Washington Grain Commission

Wheat and Barley Research Annual Progress Reports and Final Reports
Updated November 2014

Project #:	**3019 3571**
Progress Report Year:	*_2___ 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, and Chet (WA8165) low rainfall hard red was produced as all three were released in 2014. Each variety has very good yield potential, a high level of stripe rust resistance, Hessian fly resistance, aluminum tolerance, good-to-excellent end-use quality, and better straw strength compared to existing varieties. Foundation seed is sold out for 2015 seed production of these new varieties, and will be available to growers in 2016. WA8193, a shorter spring club to replace JD in >16" rainfall areas, will be proposed for release in February 2015. Glee hard red spring wheat was again a top performer in >12" through >20" precipitation areas, and will be the leading hard red spring by acres in 2015. Kelse and Glee were the two leading hard red spring wheat varieties, planted on >85,000 acres. Diva, Louise, Whit, Babe and JD are collectively planted on >75% (228,000) of soft spring wheat acres. Across spring wheat market classes, our varieties were planted on 57% of all spring wheat acres in 2014.

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. 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:

WGC project number: 3019 3571
WGC project title: Improving Spring Wheat Varieties for the Pacific Northwest
Project PI(s): Mike Pumphrey
Project initiation date: 2014
Project year: 2 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.	Three new spring wheat varieites were released in 2014, Seahawk (WA8162) SWS, Alum (WA8166) HRS, and Chet (WA8165) HRS. These varieties will have a significant positive economic impact for PNW growers. Despite a rough year due to hail and other environmental impacts our advanced experimental lines performed very well in the WSU Variety Trials. WA8214 (SWS) and WA8213 (SWS) were among the top performers across all precipitation zones in the 2014 Variety Trials. WA8193 (SWC), WA8224 (SWS), and WA 8215 (SWS) also showed very good performance in the 2014 soft white Variety Trials. WA8193 (SWC) will be proposed for release in 2015. In the 2014 hard WSU Variety Trials WA8220 (HRS) was second in the >20" zone. WA8117 (HRS) and WA8118 both performed well across all zones. WA8216 (HWS) performed well across all zones, particularly in the moderate rainfall zones and the <12" zone were it ranked #1. Other WSU Spring Wheat varieties and elite lines, including Seahawk, Louise, JD, Diva, Whit, Babe, Alum, Chet, Kelse, Scarlet, Hollis, Otis, WA8189 (SWS), and WA8195 (SWS) performed well in WSU Variety Testing trials in 2014. WSU spring wheat varieties accounted for 70% of the SWS, 100% of the SWC, and 34% of the HRS acreage in Washington State.	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 429 unique cross combinations were made for selection in field nurseries in 2014, and ~30,000 breeding lines were evaluated in field trials at 1 to 18 locations throughout Washington State. Grain samples from 520 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 1,981 F4 headrows (822 SWS, 867 HRS, 137 HWS and 155 spring clubs) 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 1168 superior lines were identified. Afterwards, we implemented an additional single-seed-descent generation in the greenhouse in December 2014 and F5-derived lines will be grown at Spillman Farm in 2015.	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. Annual Wheat Life contributions

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, identification of superior germplasm through association mapping and prediction of breeding values, 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 2014 the design and setup of tractor mounted spectral reflectance cameras was implemented to obtain field-based high throughput phenotyping. This will greatly enhance the range and amount of data that can be collected. 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 variety "Alum".	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.	