

PI: Paul Murphy

PI's E-mail: Paul_Murphy@ncsu.edu

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Project Title: Enhancement of Fusarium Head Blight Resistance in the Southeastern U.S. Germplasm

PROJECT 1 ABSTRACT

(1 Page Limit)

The objectives of this research are 1) increased acreage planted to varieties with improved FHB resistance and low DON, 2) increased efficiency of Coordinated Project breeding programs to develop FHB resistant varieties, and 3) Implement new breeding technologies and germplasm to further enhance short term and long term improvement of FHB resistance and to efficiently introgress effective resistance genes into breeding germplasm. The Southern Uniform Winter Wheat Scab Nursery continues to play a vital role in the development of FHB resistant cultivars and germplasms in the Coordinated Project. The nursery provides timely data on resistance levels in advanced generation breeding lines compared with the resistant check cultivars Ernie, Bess and Jamestown. The nursery also serves as a platform for germplasm exchange. I propose to include output from the Popvar software in future reports so project leaders can compare crossing decisions among nursery entries with those based on Genomic Selection (GS) research. We will investigate the utility of (GS) to increase efficiency in Southern wheat programs breeding FHB resistant varieties. The hypothesis being tested is that GS, using the training population based on the Southern Scab Nursery, does not effectively estimate FHB resistance of entries in the Sungrains Sunpre and Sunwheat nurseries. The nurseries contain approximately 250 and 80 entries, respectively, and are evaluated for agronomic, disease and insect resistance traits in six states annually. We will examine the impact of utilizing known major genes and QTL as fixed effects on estimation accuracy. The experiment will be conducted in the 2017-18, 2018-19 and 2019-20 seasons with the training population being updated annually. The results will likely indicate that GS does predict FHB resistance levels for entries in the Sungrains Sunpre and Sunwheat nurseries, however, of key importance will be the accuracy of those estimates. We plan to produce 3,000 DH annually in-house. The primary goal will be the production of DH cultivars with moderate resistance to FHB. Each of the crosses will have one, or both, parents expressing moderate resistance to FHB. Several will segregate for known FHB resistance QTL (Fhb1, FHB5A-Ernie, FHB1A-Neuse, FHB4A-Neuse, FHB6A-Neuse and FHB1B-JT, and FHB3BL-Massey). We will conduct MAS among DH lines based on major effect QTL in-house, also paying special attention to Hessian fly, powdery mildew and leaf rust genes where appropriate. Over 90 percent of our variety development breeding populations result from crosses between one or more parents exhibiting partial to high levels of resistance to FHB. Approximately 550 F2 and F3 bulks (combined) will be advanced in both seasons utilizing mass selection. Approximately 30,000 headrows in the F4, F5 and F6 generations (combined) will be advanced each season using the pedigree method. We will sequence approximately 750 new F5:7 lines entering first year yield testing annually. This will inform us of the practical value of obtaining GEBV for FHB resistance at a timely point in our breeding pipeline.