PI: Richard 'Esten' Mason

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PI's E-mail: esten@uark.edu

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

PROJECT 1 ABSTRACT
(1 Page Limit)

Fusarium head blight (FHB) is a destructive fungal disease that negatively affects wheat production worldwide, resulting in losses in grain yield and quality. In the United States, specifically Arkansas, the most common causal pathogen is *Fusarium graminearum*. FHB is a serious constraint to profitable wheat production when weather conditions are favorable for disease and growing moderately resistant varieties is the key component for managing FHB. However, FHB resistance is quantitative and needs to be incorporated into adapted, high-yielding varieties with resistance to other prevalent diseases before FHB-resistant varieties will be grown widely in the region.

The Arkansas Wheat Breeding Program has a strong history of developing wheat lines with a high level of resistance to FHB. This is done through intensive phenotyping of resistance in misted and inoculated nurseries in Fayetteville and Newport, Arkansas. In addition, we utilized both marker-assisted selection (MAS) for both exotic (i.e. *Fhb1*) and native resistance genes, and genomic selection (GS), to pyramid sources of resistance and expedite development of resistant germplasm and cultivars.

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 and genomic selection, 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, 500-600 crosses or top crosses will be made each year that directly target FHB resistance. Nearly 7,000 unique genotypes are evaluated each year in two misted and inoculated FHB nurseries, including ~5,000 $F_{4:5}$ progeny rows, 900 Arkansas advanced breeding lines and 1,100 cooperative nursery or state variety trial lines. Marker assisted selection is done at the observation stage and on double haploid populations with known segregating QTL of high interest, including FHB1, Neuse_1A, Neuse_4A, Bess_2B, Bess_3B and JT_1B. Genomic selection is utilized to predict FHB resistance, including severity, DON and FDK, as well as grain yield and other key traits beginning at the observation stage (~800 lines per year). These methods compliment phenotypic selection to identify the best lines for advancement.

This proposal addresses Research Goals 1: Increase and document the number of varieties with improved FHB resistance, Research Goal 2: Increase efficiency of coordinated breeding programs to develop and release FHB resistant varieties, and Research Goal 3: Evaluate and implement new breeding technologies and develop germplasm.