Washington Grain Commission

Wheat and Barley Research Annual Progress Reports and Final Reports

Project #: **3019 3571**

Progress Report Year: *_3___ of __3__ (maximum of 3 year funding cycle)*

Title: **Improving Spring Wheat Varieties for the Pacific Northwest**

Cooperators: Mike Pumphrey, John Kuehner, Vic DeMacon, Sheri Rynearson, Wycliffe Nyongesa

Executive summary:
The WSU spring wheat breeding program's elite material and recently released varieties continue to be the top performers is statewide variety trials and for growers. Foundation seed of Seahawk (WA8162) soft white, Alum (WA8166) hard red, Chet (WA8165) low rainfall hard red, and Melba (WA8193) spring club was produced and sold as all three were released in 2014 or 2015. Each variety has very good yield potential, a high level of stripe rust resistance, good-to-excellent end-use quality, and better straw strength compared to existing varieties. Melba club is intended to replace JD in >16" rainfall areas, with significantly shorter height and lower protein. WA8214 soft white spring wheat will be proposed for release in Feb 2016, and we expect broad adoption due to early maturity, shorter height, and top yield performance. WA8214 has aluminum tolerance, Hessian fly resistance, excellent rust resistance, and below average protein. Two-gene Clearfield variety candidates performed well in WSU variety testing trials, and we expect a release in the next one-two years.

Impact:
The WSU spring wheat breeding program is in a unique position to focus on grower opportunities and challenges, large and small. We identify and develop traits, technology, germplasm, and released varieties to meet the needs of the majority of Washington producers, whether the needs are localized or widespread. Our latest releases package excellent yields with superior quality and key yield protection traits. Glee hard red spring wheat was again a top performer in >12" through >20" precipitation areas, and was the leading hard red spring by acres in 2015. Diva, Louise, Whit, Babe and JD were collectively planted on >72% of soft spring wheat acres. Across spring wheat market classes, our varieties were planted on >57% of all spring wheat acres in 2015. These varieties were also top performers in 2015 spring wheat variety testing trials. Public wheat breeding programs at WSU and across the country payback consistently on research dollars invested. It is commonly referenced that public wheat breeding programs consistently return > ~60% on investment. With >57% of the spring wheat acres in Washington planted to WSU varieties, growers continue to realize a substantial return on research dollars invested in this program.

Outputs and Outcomes: File attached

WGC project number: 3019 3571
WGC project title: Improving Spring Wheat Varieties for the Pacific Northwest
Project PI(s): Mike Pumphrey
Project initiation date: 2013
Project year: 3 of 3

Objective	Deliverable	Progress	Timeline	Communication
Develop biotic and abiotic stress tolerant, high-yielding, and high-quality hard red, soft white, club, and hard white spring wheat varieties for diverse Washington production environments.	New spring wheat wheat varieties that are superior to existing varieties. This effort includes all four market classes of spring wheat and all precipitation regions in Washington state.	Four new spring wheat varieites were released during the 3 years of this project. In 2014, Seahawk (WA8162) SWS, Alum (WA8166) HRS, and Chet (WA8165) HRS, and in 2015, Melba (WA8193) spring club. These varieties will have a significant positive economic impact for PNW growers. Despite a few rough years due to drought and heat, our advanced experimental lines performed very well in the WSU Variety Trials. WA8214 (SWS) was the top performer across all precipitation zones in the 2014 and 2015 Variety Trials, and will be proposed for full release in Feb 2016. Other WSU Spring Wheat varieties and elite lines, including Seahawk, Louise, JD, Diva, Whit, Babe, Alum, Chet, Kelse, and WA8189 (SWS) performed well in WSU Variety Testing trials over the past 3 years. WSU spring wheat varieties accounted for >57% of spring wheat acreage in Washington State, and all have very good to excellent quality.	Recurring annually	
Improve PNW spring wheat germplasm to strengthen long-term variety development efforts/genetic gain.	Enhanced germplasm. Consistent genetic gain for many desirable traits.	A total of over 500 unique cross combinations were made for selection in field nurseries in 2015, and ~28,000 breeding lines were evaluated in field trials at 1 to 18 locations throughout Washington State. Grain samples from advanced breeding lines with superior agronomic performance were sent to the WSU/USDA-ARS Western Wheat Quality Laboratory for end-use quality assessment. A total of nearly 2600 F4 headrows were selected from the field based on plant type, stripe rust resistance and heading date. Early generation, end-use quality assessment methods were used to evaluate these selections and ~950 superior lines were retained.	The payback for this work will fully be realized for many years to come as these lines continue to be crossed into existing breeding lines. We expect this effort to result in introgression of desirable variation for yield, disease resistance, and other agronomic characters.	WSU Field days attended by Pumphrey: Connell, Dayton, Farmington, Horse Heaven, Reardan, St. John, Lind Field Day, Spillman Farm Field Day. Workshops/meetings/presentations attended/given by Pumphrey: Western Wheat Workers, WSCIA Annual Meeting (presentation), WSCIA Board, WA Grain Commission, Several public-private exploratory meetings.

Objective	Deliverable	Progress	Timeline	Communication
Discover/improve/implement scientific techniques and information to enhance current selection methods.	We will continue to leverage the efficiency of the Spring Wheat Breeding Program to enhance traits and research of direct relevance to Washington producers. Current examples that will continue are development of DNA markers for useful sources of Hessian fly and stripe rust resistance, drought and heat tolerance loci, identification of superior germplasm through association mapping, screening for tolerance to aluminum, development of facultative wheat, screening for drought and heat tolerance, development and screening of mutant populations (TILLING) and the development of high-throughput field phenomics selection methods.	In 2015 the tractor mounted spectral reflectance cameras were further implemented to obtain field-based high throughput phenotyping measures. We again planted individual rows of ALL our material, from early generation to our most advanced lines, at Rockford Wa. in a field with known low pH values and high levels of exchangeable aluminum. This information is very useful in selecting lines with aluminum tolerance and was very helpful in the release of the varieties "Alum", Seahwak, and WA8214.	This works has short, medium, and long term goals. We are already using new DNA markers discovered through this work to improve selection for quality and pest resistance.	Annual Wheat Life contributions