

**AMBA pilot scale selection
BCD-47**

Spring 2-row barley
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Description

Growth habit	spring
Spike type	2-row, semi-erect
Awn type	rough
Rachilla hair	long
Aleurone color	white
Disease resistance	Barley stripe rust

Pedigree and history

BCD-47 is a doubled haploid (DH) derived from a molecular marker-assisted selection program designed to pyramid multiple stripe rust resistance genes in a malting quality background. The initial parents were Orca and Harrington. We conducted one cycle of molecular marker-assisted backcrossing for the Orca stripe rust resistance QTL alleles on chromosomes 4 (4H) and 7 (5H). Orca is a stripe rust resistant two-row feed barley (Hayes et al., 2000) that was developed in the course of mapping stripe rust resistance QTL (Chen et al., 1994; Hayes et al., 1996). Harrington, the two-row North American malting quality standard, was the recurrent parent. Selected BC1 plants were crossed with D1-72, a germplasm line derived from the Shyri x Galena mapping population. Shyri is a stripe-rust resistant two-row feed barley developed by ICARDA/CIMMYT and released in Ecuador. Shyri has stripe rust resistance QTL alleles on chromosomes 2,3,5, and 6 (Toojinda et al., 2000). Galena is a proprietary two-row malting barley belonging to the Coors Brewing Company. One hundred and fifteen doubled haploids were produced from these crosses, using the *Hordeum bulbosum* technique to produce the "BCD rust resistance pyramid population" (Castro et al., 2000). "BCD" stands for "beavers conquer ducks". BCD-47, is line number 47 in this population. The Washington Crop Improvement Association produced foundation seed in 1999.

Agronomic performance and area of adaptation

BCD-47 was tested under both irrigated and dryland conditions in Oregon, Washington, and Idaho. It was entered in the Western Regional Spring Barley Nursery in 1999. BCD-47 is a semi-dwarf, lodging resistant, full-season selection that will perform well in irrigated environments. It is not suitable for dryland production. Agronomic performance data are presented in Table 1.

Disease resistance

BCD-47 is resistant to barley stripe rust. It has been tested extensively in Mexico, South America, and the Pacific Northwest. Disease resistance data are summarized in Table 2. Our molecular analysis of the BCD population confirms that BCD-47 has the resistance QTL allele from Shyri on chromosome 5 (1H) and the resistance QTL alleles from Orca on chromosomes 4 (4H) and 7 (5H).

Malting quality

We have not yet received results from 1999 malting analyses. Available malting quality data for BCD-47, and its Harrington and Galena parents, are presented in Tables 3 and 4. Compared to Harrington, BCD-47 has plumper and heavier grain. It is somewhat lower in extract, and higher in grain protein. It has a lower S/T ratio, higher diastatic power and alpha amylase activity, and lower wort beta glucan.

References

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5. Toojinda, T., E. Baird, L. Broers, X.M. Chen, P.M. Hayes, A. Kleinhofs, J. Korte, D. Kudrna, H. Leung, R.F. Line, W. Powell, and H. Vivar. 2000. Mapping qualitative and quantitative disease resistance genes in a doubled haploid population of barley. Theor. Appl. Genet. (in press).

Table 1. BCD-47 compared to Baronesse and Harrington. Numbers in parentheses refer to number of test environments. Data from California, Idaho, Oregon, Washington. (2/2000). For a complete data summary, please see <http://www.css.orst.edu/barley/orbarley/orbarley.htm>

Variety	Yield (lbs/acre)	Test weight (lbs/bu)	Height (inches)	Grain on 6/64 (%)	Lodging (%)	Heading (Julian days)
Baronesse (52)	4653	51.4	29	81	25	180
Harrington (37)	4227	50.5	32	83	30	173
BCD47 (52)	4097	51.5	24	85	16	181

Table 2. Stripe rust severity (percent infection) on spring barley varieties. Data from Mexico are averages of multiple observations per year. Years of testing are indicated in parentheses. U.S. data are based on sites (number in parentheses) with significant stripe rust.

