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Project Title: Development of FHB Resistant Wheat Genotypes Adapted to the Gulf Coast and Use of DHs to Expedite

PROJECT 1 ABSTRACT

(1 Page Limit)

The LSU AgCenter wheat breeding and variety development program develops and releases wheat varieties that are widely grown across the Gulf Coast region. FHB occurred statewide and caused very significant monetary, yield, and quality losses in 2015, 2016, and 2017. This resulted in a precipitous drop in wheat acreage. The most economical and effective means to prevent grower's losses and export market contamination from FHB toxins is to develop and release high-yielding FHB-resistant varieties for the region. Our goal is to accelerate development of FHB resistant wheat varieties adapted to the unique environment of the Gulf Coast and have high grower acceptance.

Objectives of the LSU AgCenter (LSUAC) wheat breeding project are to: 1) develop and release high-yielding FHB resistant varieties; 2) increase efficiency of coordinated breeding programs through sharing of F1s and DH populations, marker development, introgression of useful genes using MAS-population enrichment, and Kasp-marker screening of regional nurseries and breeding lines; and 3) screening of varieties and advanced breeding lines for FHB reaction to help growers make wise variety choices.

The regional FHB nursery, statewide trials, and advanced LSUAC breeding lines will be evaluated at three locations in misted nurseries inoculated with scabby corn. Fusarium Damaged Kernels and DON (toxin) will be determined on ~2,000 samples from these nurseries. First-year observation yield trials with "FHB parentage" will be screened in-house for major FHB QTL and evaluated in misted nurseries.

Approximately 500 new crosses will be made. FHB resistance will be incorporated by crossing with parents from the USFHBN and other FHB resistance sources to elite, adapted lines. F1 plants with a FHB resistant parentage will be top-crossed to develop F1 populations for marker assisted population enrichment. FHB resistant lines will be crossed to adapted lines that have high yield and good resistance to leaf and stripe rust. Two-way F1 plants with a FHB resistant parent will be topcrossed with elite LA lines in the greenhouse to set up F1 population enrichment via MAS next fall. The topcrosses will emphasize combining three of four of the most effective FHB genes (Fhb1, Fhb-Ck9511, Fhb1AN, FhbJT1B, Fhb4AN, Fhb5AN, Fhb2BB). Genomic selection for FHB resistance will be carried out on approximately 570 breeding lines in first-year yield trials. Genomic selection will also be used to predict cross combination performance and aid in choosing lines to use as parents.

Breeding lines in replicated FHB yield trials will be increased in breeder strips and blocks at two locations. Numerous early-generation populations and headrows will be evaluated for agronomic adaptation and disease resistance in Baton Rouge and Winnsboro. Selected F2 – F4 segregating populations will be planted in a spaced grid to permit genotyping and permit individual plant selection. A doubled haploid population of AGS2035/AGS2060 will be phenotypes at three locations in misted nurseries and genotyped on the Illumina 90K SNP chip to determine QTL associated with resistance in AGS2060. A population of 90 advanced lines segregating for FHB1 will be evaluated in misted nurseries and replicated yield trials to evaluate efficacy of FHB1 in Louisiana.