

SPRING BARLEY PERFORMANCE IN 2001⁽¹⁾

WSU BARLEY PROGRAM AND WSU EXTENSION UNIFORM VARIETY TESTING PROGRAM TRIAL RESULTS

The 2001 spring barley crop-year yields in eastern Washington were generally below average due primarily to low precipitation last winter and during the growing season. Estimated 2001 state average yield for spring barley was 2400 pounds per acre compared to 3360 and 2832 pounds per acre in 2000 and 1999, respectively. Barley acreage seeded in Washington was estimated at 490,000 acres in 2001, down slightly from the 500,000 acres a planted in both 2000 and 1999. Overall quality was relatively good. A Washington Barley Commission sponsored quality survey reported that 84% of the 2001 Washington barley crop graded No. 1, down from 92% in 2000. The average test weight was 49.8 pounds per bushel (51.5 lb/bu in 2000 and 50.0 lb/bu in 1999). In contrast to a high incidence of barley stripe rust in 1998, this disease was at a very low level in 2001 as it has been the past three years.

WSU Statewide Extension Uniform Spring Barley Variety Testing nurseries were harvested at 13 locations in 2001 with 39 entries (two additional nurseries at Bickleton and Ritzville were not harvested due to severe drought conditions). Twelve nurseries were planted on non-irrigated sites with a single irrigated site is maintained at Royal Slope (WSU Research Farm). All dryland nurseries were planted on grower-cooperator fields except Pullman (WSU Spillman Farm). The 2001 summary below (Table 1) includes 19 commercial cultivars and 20 advanced breeding lines (17 of which are from WSU). A 26 site-year summary of the Uniform Testing Nurseries includes 15 commercial cultivars and 9 advanced breeding lines that were common to all trials grown in 2000 and 2001. (Table 2) The Least Significant Difference (LSD) is given for each location and over all locations in both tables. The LSD indicates, with 90% confidence, which numerical differences between averages are significant, that is, real or not. If the difference in yield between two varieties is equal or less than the LSD value (listed as pounds per acre), then the yields are not statistically different and the numerical differences are due to random chance. For example, using the Almira location (Table 1), the top 9 yielding varieties were:

Almira Location – 2001 (pounds per acre)

Farmington	4643	WA10147-96	4426	WA10144-96	4292
Valier	4481	98NZ533	4404	WA10467-97	4270
85AB2323	4451	WA8674-96	4403	WA8601-97	4238

None of the varieties listed above were statistically different from one another with an LSD = 472 pounds per acre. (**4643 – 472 = 4171 lb/acre = the statistical threshold**).

Kernel quality was generally good but varied considerably in 2001. Location test weight averages ranged from 45.6 pounds per bushel at St. John to 54.5 pounds per bushel at Royal Slope. Four of 13 locations had test weight averages below 48 pounds per bushel, while seven locations had test weight averages of 50 pounds per bushel or higher. Plump kernel percentage averages were quite variable with a location range of 71-95 percent.

Six WSU 2-row barley-breeding lines had comparable yields to Baronesse, the leading Washington barley cultivar, in the 2000 Uniform Testing Nurseries. Three of these lines are 98NZ223, 98NZ015, and 98NZ533 which are proanthocyanidin-free (a brewing quality trait) lines developed in collaboration with Prof. Diter von Wettstein (see below). The other lines are WA8682-96, WA10147-96, and WA8709-96 for which pre-release Breeder Seed increase was approved and produced in 2001. In 2001 only 98NZ223 and WA10147-96 yielded up with Baronesse averaged over the 13 test locations (Table 1). All six lines excelled at certain of the locations. Over two years (26 site-yr., 2000-2001), 98NZ223 yielded 100%, 98NZ015 and WA8682-96 yielded 98%, WA10147-96 and WA8709-96 yielded 97%, and 98NZ533 yielded 95% of Baronesse, respectively. The strongest potential new variety release candidate is 98NZ223 followed by 98NZ015, WA8682-96, and WA10147-96. Another year's testing should clarify the situation.

