

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

**PROJECT No.: 30109-6601**

**Progress report year:** 2 of 3 (*maximum of 3 year funding cycle*)

**Title: CLUB WHEAT BREEDING**

**Researchers:** K. Garland Campbell, A.H. Carter,

**Cooperator:** M. Pumphrey,

**Emeritus Advisor:** R.E. Allan

**Executive summary:** ARS Castella (ARS20060123-31C) developed by the USDA-ARS and WSU was released in 2017 an early maturing club wheat with good performance, excellent stripe rust resistance, aluminum tolerance and tolerance to low falling numbers. ARS Castella was entered into the WAVT dry trials only where yields were 109% and 115% of the trial averages in the 12-16, and <12 inch rainfall zones, respectfully.

Foundation seed of Pritchett, was produced. Pritchett is targeted to the traditional club wheat growing region in the dry precipitation zones. Yields of Pritchett in the WAVT dry trials were 102% and 107% of the trial averages in the 12-16, and <12 inch rainfall zones, respectfully.

We entered the following breeding lines into 2018 trials: ARSDH08X117-83C in the WAVT Dry, North Idaho, and Oregon Wheat Elite Yield Trial (OWEYT); ARSWA2J100065C in the WAVT Dry; ARSDH08X103-102C and ARS06132-45C in the WAVT-Wet; ARSDH08X028-9C in the WA/OR cooperative trials and OWEYT; ARSDH08X142-11L, ARSDH08X103-102C, DH08X028-9C, and ARS2J100065-C in the Western Regional Nurseries.

We genotyped all our the entries in all of our yield trials using the targeted amplicon sequencing (TAS) procedure in the USDA Western Small Grains Genotyping laboratory. We used KASP and SSR markers to select for resistance to low falling number, BYDV, eyespot, stripe rust, dough strength, cold tolerance and reduced height.

We evaluated several hundred doubled haploid lines and advanced several to our elite replicated trials. Early generation quality testing using the micro-mill, the polyphenol oxidase assay, and solvent retention capacity tests was performed. Coleoptile testing and survival from freezing was assayed on all breeding lines. All breeding lines were selected for resistance to stripe rust, eyespot, cephalosporium stripe, and Fusarium in inoculated nurseries.

### **Impact**

Club wheat acreage represents a significant part of the total WA wheat market. The excellent disease resistance of the club wheat is a built-in premium for growers because the reduced need for fungicides. The combination of excellent end use quality, disease resistance, and cold tolerance of new club wheat cultivars allows growers to make planting decisions based on market demands and to maximize choice in marketing strategy.

**WGC project number: 3019-6601**

**WGC project title: Club wheat breeding**

**Project PI(s): Kimberly Garland-Campbell and Arron Carter**

**Project initiation date: 7/1/16**

**Project year: 2**

Objective	Deliverable	Progress	Timeline	Communication
<p>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</p>	<p>Club cultivar releases</p>	<p>The club wheat cultivar Pritchett was increased as Foundation seed. ARS-Castella (ARS20060123-31C) was approved for preliminary seed increase of breeders seed.</p>	<p>Sept 2016- June 2019. Cultivar releases are targeted as one every three years per rainfall zone.</p>	<p>Report of Progress: Washington Grains Commission Research Review, “Club Wheat Breeding”, Pullman WA, Feb. 2017. Garland-Campbell, K, Carter, AH, Jones, SS, Chen, XM, DeMacon, P, Higginbotham, R, Engle, D, Guy, SO, Mundt, CC, Murray, TD, Morris, CF, See, D, 2017. Registration of “Pritchett” Soft White Winter Club Wheat. J. Plant Reg. 11. DOI: 10.3198/jpr2016.04.0018crc</p>
<p>2. Develop club breeding lines for the &lt;15 inch rainfall zone with improved resistance to snow mold and fusarium crown rot , improved emergence and winter survival</p>	<p>Germplasm identified with resistance, used to introgress new resistance genes into existing club wheat germplasm. Better combination of traits in club wheat targeted to the &lt;15 in. rainfall zone.</p>	<p>Two new lines, (ARSDH08X117-83C and ARSWA2J100065C ) were entered into the dry trials.</p>	<p>Sept 2016- June 2019.</p>	<p>Plot and field day tours speaking to approximately 15-30 growers and industry representatives per tour during June, 2017: Connell, Harrington, Lamont, St. Andrews</p>
<p>3. Develop club breeding lines for the &gt; 15 inch rainfall zone with improved resistance to eyespot, cephalosporium stripe, aluminum toxicity, and cereal cyst nematodes.</p>	<p>Germplasm identified with resistance, used to introgress new resistance genes into existing club wheat germplasm. Better combination of traits in club wheat targeted to the &gt;15 in. rainfall zone.</p>	<p>ARSDH08X105-102C and ARS06132-45C were entered into the 2018 Washington variety trials targeted to the &gt; 15 inch rainfall zone. ARSDH08X028-9C was entered into the OR trials. ARSDH08X117-</p>	<p>Sept 2016- June 2019.</p>	<p>Plot and field day tours speaking to approximately 15-30 growers and industry representatives per tour during June, 2017: St Johns, and Walla Walla</p>

<p>4. Release a club wheat cultivar with early maturity targeted to SE Washington and NE Oregon.</p>	<p>Club wheat cultivars with early maturity (2-5d earlier than Pritchett) combined with excellent stripe rust resistance.</p>	<p>Head rows were planted in Pendleton in the fall of 2017 so that earlier maturing selections can be made in that environment.</p>	<p>Sept 2016-June 2019. Our next club wheat release after Pritchett will be targeted to this growing environment</p>	<p>Invited talk, 'Falling Numbers' Northwest Grain Growers Meeting, June 21, 2017. Walla Walla WA</p>
<p>5. Release germplasm with improved resistance to low falling number</p>	<p>Club wheat breeding lines with stable falling numbers above 300 in all but extreme environments.</p>	<p>All elite lines in the breeding program were assayed for LMA using field testing and PHS using spike wetting tests. Lines that were susceptible were not advanced.</p>	<p>Sept 2016-June 2019.</p>	<p>Presentation at grower meetings, Wheat commission meetings, field days, plot tours, Wheat Life and Research Review.</p>
<p>6. Identify an early generation method to assess cake baking quality</p>	<p>Early generation prediction equation for cake baking quality, the key trait for club wheat.</p>	<p>Association mapping and genomic selection for improved baking quality is underway.</p>	<p>Sept 2016-June 2019.</p>	<p>Presentation at grower meetings, Wheat commission meetings, field days, plot tours, Wheat Life and Research Review.</p>