

Washington Grain Commission: Barley Research Annual Progress Report

Project #: 3019-3009

Progress Report Year: Year 2 of 3

Title: Improving Barley Varieties for Feed, Food and Malt

Project PI: Kevin Murphy; **Cooperators:** Janet Matanguihan, Max Wood, Sachin Rustgi, Ryan Higginbotham, Xainming Chen, Deven See

Executive Summary: Significant strides were made in 2015 within each market class – feed, malting, and food – of barley. One major accomplishment in 2015 was the successful release and continued success of one new, hullless, two-row, spring *food barley* variety, Havener (09WA-265.5). Havener is the first hullless food barley release by the WSU Barley Breeding Program and addresses a need for higher yielding hullless varieties with an elevated β -glucan (a heart-healthy soluble dietary fiber) content. Developed specifically for human consumption, Havener contains 50 to 75% higher β -glucan than common Washington-grown varieties Lyon, Muir, Champion, Bob and Baronesse. Havener has higher yields and test weights across all eastern Washington rainfall zones than the hullless variety Meresse. Our continued field trials of the imidazolinone (IMI) *herbicide tolerant feed barley* germplasm also showed promise. We submitted five advanced IMI-tolerant spring barley lines in the Bob background to the WSU Variety Testing Program. In the Intermediate Precipitation Zone (16-20”), four of the top five experimental lines (out of 18 total) were our IMI-tolerant lines. Though they were all lower yielding than Lyon, the highest yielding variety across all five locations in the 16-20” precipitation zone, two of the five lines showed higher average yields than Champion and Baronesse. In the high rainfall zone location of Farmington, the top IMI-tolerant line was ranked third for yield among all 36 entries, and was statistically equal to the top two entries for yield. We currently have our top two IMI-tolerant lines growing (~1500 headrows each) in our winter breeding nurseries for purification and increase. Our intent is to submit one or both of these for pre-release in the winter Variety Release Committee meeting. Our continued breeding efforts for an IMI-tolerant spring barley include the development of hundreds of advanced feed, food and malt lines through extensive crossing and utilization of double haploid technology when appropriate to speed the breeding process. Our backcross and topcross lines show promise and will be the focus of our breeding program to expedite a release of an IMI-tolerant barley variety in the near future. Finally, low protein, high-yielding breeding lines that showed excellent potential for future release of *malting barley* lines were identified. Several high yielding breeding lines had low protein (6.3 to 9.5%) and significantly higher yields than both Champion and Baronesse and are currently being tested for malting quality traits.

Impact: As a newly released variety, Havener has yet to impact the market, however, due to its enhanced β -glucan content and increased yield for a hullless barley, farmers and distributors have shown interest in the cultivation of Havener. Prices for food barley are often \$70/ton higher than feed barley and \$20/ton higher than malting barley. Seed of Havener is anticipated to be available from Washington State Crop Improvement Association (WSCIA) on a limited basis in 2017 (a 2014 hailstorm delayed seed availability by one year). Additionally, at present, considerable winter wheat acreage is devoted to the planting of IMI-resistant varieties, which severely hinders spring barley production due to residual herbicide damage and associated plant back restrictions. Our herbicide resistant breeding lines with the potential for varietal release in the near future would have a significant positive impact on barley acreage and production.

Outputs and Outcomes:

Objective	Deliverable	Progress	Timeline	Communication
<p>Objective 1. <i>Continue to develop and release high yielding, spring, two-row feed barley varieties with improved disease resistance, high protein and test weight, and excellent agronomic characteristics.</i></p>	<p>Development of disease resistant and high yielding feed barley varieties designed to improve upon Lyon and Muir continues to progress. Anticipate the pre-release of a feed barley breeding line in 2017.</p>	<p>Muir and Lyon continue to perform well. Lyon topped the 5-location Intermediate Precipitation Zone for yield in 2015 and Muir continues to perform well in low rainfall locations and sets the standard for stripe rust resistance. Experimental lines in our breeding program show improvements over these two varieties in terms of yield, test weight and protein content, and show excellent promise for future release.</p>	2017	<p>Talks and presentations at multiple field days; distribution of informative variety rack cards.</p>
<p>Objective 2. <i>Continue to expedite the development and future release of barley varieties that are highly tolerant to the imidazolinone (IMI) herbicides used in winter wheat production.</i></p>	<p>Pre-release of two IMI-resistant barley varieties during the 2016 winter Variety Release Proposal Committee Meeting. Full release of at least one IMI-barley variety the following year.</p>	<p>Excellent progress is being made on this front. Our 5 IMI-tolerant lines in WSU variety testing performed very well and two of these lines are currently being purified and increased in our winter nurseries. Our goal is to pre-release one or both of these lines</p>	2016-2017	<p>Talks and presentations at multiple field days.</p>

		in winter 2016 and fast-track their progress to expedite a full release and seed availability by spring 2017. A PVP is also being pursued at this point and will be submitted in March 2016.		
Objective 3. Capitalize on the leveraged funding from the American Malting Barley Association (AMBA) for malting barley research by focusing on the development of varieties that set new standards for malting quality.	a) Development of malting quality genetics; b) Potential release of a malting barley cultivar	We are currently in our final year of phenotyping and genotyping over 600 breeding lines for malting quality traits using genome wide association mapping. Results are expected in the spring/summer of 2016. This will be beneficial for the identification and use of markers to select for malting quality traits for both all-malt and adjunct malt market classes.	2016-2017	Talks and presentations at multiple field days, including the inaugural 'Know Barley Know Beer' field and brewery day with farmers, brewers, breeders and maltsters. Wheat life article.
Objective 4. Evaluate, select and develop high-yielding, hulless, heart-healthy food barley varieties with elevated levels of beta glucan, protein, test weight, minerals and antioxidants.	2015 release of a hulless food barley, Havener, with significantly higher beta glucan, protein and test weight compared to hulled feed varieties and higher yields and test weight than other hulless varieties.	The food barley market class is in its infancy and very small compared to the malt and feed market classes. We will continue to develop hulless food barley varieties, but with our recent release, this is a low priority. We will	2016-2017	Talks and presentations at multiple field days, development of a rack card for Havener. Wheat life article.

		continue to test over 600 lines each year for beta glucan and are currently conducting a genome wide association study for beta glucan content.		
--	--	---	--	--