Summary tables for yield and test weight and are listed on the WSU Statewide Extension Uniform Cereal Variety Testing Program web page: <http://variety.wsu.edu>. Additional information can be obtained by contacting local WSU Cooperative Extension offices or WSU Cooperative Extension, Dept. of Crop and Soil Sciences (509)-335-2915 for hard copies.

FARMINGTON SPRING BARLEY – NEW WSU RELEASE

On October 19 2001, the WSU Agricultural Research Center signed a joint release with Idaho, Oregon and the USDA-ARS for 'Farmington' (WA 9504-94) 2-row spring feed barley. Farmington was developed by the WSU Barley Program and is moderately resistant to barley stripe rust. Farmington has a yield advantage over the currently

available stripe rust resistant cultivars and is competitive in yield to Baronesse in certain locations. Farmington appears best adapted to higher yielding production areas in eastern Washington, which are also the areas most likely to be affected by barley stripe rust. Farmington was tested in the WSU Extension Uniform Spring Barley Testing Nurseries from 1997-2001 (10-13 sites per year). During this period (over 60 site-years) Farmington averaged 4438 pounds per acre, which was 94% of the average yield of Baronesse. During this same period Farmington yielded 108, 107, 107, and 111 percent of Harrington (leading malting cultivar), Gallatin (major feed barley), Bancroft, and Orca (barley stripe rust resistant cultivars), respectively. See the May 2001 *Wheat Life*, page 20 for a more complete description of Farmington or the WSU Extension Uniform Variety Testing Program web page (<http://variety.wsu.edu>).

MOLECULAR BREEDING TECHNOLOGY

The WSU Barley Breeding Program in collaboration with Professor Andy Kleinhofs and graduate student Deric Schmierer, WSU Dept of Crop and Soil Sciences, has developed and tested a series of molecular marker assisted backcross lines from Harrington/Baronesse crosses. These lines are a product of a Washington Barley Commission funded project, which involves applying molecular breeding technology to combine the yield potential of Baronesse with the malting quality of Harrington. Thirty-one of these lines yielded equal to or better than Baronesse in tests at two locations in 2000. A sub sample of 28 of the best lines was tested at three locations in 2001. Thirteen of the lines had yields statistically equal to Baronesse averaged over the three locations. Twenty-six, 12, and 26 of the lines equaled the yield of Baronesse at Pullman, Fairfield, and Royal Slope, respectively. Eight of the top lines especially stood out over years and locations. The first quality data indicate that some of the high yielding lines also have good malting quality. The best lines will continue to be evaluated in the variety-testing program and for malting quality.

PROANTHOCYANIDIN-FREE BARLEY

Projected for pre-release from the WSU Agricultural Research Center in 2002 are 98NZ223 and 98NZ015, high yielding spring barleys that are proanthocyanidin-free. Proanthocyanidin-free barley has high potential in the malting and brewing industry because of its ability to ensure excellent haze stability of beer. Proanthocyanidins, also known as condensed tannins, are compounds found in the barley seed coat that precipitate with proteins and carbohydrates especially under low temperatures and cause chill-haze to beer (Figure 1). Currently brewers must remove proanthocyanidins by technical procedures prior to bottling or canning of beer. It has been observed that 50 percent proanthocyanidin-free barley in mixtures with proanthocyanidin containing barley provides the same chill-haze stability as achieved by presently used technical procedures. Malting quality of 98NZ223 as determined by the USDA-ARS Barley and Malt Laboratory, Madison, WI is of the same level as Harrington when grown under suitable nitrogen limiting conditions. Malting quality potential is not as good for 98NZ015, but proanthocyanidin-free barley can be an excellent feed for both broiler chickens and beef cattle.

Diter von Wettstein, R.A. Nilan Distinguished Professor, Pullman, WA developed line 98-NZ223 using a sodium azide induced mutation in the variety Harrington and subsequent crosses with Baronesse. The induced mutation blocks the last steps in the synthesis of proanthocyanidins. Recombination breeding using the single seed descent method enabled selection of a proanthocyanidin-free barley variety that was equal in yield to Baronesse (Table 2).

