesse	2	F	4730						
WA 9508-94	2	M	3770						
WA 11825-95	2	M	4760						
SK TR150	2	M	3850						
ND 15477	6	--	3960						
PB1-95-2R-517	--	--	4380						
PB1-95-2R-A629	--	--	4060						
WPB-BZ594-35	2	H	3330						
ND 16092	2	M	3630						
OR 2967102	2	M	3450						
BA 2B95-4047	2	M	3790						
BA 2B95-4553	2	M	3980						
BA 6B94-8253	6	M	3760						
ID 93Ab688	6	F	4930						
ID 93Ab859	2	M	4000						
UT 3757	6	F	4210						
UT 4467	6	F	4550						
UT 5742	6	F	4020						
MTLB-30	6	F	4050						
MTLB-05	6	F	4420						
UCD 15B XT	--	--	3790						
UCD 35B XT	--	--	3250						
Mean			4070	4190	5010	4170		4380	
LSD (p = 0.05)			480	690	530	NS		250	
CV (%)			8	12	7	24		9	

[1]F denotes a feed barley variety, M denotes a malting line, and H represents hulless.