

PI: Mohamed Mergoum

PI's E-mail: mmergoum@uga.edu

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Project Title: Enhancement of Scab Resistant Wheat Cultivars Adapted to GA and the Southeast

PROJECT 1 ABSTRACT

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Since 2013, epidemic levels of scab disease were observed in many areas of Georgia and the Southeast which resulted in significant economic losses. The development of FHB resistant varieties with high levels of resistance such as Jamestown, Truman, Bess and/or Fhb1 is needed. Our objectives are to enhance the development of high yielding soft red winter wheat varieties with improved FHB resistance and end-use quality, to generate populations for marker assisted selection with QTL associated with both native and exotic FHB resistance, and to introgress two or more known FHB resistance QTL/genes (particularly Fhb1) by using field screening and marker assisted selection.

Elite germplasm developed from crosses involving Jamestown (1B, 6A), Bess/Truman (2B, 3B), Neuse (1A, 4A, 6A), and VA lines (3BLMASSEY) and the major QTL (Fhb1, 2DL, 5AS) have shown high levels of FHB resistance and increased grain yields. To continue improving FHB resistance in GA germplasm, numerous bi-parental, 3-way and 4-way crosses will be made annually between GA elite breeding lines and native sources of FHB resistance. Segregating breeding populations will be evaluated and advanced to select desirable pure lines with improved over-all agronomic performance and disease resistance. In addition, sources of FHB resistance from breeding programs in Illinois, Ohio, Missouri and Kentucky with Rht1 background will be transferred into Rht2 GA elite breeding lines adapted to the Southeast.

Increasing the efficiency of coordinated project breeding programs to develop and release FHB resistant varieties will continue through the collaborative efforts between the University of Georgia and Louisiana State University, North Carolina State University, Virginia Tech, University of Arkansas and the USDA-ARS Genotyping Center, Raleigh, NC. These efforts include assistance in phenotyping of mapping populations and elite breeding lines; cooperative evaluation of nurseries including the Southern Uniform Scab and the Uniform Southern Wheat; the exchange of resistance germplasm, crosses, and double haploid lines; and joint evaluation of these germplasm sources. Data and DON samples from the Uniform Southern FHB nursery grown in Georgia will be submitted.

Marker assisted selection (MAS), and Double Haploid (DH) will be used to identify and incorporate resistant germplasm that combine improved FHB resistance with other disease and insect resistances. Selected DH lines with QTL/genes (Fhb1, 5AS, 2DL), 1B, 6A (Jamestown), 1A, 4A, 6A (Neuse), 2B, 3B (Bess), 3BL (Massey), IL07-4415 and NC09-20986, MD08-26-H2, MDC0026-F2-19, KY06C1178, and MD03W61-09 (Fhb1) will be genotyped and evaluated for agronomic performance. Selected DH lines will be harvested and seed shared with other cooperators. MAS will be used including MAS enrichment of F1's, to accumulate favorite genes and QTLs from early generation screening, and haplotype parents for crossing. Marker Assisted Backcrossing (MABC) of QTL (Fhb1, 5AS, 2DL), 1B, 6A (Jamestown), 1A, 4A, 6A (Neuse), 2B, 3B (Bess) and 3BL (Massey) into SRWW background will be performed using adapted and moderately resistant FHB lines.