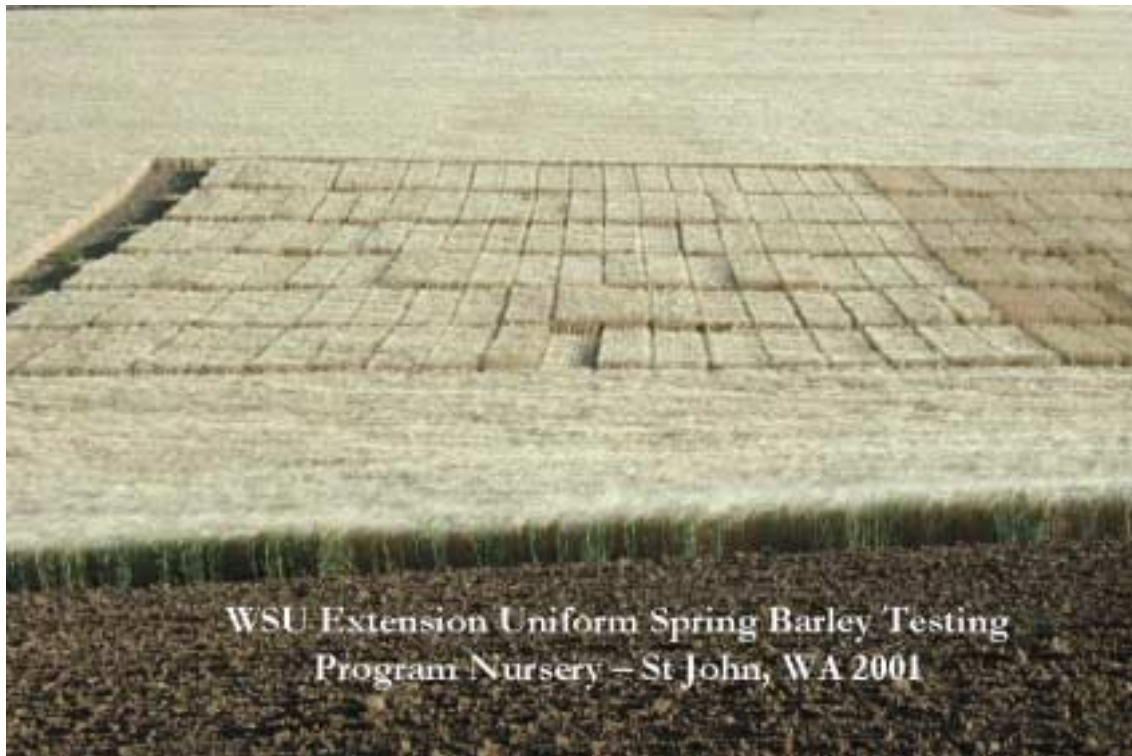
Special appreciation is given to R. A. Nilan, Professor/Geneticist and the Washington Barley Commission for supporting this breeding effort. In addition Judy Cochran, Ag Research Tech, WSU is recognized for her faithful, determined efforts to find high yielding lines such as 98-NZ223.

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⁽¹⁾ Steve Ullrich, et al., WSU Barley Breeder; Diter von Wettstein, et al., R.A. Nilan Distinguished Professor; John Burns, et al., WSU Extension Agronomist and Andy Kleinhoffs, et al., WSU Professor/Scientist, Department of Crop and Soil Sciences, Washington State University



Fig. 1. Beer brewed without chill-haze stabilization from proanthocyanidin-free barley at left and from proanthocyanidin containing barley at right.



