

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

**PROJECT #: 30109-3156**

**Progress report year: 2 of 3**

**Title: Club wheat Breeding**

**Researcher(s): Kimberly Garland Campbell, Arron Carter**

**Cooperator: Mike Pumphrey**

**Executive summary:**

Pritchett was grown on 15,183 acres in 2020. Castella club wheat was available as registered seed in fall of 2020. New entries with better resistance to snow-mold, including one IMI-club, were entered in the WA variety trials in the dry zone. New entries with earlier maturity, excellent standability, excellent club wheat quality and resistance to stripe rust were entered into the WA variety trials in the high rainfall zone. With our collaborators, we evaluated nurseries at 12 locations in Washington, Idaho and Oregon. This year we evaluated all of plots in our yield trials in Lind and Pullman for resistance to low falling number using spike wetting tests. This data was available prior to planting so that we could make selections. Pritchett was rated as resistant to soil borne mosaic virus over multiple years of testing by Dr. C. Hagerty of OSU. We evaluated over 2500 breeding lines from around the U.S. for resistance to stripe rust. We made crosses to several good sources of Hessian fly and wheat virus resistance and these are being advanced for selection. We evaluated mini-bulk breeding and speed breeding techniques in the greenhouse and discovered that we can save about 20 days off of normal winter wheat generations using these techniques which allows us to advance material through the greenhouse faster and serves as a cost effective alternative to doubled haploids. We were unable to visit with our collaborators of the Japanese Flour Miller's Association in person in 2020 due to the pandemic but we were able to meet in a virtual conference in July 2020. From that interaction, we are investigating additional methods to measure cake quality including image analysis and texture classification. We entered the following lines into the WA variety testing trials in 2021: ARS09X492-6CBW, ARS14DH1122-26, ARS09500-17CBW, ARSX12015-68CBW, ARSX190997-8D, WA8317. We currently plan to propose ARS09X492-6CBW for release targeted to the Palouse. WA8317 is a C12 line developed in conjunction with the WSU Winter Wheat program and will also likely be proposed for release.

**Impact**

The integration of genomic selection, speed breeding, doubled haploid breeding, and new methods of analyzing data enables us to continue to be efficient with grower dollars and produce club wheat cultivars that are competitive as well as additional soft wheat germplasm with specific useful traits for other breeders. Better resistance to low falling number will stabilize markets and reduce grower risk. Growers will maximize choice in marketing strategy.

**Summaries from 2020 WSU Cereal Variety Testing Program  
By Rainfall Zone. Club Wheats are in Italics**

<i>Name</i>	<b>&gt;20 in.</b>					<b>16-20 in.</b>				
	<i>Colton</i>	<i>Fairfield</i>	<i>Farmington</i>	<i>Pullman</i>	<i>Ave.</i>	<i>Dayton</i>	<i>Mayview</i>	<i>St John</i>	<i>Walla Walla</i>	<i>Ave.</i>
<i>ARS Crescent</i>	130	135	137	124	131	127	104	130	132	123
<i>ARS09X492-6CBW</i>	125	137	139	144	136	124	98	128	132	121
<i>ARSX12016-45CBW</i>	129	125	132	147	133	120	97	115	124	114
<i>Castella</i>	125	130	131	145	133	123	57*	115	134	107
<i>OR5170022</i>	107	114	114	118	113	115	92	117	118	110
<i>Pritchett</i>	125	130	131	145	133	131	97	124	132	121
M-press	140	142	131	142	139	131	110	119	146	127
Norwest Duet	125	130	131	145	133	126	111	127	138	126
Purl	125	130	131	145	133	132	94	130	139	124
Isd	16	11	17	15	6	13	15	11	21	7

  

<i>Name</i>	<b>12-16 in.</b>						<b>&lt;12 in.</b>					
	<i>Almira</i>	<i>Anatone</i>	<i>Creston</i>	<i>Lamont</i>	<i>Reardan</i>	<i>Ave.</i>	<i>Bickleton</i>	<i>Connell</i>	<i>Harrington</i>	<i>Horse Heaven</i>	<i>Lind</i>	<i>Ave</i>
<i>ARS Crescent</i>	77	75	73	95	127	89	27	69	67	40	70	56
<i>ARS12015-68CBW</i>	64	75	75	85	111	82	24	61	57	36	60	48
<i>Bruehl</i>	73	66	81	88	101	82	25	64	54	39	58	47
<i>Castella</i>	74	59	88	95	119	87	25	56	51	38	60	46
<i>OR5170022</i>	64	70	79	84	97	79	19	60	41	29	60	42
<i>Pritchett</i>	81	73	72	95	117	88	29	62	54	39	59	49
<i>WA8317</i>	69	69	84	85	106	83	26	61	60	38	58	49
Otto	66	72	81	94	108	84	27	57	49	39	57	46
Devote	66	70	88	89	108	85	25	64	60	45	61	51
M-press	79	71	95	91	122	92	29	68	57	38	56	50
Norwest Duet	82	78	78	95	122	91	32	67	68	37	59	53
Purl	74	83	82	88	114	88	27	65	51	40	60	48
Isd	10	11	13	8	14	4	3	14	15	8	12	4

\* The low score at Mayview for Castella is likely due to deer and elk feeding.

