

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

Project #: 3193

Progress Report Year: 2 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: Two hard white winter wheat lines were proposed for release in 2014.

WA8184 is a hard white line targeted toward the intermediate rainfall zones of the state, but particularly, the Davenport/Reardan area. This line has good end-use quality for the domestic market, good protein content, good stripe rust resistance, and good yield potential. It has also been evaluate by ADM and found to meet their market use. This line was approved for release and foundation seed is being increased. WA8158 is a hard white line targeted to the low rainfall zones of the state and does especially well under deep-furrow planting systems. This line has very good end-use quality, good protein content, good resistance to stripe rust, and very good yield potential. The release of this line was deferred another year to continue to estimate the amount of hard white winter acres are needed before release. Two other hard red lines are on breeder seed increase. WA8180 is a standard height hard red winter line for production in the low rainfall zones under deep-furrow cropping systems. This line has good yield potential, good protein content, and good end-use quality. 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. WA8181 is a hard red winter line targeted toward production in the intermediate rainfall zones. WA8181 has good disease resistance, good yield potential, and good protein content. Apart from these lines, there are an additional seven lines being testing in variety testing for release potential. 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.

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 \$8.00 wheat would mean nearly \$3.4 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.

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: 2 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 is on limited acres for production in 2015. In 2014, WA8184, a hard white winter wheat line was approved for release. This line is targeted for production in the domestic market and will complement production of the already 15,000 acres of hard white spring wheat in the state. We have 6 hard red and 1 hard white breeding lines in statewide testing for consideration under low rainfall production systems and 2 hard red and 1 hard white in statewide testing for consideration under high rainfall production. We have over 12,000 plots and 40,000 rows under evaluation at various stages of the breeding process. Two lines have performed very well under the low rainfall conditions and are on breeder seed increase. One line, WA8180, has some of the quickest and best emergence we have seen.	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 16 locations in 2014. This includes emergence, winter survivability, heading date, test weight, plant height, and grain yield. Our Kahlotus trial gave a very good screen for emergence potential, and Lind gave a very good screen for cold tolerance. With this data combined, very good selection was made for these traits in 2014.	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 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	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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