**Table 1: GRAIN YIELD summaries (Spring Barley) for entries in the
2001 WSU Statewide Extension Uniform Cereal Variety Testing Program Trials.
PRELIMINARY DATA⁽¹⁾**

VARIETY	ANATONE	LAMONT	WALLA WALLA	DAYTON	ST. JOHN	MAYVIEW	DUSTY	ALMIRA	FAIRFIELD	REARDAN	FARMINGTON	PULLMAN	ROYAL SLOPE	VARIETY MEAN
	YIELD (Pounds per Acre) - high 3-varieties at each location underlined													
85AB2323	1582	1395	2963	3006	3405	3482	4341	<u>4451</u>	5066	4985	5151	6096	<u>7696</u>	<u>4124</u>
BARONESSE	1552	2040	2944	2729	<u>3517</u>	3878	4463	4056	4945	4724	5103	6205	7291	<u>4111</u>
PONGO	<u>1661</u>	2152	2563	3059	2948	<u>4281</u>	4092	3822	<u>5223</u>	4439	<u>5207</u>	6289	7428	<u>4090</u>
98NZ223	1321	<u>2203</u>	2729	2763	<u>3497</u>	3782	3944	4011	5215	5175	4831	<u>6477</u>	6795	4057
CAMAS	1464	1983	3002	2869	3126	3397	3625	3782	5152	5197	<u>5203</u>	<u>6417</u>	7326	4042
WA 8608-97	1281	2002	2955	2888	3122	3120	4328	3921	5087	5133	5000	6174	7518	4041
JERSEY	1200	1364	2666	<u>3584</u>	3236	3252	<u>5123</u>	3631	<u>5250</u>	4649	4996	6115	7342	4031
WA 8601-97	1193	1456	2656	3031	3340	3426	3591	4238	<u>5258</u>	<u>5589</u>	4635	<u>6691</u>	7287	4030
XENA	<u>1676</u>	1886	<u>3139</u>	2726	3411	3491	3377	4132	4710	4714	4752	6358	<u>7717</u>	4007
WA 8792-96	1360	1834	2810	2999	3237	3088	4786	3700	4832	<u>5289</u>	4931	5776	7218	3989
VALIER	1492	1934	3035	2772	3190	3593	3932	<u>4481</u>	4373	<u>5329</u>	4377	5892	7242	3972
WA 10144-96	1286	1992	2598	3045	2919	3178	4009	4294	5017	4331	5036	6086	7625	3955
PB1-95-2R-A629	1213	1262	2952	2574	3086	<u>4308</u>	3980	3990	4896	5097	4983	6074	6986	3954
WA 10147-96	1477	1865	2737	2733	3154	3347	3069	4426	5015	4748	5066	6304	7454	3953
HARRINGTON	1136	<u>2190</u>	<u>3079</u>	2524	3047	2967	<u>4958</u>	4163	4806	4616	5096	5844	6839	3943
FARMINGTON	1098	1429	2948	2607	3119	3479	3506	<u>4643</u>	5071	4756	5164	6062	7333	3939
WA 8674-96	1593	1728	2810	2939	2897	2638	3580	4403	5068	5183	4815	6380	7140	3936
WA 8682-96	1437	1496	<u>3078</u>	2468	3481	3265	3977	3913	4917	5095	4919	5665	7268	3921