\*\* Shaded entries are in the same highest Isd group.

**WGC project number:** 3019-3156  
**WGC project title:** Club wheat breeding  
**Project PI(s):** Kimberly Garland-Campbell and Arron Carter  
**Project initiation date:** 7/1/19  
**Project year:** 2 of 3

Objective	Deliverable	W	Timeline	Communication
1. Develop agronomically competitive club wheat cultivars targeted to the diversity of rainfall and production zones of the PNW. These cultivars will possess the excellent end use quality characteristic of club wheat. They will also possess excellent resistance to stripe rust. Specific other characteristics will be targeted to individual rainfall regions (see below).	Club cultivar releases	Four club wheat breeding lines were entered into the high rainfall Washington Cereal Variety Testing nurseries. IN the high rainfall zone, ARS09X492-6CBW and ARSX12016-45CBW were entered into the high rainfall zone and ARS12015-68CBW and WA 8317 were entered into the low rainfall nurseries. ARS09X492-6CBW, adapted to the Palouse, and WA8317, a 2 gene IMI club wheat that is adapted to the dry region, will be proposed for release. The following lines were entered into WA variety testing trials in 2021: ARS09X492-6CBW, ARS14DH1122-26, ARS09400-17CBW, ARSX12015-68CBW, ARSX190997-8D, WA8317.	June 2019-June 2022. Cutlvar releases are targeted as one every three years per rainfall zone.	Presentation at grower meetings, Wheat commission meetings, field days, plot tours, Wheat Life and Research Review. Plant registrations manuscripts. Virtual field days in conjunction with Dr. Clark Neely.
A. Develop club breeding lines and cultivars for the <15 inch rainfall zone with improved resistance to snow mold and fusarium crown rot, improved emergence and winter survival.	Club cultivar releases and breeding lines entered into Western Regional and state extension trials.	We evaluated snow mold resistance at Waterville an Mansfield in collaboration with the WSU winter wheat breeding program. The club breeding line ARSX12015-68CBW, has above average resistance to snow mold and is being tarted to the area north of US Highway 2 in Washington. Results for fusarium evaluation will be reported in that project.	Sept 2016-June 2019.	Presentation at grower meetings, Wheat commission meetings, field days, plot tours, Wheat Life and Research Review. Peer reviewed paper on molecular approaches to breeding for soil born disease.
B. Develop club breeding lines and cultivars for the >15 inch rainfall zone with improved resistance to eyespot, cephalosporium stripe, aluminum toxicity, and cereal cyst nematodes.	Club cultivar releases and breeding lines entered into Western Regional and state extension trials.	We initiated a collaboration with Univ. of Idaho to evaluate populations that are segregating for Al tolerance at the U.I.Parker Farm in a location with high levels of exchangeable Al. Results will be available this spring and summer.	Sept 2016-June 2019.	Presentation at grower meetings, Wheat commission meetings, field days, plot tours, Wheat Life and Research Review.
C. Release a club breeding lines and cultivars with early spring green up, targeted to SE Washington.	Club cultivar releases and breeding lines entered into Western Regional and state extension trials.	Each year we plant headrows and plots at Pendleton and Walla walla and rated growth prior to and just at heading to target earlier heading cultivars. Club wheat sister lines, ARS090500-14CBW and ARS09500-17CBW, performed well early environments and were entered into the Oregon and Washington state extension trials for 2021.	Sept 2016-June 2019.	Presentation at grower meetings, Wheat commission meetings, field days, plot tours, Wheat Life and Research Review.
Objective 2. Release germplasm and cultivars with the excellent end use quality characteristic of club wheat and with resistance to preharvest sprouting and late maturity alpha amylase (LMA)	Club wheat breeding lines with stable falling numbers above 300 in all but extreme environments.	We applied factor analysis to the data collected by Camille Steber and ranked cutlvars and breeding lines for resistance to falling number. In conjunction we harvested spikes at physiological maturity from 2020 field plots and worked with the Steber lab group to rate early and mid level breeding plots for resistance to preharvest sprouting. This provided data that we could use to make selections prior to planting.	Sept 2016-June 2019.	Presentation at grower meetings, Wheat commission meetings, field days, plot tours, Wheat Life and Research Review. Direct communication with breeders. Peer reviewed papers.