

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

Project #: 6195

Progress Report Year: 3 of 3

Title: Field Breeding Soft White Winter Wheat

Investigator/Cooperators: **AH Carter**, TD Murray, XM Chen, KG Campbell, CF Morris

Executive summary: A new soft white winter wheat line, WA8169, was approved for release in 2014. WA8169 has good end-use quality, resistance to stripe rust and eyespot foot rot, and excellent yield potential. WA8169 appears to have broad adaptability across the state, but is most targeted to the intermediate rainfall zones of the state. In the 2014 VT trails, WA8169 was the top producing line in six of the 20 locations, and was in the top significance group in 17 of the 20 locations. Averaged over rainfall zones, it was the highest yielding line in the >20 inch rainfall zones, was second in the 16-20 inch and 16-12 inch rainfall zones, one bu/acre and three bu/acre below Xerpha, respectively, and was second in the <12 inch rainfall zone with a yield potential similar to Otto. Foundation seed production of WA8169 is currently underway. Puma was in high demand in the fall of 2014 and is being increased to meet demand. Otto, a 2011 release from this program, was also in high demand in 2014. It was planted on roughly 125,000 acres in 2013 and production acreage is estimated to have increased for this coming year. Ten advanced breeding lines were entered into WSU's Variety Testing (VT) Program. Over 600 unreplicated yield-trial plots were evaluated at either Pullman or Lind and thousands of F4 head rows were evaluated in Pullman, Lind, and Waterville. High selection pressure is continually placed on disease resistance, emergence, flowering date, end-use quality, straw strength, etc. Multiple screening locations have been established to evaluate germplasm for: stripe rust resistance, foot rot resistance, snow mold resistance, good emergence, aluminum tolerance, soil borne wheat mosaic virus resistance, Cephalosporium tolerance, and nematode resistance. The program has also employed efforts to develop herbicide resistant cultivars and advanced lines have been entered into Variety Testing. Many lines have been performing every well and some are on breeders seed increase in preparation for variety release proposal. We continue to put a strong emphasis on soft white wheat in the program, and have begun to modify our breeding schemes to account for marker-assisted selection and doubled-haploid production.

Impact: Traditionally, over 85% of the wheat crop in our state is winter wheat. Even very small reductions of required grower input and/or increases in productivity can mean millions of dollars to the growers, grain trade and allied industries. By providing genetic resistance to diseases and increasing agronomic adaptability, input costs will be reduced and grain yield increased. This program aims to provide growers with winter wheat cultivars that have far reaching positive financial and environmental impacts. Our efforts target production in the major grain growing regions of the state, and the accompanying disease pressures. Release of new cultivars with excellent agronomic performance benefits growers within the state while excellent end-use quality increases market demand and acceptance.

WGC project number: 6195
WGC project title: Field Breeding Soft White Winter Wheat
Project PI(s): AH Carter
Project initiation date: July 1, 2012
Project year: 3 of 3

Objective	Deliverable	Progress	Timeline	Communication
Develop soft white winter wheat cultivars	New cultivars released for production in WA	We released Otto in 2011. Puma (WA8134) was released in 2012. Puma is adapted to the Palouse region of the state and has resistance to stripe rust and foot rot, tolerance to Cephalosporium and low pH soils, and has excellent end-use quality. Due to demand, this line was increased again in 2014 and will be available in 2015. We recently received approval to release WA8169, a soft white winter wheat line with very broad adaptability. This line was a top yielding line in all locations in 2014, and in the intermediate to low zones in 2013. This line is targeted to replace Xerpha acres. We have 4 breeding lines in statewide testing for consideration under low rainfall production systems and 6 in statewide testing for consideration under high rainfall production. Two of these lines are two-gene imazamox resistant lines. We have over 12,000 plots and 40,000 rows under evaluation at various stages of the breeding process.	Each year we evaluate germplasm at each stage of the breeding process. Each year lines are entered into statewide testing for final release consideration. A cultivar is released, on average, every two years.	Progress will be reported through field days, grower meetings, commission reports, annual progress reports, and peer-reviewed manuscripts
	Agronomic traits	We have 16 locations across the state representing diverse climatic zones in which advanced breeding lines are evaluated for agronomic characteristics. Early generation material is selected for in Lind and Pullman. Specifically, this year was added 15,000 head rows for selection at Lind due to the ability to screen for emergence and cold tolerance.	Evaluation is done annually at multiple locations across the state.	
	Disease resistance	Disease resistance is recorded on our 16 breeding locations as disease is present, with certain locations being selected specifically for disease pressure (Waterville for snowmold, Pullman for stripe rust, etc.). Additional locations are planted in cooperation with plant pathologists to screen other diseases of importance in WA	Evaluation is done annually at multiple locations across the state.	

	End-use quality	All F4 and greater material is subjected to end-use quality screens to evaluate performance. Lines with poor quality are discarded from the breeding program and from selection in 2015.	Each year, all head rows are evaluated for end-use quality and lines predicted to have superior quality advanced. Each yield trial is submitted for quality evaluations and those with high performance are advanced in the breeding process.	
	Herbicide resistance	Multiple soft white lines have been developed for herbicide resistance and are being evaluated under replicated trials across the state. Two lines have shown very good promise and are on increase for seed production in 2015.	Evaluation is done annually at multiple locations across the state.	
Introgress novel genes for essential traits	Incorporation of novel genes into adapted germplasm for evaluation under WA environments			Progress will be reported through field days, grower meetings, commission reports, annual progress reports, and peer-reviewed manuscripts
	Rht and photoperiod genes	Crosses have been made to include non-traditional Rht and photoperiod genes into our soft white winter wheat germplasm for testing under PNW conditions.	Crosses made through the project #5195 will be evaluated under field conditions upon MAS completion.	
	Stripe rust genes	We constantly have material coming out of the MAS program for stripe rust. In 2015 we will evaluate multiple populations in both early and preliminary yield trials. Material includes new genes identified from Eltan, Coda, and novel genes.	Crosses made through the project #5195 will be evaluated under field conditions upon MAS completion.	
	Foot rot genes	We have many populations being screened for foot rot resistance.	Crosses made through the project #5195 will be evaluated under field conditions upon MAS completion.	
	Cephalosporium	No markers are currently being used for this introgression. All selection is being done under field conditions. We recently completed an association mapping study, and have identified numerous markers which can be used for selection, as well as germplasm which can be used for crossing and pyramiding QTL together.	Evaluation will be done in field locations in WA in 2014	
	Aluminum tolerance	Field screening of breeding lines for aluminum tolerance is being conducted under field conditions. We recently completed an association mapping study, and have identified numerous markers which can be used for selection, as well as germplasm which can be used for crossing and pyramiding QTL together.	Evaluation will be done in field locations in WA in 2014	

	End-use quality	Seed of bi-parental mapping populations have been submitted for quality analysis and an association mapping panel for end-use quality is currently being grown for analysis in 2015.	Seed will be collected in 2014 and sent for quality evaluations, after which analysis will be performed and markers identified.	
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