WA 7478-97	1446	1636	2469	<u>3190</u>	2983	2989	4252	3894	5102	4663	5016	6333	7003	3921
MENTOR	1385	1842	2827	2784	3140	<u>4518</u>	3454	3203	5063	5135	4978	5680	6916	3917
STEPTOE	1652	1029	2915	3062	<u>3646</u>	3588	4211	3691	4179	4860	4877	5922	7201	3910
WA 8709-96	1218	1650	3041	2510	3306	3967	2988	3995	4962	4633	4865	6108	7572	3909
98NZ015	824	1782	2123	2790	3341	3979	4213	3641	5141	4664	<u>5196</u>	5785	7193	3898
H3869224	1589	1602	2801	2945	3127	3361	<u>4792</u>	4070	4570	4637	4805	5932	6419	3896
LEWIS	1601	<u>2210</u>	2521	2986	3348	3307	3990	3499	4412	4896	5030	6151	6564	3886
WA 10138-96	1419	1165	2852	<u>3126</u>	3441	2941	3912	3840	4850	4591	5093	6153	7075	3881
WA 13898-97	1285	1880	2897	2820	3388	3088	3687	3835	4956	5023	4988	5628	6741	3863
GALLATIN	1464	1823	2689	2580	3235	3469	3790	4027	4600	4555	4989	5745	6954	3840
98NZ234	1291	1867	2693	2548	3336	3228	3898	3987	4950	4348	4714	5706	7000	3813
98NZ533	1261	2009	2520	2094	3024	3637	3111	4404	5028	4922	4753	6071	6652	3807
BANCROFT	1574	1232	2510	2743	3394	2642	4022	4153	4576	4830	4797	5983	6746	3785
WA 10467-97	1083	1712	2502	3009	3199	3053	2250	4270	4995	5025	4931	6079	6890	3769
BZ 594-20	1657	1522	2833	2873	3278	3028	3019	3300	3971	4906	4747	5786	<u>7733</u>	3743
WA 8769-96	1351	1430	2630	2967	2834	3016	3229	3503	4996	5041	4915	5792	6642	3719
PB1-95-2R-517	1027	1212	2739	2656	3140	3469	2844	3471	4568	4670	5049	6038	7322	3708
BCD 47	1318	1189	2736	2600	3096	3140	2842	3562	4556	4599	4719	5692	6996	3619
ORCA	1088	1528	2844	2115	3176	3252	2960	3444	4334	4747	4681	4894	7272	3564
TANGO	1322	1197	2346	2307	3090	2894	3742	2860	3806	4553	4214	5127	6361	3371
MOREX	<u>1752</u>	1043	2904	2456	3303	2195	3650	3281	3643	4366	4844	5148	4865	3342
	NURSERY STATS													
LOCATION MEAN	1375	1661	2770	2781	3219	3352	3783	3896	4799	4838	4909	5966	7067	3878
CV %	16.1	26.8	8.4	11.6	11.1	16.6	24.2	8.9	6.4	9.3	7.6	4.7	7.6	11.5
LSD @ .10	301	605	315	437	485	759	1243	472	419	610	506	380	730	167

