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Project Title: Development of FHB Resistant Wheat Cultivars for the Midsouth

PROJECT 1 ABSTRACT

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The Arkansas Wheat Breeding Program has a strong history of developing wheat lines with a high level of resistance to Fusarium head blight (FHB). In the 2017 Uniform Southern Scab Nursery, the Arkansas program had the 4th, 10th and 16th most resistant lines (out of 46) to Fusarium damaged kernels and the 7th, 17th, 18th and 19th most resistant lines to DON content. Based on two-year averages in the Arkansas Official Variety Trial (out of 96 entries) breeding line 'AR06037-17-2' was 6th overall at 75.1 bu/ac; 'AR071333C-19-4' was 10th at 74.3 bu/ac; and 'AR06146E-1-4' 20th at 72.2 bu/ac. In terms of FHB resistance, AR06037-17-2, AR071333C-19-4 and AR06146E-1-4 are all moderately resistant (DON range from 1.7 to 2.4 ppm in inoculated testing). For comparison, 'Hilliard' had a two-year average yield of 70.7 bu/ac and a DON concentration of 5.2 ppm. 'Pioneer 26R41' had a two-year average yield of 76.9 bu/ac and a DON concentration of 5.1 ppm.

The specific objectives of this proposal are; 1) Develop and release high yielding, FHB resistant cultivars adapted to Arkansas and the mid-south, 2) Increase breeding efficiency through collaborative phenotyping, marker-assisted selection (MAS) and genomic selection (GS) and, 3) Screen and report the reactions of breeding lines and currently grown commercial cultivars to FHB using misted inoculated nurseries.

To meet these objectives, 300-400 crosses or top crosses are made each year that directly target FHB resistance. Marker assisted selection (MAS) is used on bulk populations and double haploid populations with known segregating QTL of high interest, including KASP marker assays for FHB1, Neuse_1A, Bess_2B, Bess_3B and JT_1B in house. A genomic selection approach is utilized for FHB resistance traits, grain yield and other traits beginning at the observation (1 replication) yield testing stage to identify the best lines for advancement. In total around 5,000 unique genotypes are evaluated each year in misted and inoculated FHB nurseries, including ~3,000 F3:4 breeders' head-rows, 900 Arkansas advanced breeding lines and 1,100 cooperative nursery or state variety trial lines.

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.

Future work will focus on releasing identified lines as varieties and a more targeted focus on introgression and pyramiding of genes and QTL for FHB resistance and genomic selection for more rapid cultivar development.