Variety	Mexico		U.S.	
	BSR (%)	Years	BSR (%)	Tests
Colter	90	(94-99)	89	(3)
Steptoe	83	(95-99)	78	(4)
Tango	20	(96-99)	3	(3)
Harrington	78	(96-99)	52	(3)
Baronesse	70	(96-99)	49	(5)
Orca	13	(91-95)	2	(4)
BCD-47	13	(96-99)	2	(2)

Table 3. Malting quality of BCD-47 compared to its malting parents, Harrington and Galena. Average of nine tests conducted in Oregon, Washington, and Idaho, 1997-1998. 1999 data not yet received (3/00). Malting quality data courtesy of CCRU.

Variety	Kernel Weight (mg)	Plump 6/64 (%)	Malt Extract (%)	Barley Protein (%)	Wort Protein (%)	S/T (%)	DP (°ASBC)	Alpha- amylase (20°DU)	Beta-glucan (ppm)
Harrington	39.3	86.1	80.7	11.6	5.26	46.8	131	56.1	181
Galena	37.2	78.7	79.1	12.1	4.08	34.5	100	38.1	282
BCD-47	42.3	89.9	79.6	12.2	5.34	44.6	171	62.4	139

Table 4. Malting quality of BCD-47 compared to its malting parents, Harrington and Galena. Complete data, 1997-1998. 1999 data not yet received (3/00). Malting quality data courtesy of CCRU.

Variety or Selection	Location	Year	Kernel Weight (mg)	Plump 6/64 (%)	Malt Extract (%)	Barley Protein (%)	Wort Protein (%)	S/T (%)	DP (°ASBC)	Alpha-amylase (20°DU)	Beta-glucan (ppm)
Harrington	Pendleton	1997	43.1	96.8	82.0	10.0	5.15	52.2	108	58.3	72
	KFalls	1997	42.0	88.9	80.1	12.6	5.60	43.9	159	53.0	207
	Pullman	1997	40.7	95.6	81.4	10.8	5.49	52.7	107	53.4	267
	Moscow	1997	34.8	75.6	79.9	11.8	4.70	40.0	133	49.9	174
	Aberdeen	1997	42.6	93.0	80.5	11.3	4.93	43.5	133	60.8	227
	Pendleton	1998	30.3	58.9	82.4	9.6	5.02	55.8	104	56.5	47
	KFalls	1998	39.2	85.9	78.4	14.5	5.88	41.4	145	53.0	288
	Aberdeen	1998	41.8	94.2	81.1	12.5	5.31	44.7	157	63.5	164
	<i>average</i>			39.3	86.1	80.7	11.6	5.26	46.8	131	56.1
Galena	Pendleton	1997	37.9	83.8	79.7	11.6	4.58	40.6	96	42.0	138
	KFalls	1997	40.0	84.4	78.9	12.5	4.35	33.8	114	34.1	326
	Pullman	1997	38.4	94.1	80.9	11.0	4.88	45.1	82	44.1	283
	Moscow	1997	33.0	68.5	78.4	12.7	3.93	31.9	91	31.5	237
	Aberdeen	1997	39.5	86.9	78.9	11.6	4.04	34.8	102	37.3	464
	Pendleton	1998	28.2	28.1	79.0	10.2	3.76	37.3	79	35.3	64
	KFalls	1998	39.9	88.8	76.5	14.9	4.50	30.5	108	37.6	550
	Aberdeen	1998	40.6	94.7	80.5	12.3	2.62	22.0	129	42.5	197
	<i>average</i>			37.2	78.7	79.1	12.1	4.08	34.5	100	38.1
BCD-47	Pendleton	1997	44.3	96.4	81.1	10.3	5.42	52.0	130	67.3	105
	KFalls	1997	44.1	88.8	78.1	13.4	5.40	40.1	196	61.5	221
	Pullman	1997	40.9	93.8	80.6	11.6	5.50	49.5	140	64.3	165
	Moscow	1997	39.0	86.3	79.0	12.8	5.11	40.9	188	61.5	36
	Aberdeen	1997	42.7	92.2	79.2	12.5	5.19	42.5	170	58.3	194
	Pendleton	1998	36.7	70.6	81.2	9.9	4.62	48.1	140	56.5	6*
	KFalls	1998	47.1	96.3	77.9	14.7	6.03	40.2	186	57.6	164
	Aberdeen	1998	43.2	95.1	79.7	12.3	5.42	43.8	215	71.9	85
	<i>average</i>			42.3	89.9	79.6	12.2	5.34	44.6	171	62.4