

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: One hard red winter wheat line was released in 2015. Sequoia (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. This line will be a benefit to growers in the low rainfall zones in moisture limiting conditions. This variety has replaced many of the Farnum acres and should be seen in large commercial production in 2018. Apart from this line, there are additional lines being testing in variety testing for release potential, under both low and high rainfall conditions. WA8268 is a hard red line adapted to the high rainfall zones of the state with excellent yield potential and disease resistance. In 2017 WA8268 was in the top significant group for yield with newly released cultivars LCS Jet and LCS Rocket. As such, we have begun seed increase of this line. 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. We have identified lines with aluminum tolerance and are testing them for release potential. 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. Some of these hard white lines have been tested under irrigation in Southern Idaho and have performed very well. There is interest to release these lines for production under irrigation in Idaho. Our next main target is to develop hard red cultivars with herbicide resistance.

Impact: Sequoia replaced many of the Farnum acres in the state due to its excellent emergence capability and high yield potential under low rainfall and deep planting conditions. Emergence capabilities are a desired trait to reduce risk to planting failures under deep planting conditions when moisture is limited. WA8268 is one of the first WSU hard red lines targeted to high rainfall conditions and will provide growers with a high yielding line with good disease resistance adapted to PNW growing conditions. Current and future hard red and white lines will continue to lead to a sustainable production of hard wheat in the PNW.

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	In 2015 we released Sequoia, and will be on large commercial production in 2018, replacing many of the Farnum acres. We have 3 low rainfall and 3 high rainfall hard red breeding lines in statewide testing for release consideration. WA8268 has been performing very well in high rainfall trials and WA8248 has shown excellent aluminum tolerance. We had over 3,000 plots and 15,000 rows of hard material under evaluation at various stages of the breeding process for 2017. Some hard white winter lines have been submitted for testing in Southern Idaho and have had very good performance under irrigated conditions. These continue to be evaluated for release potential. Focus has been on developing lines with herbicide tolerance as well.	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 15 locations in 2017. 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. Our snow mold locations gave a good rating of snow mold tolerance. All other locations had very good stand establishment and we are looking forward to a good year of screening the germplasm.	Evaluation is done annually at multiple locations across the state.	In 2017 we communicated results of this project through the following venues: 8 peer-reviewed publications; 2 field day abstracts; 4 invited speaker presentations; 6 poster presentations; 5 popular press interviews; 4 grower meeting presentations; 2 wheat workshop presentations; 12 field day presentations; 2 seed dealer presentations; participation in the Tri-State Grain Growers Convention; and hosted 3 trade teams.
	Biotic and Abiotic stress resistance	Lines were screened for snow mold, stripe rust, eyespot foot rot, nematodes, 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. Data should be back in early 2018. Lines with inferior performance will be discarded from selection in 2018. We screened nearly 800 early generation lines for end-use quality in 2017.	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. The hard red material had a lower priority for development when we started compared to the soft white germplasm, but now since that material has matured more emphasis is on the hard red material. Crossing has been initiated to incorporate novel herbicide resistance into hard red lines.	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. Some lines have already been returned to the breeding program as parents for additional crosses.	Crosses made through the project #5195 will be evaluated under field conditions upon MAS completion.	

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