OREGON AGRICULTURAL EXPERIMENT STATION
OREGON STATE UNIVERSITY
CORVALLIS, OR 97331

Proposed release of 'Buck' winter naked barley

Description

Growth habit	winter
Spike type	6-row, semi-compact
Awn type	rough
Rachilla hair	long
Grain type	naked (hull-less)
Aleurone color	white/blue
Disease resistance	Barley stripe rust, leaf rust, and scald

Buck is a hull-less six-row selection with rough awns and a compact spike. The grain has a mixture of blue and white aleurone. Buck is an obligate winter type: it requires vernalization for flowering in a timely manner. Buck has a level of winter hardiness comparable to other cultivars commercially available in the Pacific Northwest of the US. Buck is resistant to barley stripe rust and leaf rust. The planned end use of Buck grain is as food for human consumption. Feed use is possible. Buck may be suitable for the production of malt under specialized conditions.

Buck was derived from the F1 of the cross "Strider x Doyce" made in 2003. Strider is a hulled six-row feed barley with a strong vernalization requirement and winter hardiness comparable to other commercially available winter cultivars. Doyce is a six-row, hull-less feed barley with winter growth habit. The SNP haplotype of Buck is available at the T3 database (http://triticeaetoolbox.org/barley/) listed under the designation 09OR-86. Conventional generation advance, phenotypic selection, and head row purification were used to develop Buck. Buck was tested as 09OR-86 throughout the Pacific Northwest in breeding and extension trials. The name Buck was chosen due to the fact that the grain is hull-less, or naked.

Performance data

Buck was tested for agronomic, disease resistance, and food quality traits at multiple locations throughout Oregon, Idaho, and Washington in the OFOOD trial from 2011-2013. Trials were conducted under irrigated, dryland, and high rainfall conditions.

Overall, Buck is a high yielding selection with good test weight. Buck has excellent resistance to barley stripe rust (incited by *Puccinia striiformis* f.sp. *hordei*) and leaf rust (incited by *Puccinia hordei*) and moderate susceptibility to scald (incited by *Rhynchosporium commune*). Winter hardiness is comparable to commercially available cultivars. Grain beta glucan is comparable to other commercially available barley cultivars. Buck has a low kernel hardness and solvent

retention capacity for water, indicating that its flour would be best suited for use in pastry products.

Summary data are presented in the following Tables and provided online at http://barleyworld.org/breeding-genetics/data. Buck is compared to hulled checks Alba and Maja, and hull-less check #STRKR (tested as Streaker). As shown in Table 1, averaged over 13 location/years, Buck had an average yield of 6,485 kg/ha. Buck has an excellent test weight (77.7 kg/hL), which was higher than that of any other cultivar in these trials or in adjacent experiments. Buck was significantly taller and significantly later to flower (by 6-8 days) than Maja and #STRKR. It was similar in height and heading date to Alba. Tables 2, 3, and 4 separate the overall data in three types of production conditions: dryland, high rainfall, and irrigated. In each of the separate environments Buck has a lower yield than the hulled checks, but this is to be expected when comparing hulled and hull-less lines, as the hull accounts for 11-13% of the grain weight. Buck shows similar yields to #STRKR under irrigated and dryland conditions, but had a higher yield under high rainfall conditions. The later maturity and greater plant height for Buck observed in the average data was most obvious at the high rainfall locations.

Buck has excellent resistance to barley stripe rust and significantly better resistance to scald than #STRKR as shown in Table 5. Limited stripe rust symptom development is observed on Buck – an average severity of 3%. This limited symptom development may be indicative of quantitative resistance, which is more likely to be durable than qualitative resistance. Seedling inoculation with five leaf rust isolates at the USDA-ARS Cereal Disease Laboratory revealed that Buck was resistant to four of five isolates. Leaf rust was observed under field conditions at Corvallis, OR and Mount Vernon, WA in 2013; Buck was rated as resistant. Barley Yellow Dwarf Virus (BYDV) occurrence is episodic and not uniform in trials when it does occur. Therefore, no data on this disease are presented. However, Buck has shown severe localized BYDV symptoms when the disease is present. Therefore, every precaution should be taken to reduce the incidence of BYDV.

Winter hardiness is measured by percent survival in field. When differential winter injury was observed, Buck was lower than, but not significantly different from, check cultivars (Table 5).

Because Buck is hull-less, it can be directly eaten or processed for human consumption. Buck has normal (non-waxy) starch. Buck had significantly lower protein than #STRKR and Maja across all growing conditions (Table 1). Buck had similar levels of grain β-glucan to #STRKR and Maja across all growing conditions and significantly lower levels compared to Alba. Buck had a significantly lower solvent retention capacity for water than Alba across all growing conditions. Across all growing conditions, Buck had significantly softer kernels than Alba and Maja. In 2006, the US-FDA approved a health claim for barley that allows: "foods containing barley to claim that they reduce the risk of coronary heart disease. Specifically, whole grain barley and dry milled barley products such as flakes, grits, flour, and pearled barley, which provide at least 0.75 grams of soluble fiber per serving" (21 CFR 101.81) (Ames and Rhymer, 2008; National Barley Foods Council, 2003). Based on the average β-glucan content of Buck, in order to receive the daily recommended soluble fiber, a person would have to eat approximately 17g of steamed grain or 44g of bread made with 40% barley flour.

Six hundred heads were selected from plots of 09OR-86 in Corvallis, OR in the summer of 2013 and planted for head row purification and increase in the fall of 2013 at Lewis-Brown, OR to produce breeder's seed of Buck. Breeder's seed stock was produced by Washington State Crop Improvement with a fall, 2015 planting and summer, 2016 harvest. In the production of certified classes of seed, covered (with adhering hull) seed variants will be allowed at a maximum of 20/lb.

