

Washington Grain Commission
Wheat and Barley Research Annual Progress Reports and Final Reports

Project #: 3019-3009

Progress Report Year: 2 of 3

Title: Improving Barley Varieties for Feed, Food and Malt

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Executive summary:

In the previous reporting period the WSU barley program continued advancing feed, food and malting populations and lines in the field at Spillman Farm. Approximately 1000 plots were harvested and processing to collect data for selection and advancement of elite material. In the 2019-2020 greenhouse the spring malting crossing blocks was planted with selected high quality malting parental lines and high yielding adapted PNW germplasm selected with increased malt quality. Winter malting and feed barley lines were also selected and planted to begin crossing for the WSU winter barley program that we are initiating in 2020. We are also continuing to evaluate and advance IMI-tolerance in multiple classes of selected elite barley lines. To better utilize molecular marker selection current parental lines and breeding material from the WSU breeding program are being evaluated by genotyping with malt quality molecular markers. In collaboration with Dr. Deven See we are utilizing our PCR targeted Genotype-By-Sequencing (PCR-GBS) platform developed for Ion Torrent next generation sequencing technology to screen 40 WSU two-rowed parental lines to analyze a panel selected from markers associated with low grain protein, increasing malt extract, and reduced wort β -glucan. A training population and random lines will be screened from selected 2016 WSU lines with malting data to test prediction accuracy utilizing the marker panel for future genomic selection. A virulent population of *Puccinia graminis* f. sp. *tritici* was also collected from three Washington barley fields. Nearly 100 hundred single spore *P. graminis* f. sp. *tritici* isolates were generated and inoculated onto a barley differential set containing the only two effective barley stem rust resistance genes, *Rpg1* and *rpg4/Rpg5*. We identified multiple isolates that are highly virulent on both *Rpg1* and *rpg4/Rpg5*. This type of virulence has never been reported as the combination of these two genes has historically shown resistance to all known isolates worldwide. In order to identify new sources of resistance effective against the new virulent isolates the world barley core collection (BCC) is being screened with the virulent isolates. We conducted phenotypic evaluation and have genotypic data for the BCC lines which will be utilize to identify novel resistance genes as well as utilized for association mapping of identified resistances. If identified these novel stem rust resistances will be introgressed into WSU breeding lines.

Impact:

We are further optimizing and streamlining our selection processes including high throughput genotyping and phenotyping procedures to optimize the return on funding invested. As we move the breeding program forward these investments will have measurable impact on the ability to make more precise selections from intensive hybridization and screening of larger numbers of recombinant individuals. Our major focus will be on fixing malt quality in the program while increasing agronomic traits such water use efficiency, disease resistance and ultimately yield.

Outputs and Outcomes:

Objective	Deliverable	Progress	Timeline	Communication
1	Release of a malting barley cultivar suited to brewing and/or distilling	Several of the advanced malting barley breeding lines have performed well in malting end use quality tests and agronomically in Variety Testing. A second WSU malting line should be released in the coming year	2021-2022	Talks and presentations at field days; distribution of informative variety rack cards; Wheat Life articles
2	Release of a second IMI-tolerant barley variety with high yield and excellent disease resistance to complement Survivor. This could also be in the food or malt market class	We have thousands of known IMI-tolerant barley lines in our breeding pipeline. These have and will continue to undergo greenhouse and field trials as well as multi-location yield trials to identify the superior breeding lines available.	2022	Talks and presentations at field days; distribution of informative variety rack cards; Wheat Life articles
3	Hulless, waxy food barley variety release to support non-waxy high beta glucan varieties Havener and Meg's Song	Our hulless, high Beta-glucan breeding lines are performing well in the advanced breeder trials and will be included in variety testing trials	2021-2022	Talks and presentations at field days; distribution of informative variety rack cards; Wheat Life articles
4	One new two-row feed spring barley variety released with superior yield disease resistance, protein and agronomic characteristics	Two two-row spring varieties were released in 2013. The elite breeding lines are showing excellent promise to exceed these and other existing varieties.	2021-2022	Talks and presentations at field days; distribution of informative variety rack cards; Wheat Life articles