

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, KG Campbell, XM Chen, CF Morris, TD Murray

Executive summary: Two new cultivars, Piranha CL+ and Sockeye CL+, were approved for release in September, 2020. Both lines have improved disease resistance (snow mold tolerance, stripe rust resistance, and strawbreaker foot rot tolerance) and yield potential over the two most widely grown Clearfield cultivars in production. Piranha CL+ is a widely adapted line and performs best under deep-furrow plantings. Sockeye CL+ is also widely adapted, and has maximum yield potential under high input systems. Both lines had strong demand for foundation seed, and are being increased by seed dealers as rapidly as possible. Recent releases of Stingray CL+ and Pritchett were planted in 2020 for commercial production, and were in high demand. Castella and Devote are in their final stages of seed increase and will be available for commercial production in 2021. These recent releases all have high grain yield, disease resistance, and good end-use quality. Production of these lines will mitigate concerns growers have with current cultivars. Many new lines have been entered into Variety Testing trials in 2021, and are also on breeder seed increase. Promising lines are also being advanced with the CoAXium system, and are in statewide trials. Over 2,000 unreplicated yield-trial plots were evaluated at either Pullman or Lind and thousands of F4 head rows and DH rows were evaluated in Pullman, Lind, and Waterville. Over 1,500 DH lines were planted for 2020 evaluation. 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. Some of these locations were not planted in the fall of 2020 due to reductions in the FY2021 budget request. We continue to put a strong emphasis on soft white wheat in the program, and have modified our breeding schemes to account for marker-assisted selection, genomic selection, and doubled-haploid production. We have increased the number of locations we test at to account for new herbicide resistant lines (non-imazamox) and to better evaluate lines across production regions in Washington.

Impact: Traditionally, over 85% of the wheat crop in our state is soft white 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. WSU soft white cultivars are grown on approximately 40% of the acres. These include Bruehl, Eltan, Xerpha, Otto, Puma, Jasper, Purl, Curiosity CL+, Mela CL+, and Resilience CL+. Measured impact is demonstrated with performance of past cultivars, upcoming production of recent cultivars (Pritchett, ARS-Castella, Stingray CL+, Devote) and strong interest in new cultivars (Piranha CL+ and Sockeye CL+).

WGC project number: 6195
WGC project title: Field Breeding Soft White Winter Wheat
Project PI(s): AH Carter
Project initiation date: July 1, 2009
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 the soft white lines Otto, Jasper, Puma, Purl, Stingray CL+, Devote, Piranha CL+, and Sockeye CL+. Collaborative releases include Curiosity CL+, Mela CL+, Resilience CL+, Pritchett, and ARS-Castella. All lines are being commercially produced or are in seed increase for commercial production. We have multiple breeding lines in statewide testing for consideration of release, many of which had excellent performance in 2020. We have over 16,000 plots and 30,000 rows of soft white 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 will be reported through field days, grower meetings, commission reports, annual progress reports, and peer-reviewed manuscripts
	Agronomic traits	We have 18 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. This year we moved all DH production to initial 4-row selections due to the ability to screen for important traits such as emergence and stripe rust, along with our snow mold screening in Waterville.	Evaluation is done annually at multiple locations across the state.	In 2020 we communicated results of this project through the following venues: 14 peer-reviewed publications; 3 virtual field day recordings; 6 field day abstracts; 12 poster presentations; 1 popular press interviews; 3 podcasts; 1 grower meeting presentations; and 3 seed dealer presentations;
	Disease resistance	Disease resistance is recorded on our 18 breeding locations as disease is present, with certain locations being selected specifically for disease pressure (Waterville for snow mold, 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/DH 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 2020.	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. We have multiple Clearfield lines, advanced lines in testing for the CoAXium system, and novel traits are being incorporated into germplasm and field tested through collaboration with Dr. Ian Burke.	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.	
	Stripe rust genes	We constantly have material coming out of the MAS program for stripe rust. In 2020 we evaluated multiple populations in both early and preliminary yield trials. Material includes new genes identified from Eltan, Coda, and novel genes from GWAS analysis.	Crosses made through the project #5195 will be evaluated under field conditions upon MAS.	
	Foot rot genes	We have many populations being screened for foot rot resistance. Field evaluations of these selections are done in collaboration with Dr. Campbell.	Crosses made through the project #5195 will be evaluated under field conditions upon MAS.	
	Cephalosporium	No markers are currently being used for this introgression. All selection is being done under field conditions. We recently made many crosses to resistant material and are now field screening them for selection of resistant material.	Evaluation were done in field locations in WA in 2020	
	Aluminum tolerance	Field screening of breeding lines for aluminum tolerance is being conducted under field conditions. We recently made many crosses with material that was aluminum tolerant. Screening of this material will be completed in 2020.	Evaluation were done in field locations in WA in 2020	

	Hessian Fly	In collaboration with Dr. Nilsa Bosque-Perez and Arash Rashed we screened 12 F2 populations with new sources of resistance to Hessian Fly. Resistant plants were returned to the breeding program for further crossing and segregating populations are currently being screened again for resistance. Selected lines were planted for field evaluations in 2021.	Additional populations will be developed in 2021. Current populations will be field evaluated in 2021.	
	Nematodes	Nematode screening has been done in collaboration with Dr. Paulitz and Dr. Campbell. Additional advanced material will be screened in 2020.	Populations were screened in 2020	
	End-use quality	Lines are continually screened for end-use quality. We submitted an additional 10 lines for statewide testing to begin generating quality scores prior to release decisions.	Validated genomic prediction models were available for selection in 2020.	

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