Recommendation

This germplasm is proposed for public release without PVP.

Acknowledgements

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Table 1. Agronomic performance and food quality of Buck and check cultivars across 13 environments (4 high rainfall, 4 dryland, 5 irrigated).[†]
[†]Corvallis, OR (2011-12 and 2012-13); Hermiston, OR (2011-12 and 2012-13); Lewis-Brown, OR (2011-12); Pendleton, OR (2011-12 and 2012-13); Mount Vernon, WA (2011-12); Pullman, WA (2011-12 and 2012-13); Aberdeen, ID (2011-12 and 2012-13); and Parma, ID (2011-12).

	Agronomic traits				Food quality traits			
	Yield	Heading date	Plant Height	Test weight	β-glucan	Protein	Solvent Retention Capacity (water)	Kernel Hardness
	kg ha^{-1}	Days from Jan. 1	cm	kg hL^{-1}	% (w/w)	%	%	SKCS units
#STRKR	6238	134.1	90.7	74.1	4.1	12.2	100.8	46.1
Alba	7299	142.0	99.4	65.9	4.3	11.0	107.4	69.1
Maja	6746	136.3	90.6	65.0	3.9	11.2	100.5	52.4
Buck	6485	142.6	95.4	77.7	4.0	10.6	98.5	42.6
# env.	9	7	13	9	11	11	10	13
LSD (*P* = 0.05)	1056	3.9	4.4	2.6	0.3	0.6	5.1	4.9

Table 2. Agronomic performance and food quality of Buck and check cultivars across 4 dryland environments.[†]
[†]Pendleton, OR (2011-12 and 2012-13) and Pullman, WA (2011-12 and 2012-13).

	Agronomic traits				Food quality traits			
	Yield	Heading date	Plant Height	Test weight	β-glucan	Protein	Solvent Retention Capacity (water)	Kernel Hardness
	kg ha^{-1}	Days from Jan. 1	cm	kg hL^{-1}	% (w/w)	%	%	SKCS units
#STRKR	5860	144.0	89.7	74.3	4.3	14.2	108.2	45.5
Alba	7512	147.0	95.6	66.7	4.3	12.2	111.6	70.4
Maja	6023	146.0	87.0	68.3	4.0	12.7	99.7	48.9
Buck	5973	152.0	90.3	78.0	4.2	12.1	103.4	42.0
# env.	3	2	4	3	4	4	4	4
LSD (*P* = 0.05)	844	13.5	9.2	2.0	0.2	1.2	9.1	6.4

Table 3. Agronomic performance and food quality of Buck and check cultivars across 4 high rainfall environments.[†]

[†]Corvallis, OR (2011-12 and 2012-13); Lewis-Brown, OR (2011-12); and Mount Vernon, WA (2011-12).

	Agronomic traits				Food quality traits			
	Yield	Heading date	Plant Height	Test weight	β-glucan	Protein	Solvent Retention Capacity (water)	Kernel Hardness
	kg ha^{-1}	Days from Jan. 1	cm	kg hL^{-1}	% (w/w)	%	%	SKCS units
#STRKR	4635	123.3	92.8	76.0	4.4	11.8	94.2	50.6
Alba	8243	136.3	111.0	67.0	4.3	10.0	104.6	74.9
Maja	4927	125.3	96.2	60.5	3.5	10.6	100.9	56.9
Buck	5704	135.3	101.5	80.5	4.4	10.3	94.5	50.0
# env.	2	3	4	2	2	2	2	4
LSD (*P* = 0.05)	1360	4.1	5.7	12.6	1.2	3.0	12.4	9.6

Table 4. Agronomic performance and food quality of Buck and check cultivars across 5 irrigated environments.[†]

[†]Hermiston, OR (2011-12 and 2012-13); Aberdeen, ID (2011-12 and 2012-13); and Parma, ID (2011-12).

	Agronomic traits				Food quality traits			
	Yield	Heading date	Plant Height	Test weight	β-glucan	Protein	Solvent Retention Capacity (water)	Kernel Hardness
	kg ha^{-1}	Days from Jan. 1	cm	kg hL^{-1}	% (w/w)	%	%	SKCS units
#STRKR	7324	140.5	89.9	73.0	3.9	10.8	96.8	43.0
Alba	6667	145.5	93.0	64.8	4.3	10.4	104.5	63.4
Maja	8199	143.0	89.0	64.8	3.9	10.1	101.1	51.7
Buck	7261	144.0	94.6	76.0	3.6	9.6	95.7	37.2
# env.	4	2	5	4	5	5	4	5
LSD (*P* = 0.05)	1285	1.8	7.3	3.0	0.5	0.9	8.6	10.9

Table 5. Reaction of Buck and check cultivars to barley stripe rust (rated at Corvallis, OR in 2011-12 and 2012-13 and Lewis-Brown, OR in 2011-12) and scald (rated at Corvallis, OR in 2011-12 and 2012-13 and Lewis-Brown, OR and Mount Vernon, WA in 2011-12), and winter survival (rated at Pullman, WA and Aberdeen, ID in 2011-12 and 2012-13 and Parma, ID in 2011-12).

	BSR	Scald	Winter Survival
	%	1-9 scale*	%
#STRKR	6.7	7.1	92.0
Alba	3.3	0.9	97.9
Maja	0.0	6.8	93.0
Buck	3.3	4.6	80.9
# env.	3	4	5
LSD (*P*= 0.05)	9.4	2.6	23.1

[†]Based on a 1-9 rating scale where 1 = most resistant and 9 = most susceptible.

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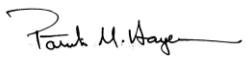
Release of Buck approved:



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