

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

Project #: 3193

Progress Report Year: 3 of 3

Title: Field Breeding Hard White and Red Winter Wheat

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

Executive summary: One hard red winter wheat line was released in 2015. WA8180 is a standard height hard red winter wheat targeted to the <12” rainfall zones of Washington. This line has good end-use quality, average protein content, very good test weight, good stripe rust resistance, and good yield potential. What makes this line stand out from other lines is its ability to emerge from deep planting and dry soils. Evaluation under crusting conditions has demonstrated this line can emerge through moderate crusting events. Trials under very low water potential done by Dr. Schillinger have shown this line to emerge very quickly from soils with very low water potential. This line will be a benefit to growers in the low rainfall zones in moisture limiting conditions. Apart from this line, there are additional lines being testing in variety testing for release potential, under both low and high rainfall conditions. After extensive selection of crosses targeted for the high rainfall zones of the state, the first material derived from DH is in statewide testing. This material comes through crossing to European material and is well adapted to Washington with high yield potential. We are very excited about these crosses. Continued emphasis has been placed on selecting breeding lines with superior quality and disease resistance. We also have a strong interest in developing hard lines with excellent emergence capabilities, and continually screen material to this end. Efforts have been initiated and are ongoing to develop hard cultivars with herbicide tolerance, snow mold resistance, and aluminum tolerance. After some renewed interest in hard white wheat, we had increased our efforts for crossing, but after further discussion with the Commission, have reduced this again due to a market shift. We maintain about 10% of the hard material as hard white and apply heavy selection pressure to ensure adapted material is advanced.

Impact: Hard winter wheat is an important crop to farmers and the Ag economy in Washington State. For the past five years, hard red winter wheat production in the state has been fairly steady at about 220,000 acres. Minimal increases are seen until new markets are developed or improved cultivars released. Input costs are constantly increasing, thereby lowering the return on crop production. Due to the extreme environmental conditions in this part of the state, average grain yield potentials are difficult to calculate. However, as an example, a modest increase in average grain yield of two bushel per acre of \$5.00 wheat would mean nearly \$2.2 million more per year for these growers and the state’s economy. Enhanced disease resistance such as Fusarium dryland foot rot and aluminum tolerance, and increased agronomic adaptability and emergence potential, along with improved nitrogen use efficiency would yield similar dollar benefits. Our measurable impact in 2015 was the release of WA8180 with excellent emergence potential, which has garnered a lot of interest in growers and seed dealers, with interest in year-in-advance sales of this line.

WGC project number: 3193
WGC project title: Development of hard red winter wheat
Project PI(s): AH Carter
Project initiation date: July 1, 2013
Project year: 3 of 3

Objective	Deliverable	Progress	Timeline	Communication
Develop hard red and white winter wheat cultivars	New cultivars released for production in WA	Sprinter was released in 2013 and was grown on about 13,000 acres in 2015. In 2014, WA8184, a hard white winter wheat line was approved for release. This line has a modest increase of seed in 2015 and limited seed was sold the fall of 2015 for production in 2016. We have 6 hard red breeding lines in statewide testing for consideration under low rainfall production systems and 3 hard red in statewide testing for consideration under high rainfall production. We have over 4,000 plots and 20,000 rows of hard material 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 is reported through field days, grower meetings, commission reports, popular press, and peer-reviewed manuscripts, and through the annual progress reports
	Agronomic traits	Field trials and agronomic data was conducted and collected at 20 locations in 2015. This includes emergence, winter survivability, heading date, test weight, plant height, and grain yield. Our Kahlotus and Ritzville trial gave a very good screen for emergence potential Lind crusted with minimal lines emerging and had to be replanted. With this data combined, very good selection was made for important agronomic traits in 2015.	Evaluation is done annually at multiple locations across the state	
	Disease resistance	Lines were screened for snow mold, stripe rust, eyespot foot rot, Cephalosporium stripe, SBWMV, and aluminum tolerance	Evaluation is done annually at multiple locations across the state	
	End-use quality	All breeding lines with acceptable agronomic performance in plots were submitted to the quality lab. Those with acceptable milling characteristics were advanced to baking trials. Lines with inferior performance will be discarded from selection in 2016.	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	Trials were conducted in Lind, Walla Walla, and Pullman for herbicide resistance.	Evaluation is done annually at multiple locations across the state	

Field test adapted germplasm with novel genes introgressed for essential traits	Incorporation of novel genes into adapter germplasm for evaluation under WA environments			Progress is reported through field days, grower meetings, commission reports, popular press, and peer-reviewed manuscripts, and through the annual progress reports
	Rht genes	Populations have been developed and are under field evaluation for Rht1, 2, and 8.	Crosses made through the project #5195 will be evaluated under field conditions upon MAS completion	
	Stripe rust genes	Multiple different stripe rust resistance genes have been introgressed into out germplasm which are under evaluation in Mount Vernon, Central Ferry, and Pullman.	Crosses made through the project #5195 will be evaluated under field conditions upon MAS completion	
	Foot rot genes	Pch1 has been selected for and is under evaluation in field trials in Pullman.	Crosses made through the project #5195 will be evaluated under field conditions upon MAS completion	
	GPC-B1 and Bx7oe	These two genes have been incorporated into many hard breeding lines. These are being tested for agronomic performance in the field.	Crosses made through the project #5195 will be evaluated under field conditions upon MAS completion	

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