⁽¹⁾ S. Ullrich, WSU Barley Breeder et al., WSU Barley Program; D. von Wettstein, R.A. Nilan Distinguished Professor et al., in collaboration with J. Burns, WSU Extension Agronomist et al., WSU Extension Variety Testing Program, Pullman, WA

Table 2: Combined GRAIN YIELD summaries (Spring Barley) for entries in 2000 and 2001 WSU Statewide Extension Uniform Cereal Variety Testing Program Trials representing 26 site-years. PRELIMINARY DATA ⁽¹⁾

VARIETY	ANATONE	WALLA WALLA	BICKLETON	RITZVILLE	MAYVIEW	LAMONT	ALMIRA	DAYTON	ST. JOHN	DUSTY	FAIRFIELD	FARMINGTON	REARDAN	PULLMAN	ROYAL SLOPE	26 SITE/YEAR MEAN
YIELD (Pounds per Acre) - high 3-varieties at each location underlined																
BARONESSE	1972	2944	2609	3669	3919	<u>4551</u>	4056	<u>4357</u>	4254	4429	<u>5894</u>	5595	5967	6798	6596	<u>4690</u>
98NZ223	1809	2729	3199	3731	3878	<u>4930</u>	4011	4239	<u>4406</u>	4339	5731	5489	5948	<u>6988</u>	6373	<u>4690</u>
PONGO	1912	2563	2797	3647	<u>4087</u>	4042	3822	4114	4046	4058	5736	<u>5885</u>	5743	<u>6012</u>	<u>7595</u>	<u>4657</u>
XENA	<u>2136</u>	<u>3139</u>	3040	3551	3846	4100	4132	4145	4379	3975	5531	5000	5894	<u>6984</u>	7086	4616
98NZ015	1358	2123	3115	<u>3899</u>	<u>4079</u>	4398	3641	3950	4113	4120	<u>5750</u>	<u>5718</u>	5790	6558	<u>7559</u>	4599
WA 8682-96	1969	<u>3078</u>	<u>3220</u>	<u>3984</u>	3774	4260	3913	3805	4237	4224	5680	5649	<u>5973</u>	6130	6803	4585
WA 10147-96	1975	2737	3148	3635	3707	4161	<u>4426</u>	4208	3715	3735	5584	5476	5791	6787	7376	4576
JERSEY	1761	2666	2865	3593	3655	3490	3631	<u>4429</u>	3798	<u>4639</u>	<u>5917</u>	5686	5498	6638	<u>7496</u>	4568
WA 8709-96	1812	3041	<u>3289</u>	<u>3894</u>	3997	4328	3995	4048	3937	3707	5163	5641	5248	6570	7361	4532
FARMINGTON	1588	2948	2262	3286	3875	3737	<u>4643</u>	3959	4268	3787	5359	<u>5852</u>	5820	6452	7298	4505
STEPTOE	<u>2141</u>	2915	2613	3563	3760	3235	3691	4244	4074	4391	5005	5196	<u>6099</u>	6540	7276	4489
WA 10138-96	1923	2852	2733	3736	3586	3328	3840	<u>4366</u>	3473	4291	5558	5612	5862	6555	7049	4476
98NZ533	1717	2520	3165	3486	3645	4485	4404	3835	3641	3708	5507	5372	5743	6746	6837	4463
H3869224	1940	2801	<u>3285</u>	3731	3606	3432	4070	4245	4000	<u>4611</u>	5543	5158	5710	6337	6353	4452
98NZ234	1678	2693	2443	3473	3414	<u>4519</u>	3987	3833	<u>4491</u>	3942	5424	5278	5339	6289	6627	4395
MENTOR	1834	2827	2820	3756	<u>4161</u>	3543	3203	4060	3787	3952	5434	5491	<u>5988</u>	6311	6056	4379
VALIER	1899	3035	2734	3694	3775	3446	<u>4481</u>	3778	4157	4174	5073	4676	5922	6316	6638	4371
HARRINGTON	1738	<u>3079</u>	1870	3129	3459	3915	4163	3659	4016	<u>4461</u>	5151	5638	5415	6280	6623	4344
BANCROFT	1912	2510	3101	3394	3289	3468	4153	3855	<u>4509</u>	4154	5155	5041	5640	6240	6541	4337
GALLATIN	1789	2689	2799	3713	3682	3515	4027	3834	3920	3949	5204	5190	5326	6084	6560	4282
BCD 47	1726	2736	3093	3149	3647	3349	3562	3659	3957	3363	4374	5122	5187	6125	6427	4093
ORCA	1710	2844	2785	3113	3294	3506	3444	3514	3980	3313	4435	4912	5482	5390	7238	4067
TANGO	1822	2346	2909	3532	3286	2927	2860	3666	4039	3939	4214	4753	5341	5891	6562	4020
MOREX	<u>2186</u>	2904	2275	2891	2464	2873	3281	3439	3522	3476	4389	5021	5126	5578	5015	3751
NURSERY STATS																
LOCATION MEAN	1846	2780	2841	3552	3662	3814	3893	3968	4030	4031	5284	5352	5660	6396	6806	4414
CV %	9.8	8.1	16.2	6.1	12.7	14.9	9.3	10.0	13.7	16.2	8.5	7.6	9.3	5.1	9.3	11.3
LSD @ .10	174	309	630	297	424	541	495	381	529	627	432	389	506	312	604	132
		2001 Data Only	2000 Data Only	2000 Data Only			2001 Data Only									

⁽¹⁾ S. Ullrich, WSU Barley Breeder et al., WSU Barley Program; D. von Wettstein, R.A. Nilan Distinguished Professor et al., in collaboration with J. Burns, WSU Extension Agronomist et al., WSU Extension Variety Testing Program, Pullman, WA