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ARS Agreement #: 59-0206-8-191

Research Category: VDHR-SWW

Duration of Award: 1 Year

Project Title: Developing Doubled Haploids to Expedite Variety Development in Soft Red Winter Wheat

PROJECT 3 ABSTRACT

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In 2003 and 2009 and more recently in 2014 and 2015, scab epidemics devastated much of the wheat crop in the southeastern U.S. Currently, production of cultivars having moderate FHB resistance derived predominantly from native sources, and fungicide applications offer the primary means of disease control. However, neither control strategy provides optimal protection in years of severe epidemics. Information provided from extensive and collaborative phenotypic and genotypic characterization of FHB resistance in breeding lines, commercial cultivars, and mapping populations can be deployed in marker-assisted selection (MAS) and pyramiding of complementary FHB resistance genes concurrently with development of doubled haploid (DH) lines. This will greatly accelerate the development of wheat cultivars having enhanced levels of resistance to FHB and DON toxin.

Each year the southern VDHR breeding programs make multiple single and three way crosses to pyramid validated FHB-QTL and other traits of interest. For this proposal, each program (AR, VA, LA, and GA) will use one or more of these crosses to develop 250-270 double haploid lines per year. These lines will be genotyped in collaboration with the USDA-ARS Eastern Regional Genotyping Center and collaboratively evaluated for phenotypic traits in future years of the project.

Within the Southern VDHR-CP, there are currently 225 DH lines in advanced testing, 540 DH lines in preliminary testing and 4,275 DH lines in the head-row stage. For example, twenty five superior DH lines derived from crosses having Fhb1 and other QTL (Jamestown FHB-1B) were selected among headrows of three populations (MD03W61-09-7/Jamestown//GA04570-10E46, MD03-69-15/Yorktown, and Pioneer 25R32/ GA001138-8E36//VA09W-73) evaluated in the field at Warsaw, VA in 2014. These lines were evaluated in observation yield tests at two locations in Virginia in 2015. Seed of superior lines was provided to other breeding programs in 2015-2016. This process was repeated in 2016-2017. In Arkansas, 40 DH lines were selected from populations exchanged from VA, NC and LA. New DH lines currently being developed will have diverse pyramids of FHB resistance genes including Fhb1 and QTL on chromosomes 2DL, 5AS (Ning 7840), 3BL (e.g. 3BSc of Massey), and 1B (Jamestown) combined with other favorable agronomic traits. Line DH12SRW056-058) having moderate resistance to FHB was approved for released in spring 2019.

This proposal addresses Research Priorities; 1) Increase and document acreage seeded to varieties with improved FHB resistance; 2) Increase efficiency of coordinated project breeding programs, and; 3) Implement new breeding technologies and germplasm.