

## **Project 2:** A Double Haploid Initiative to Speed Development of FHB Resistant Soft Winter Wheat.

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### **1. What are the major goals and objectives of the research project?**

The main objective of using double haploid (DH) technique is to increase the efficiency of coordinated project breeding programs in developing and releasing FHB-resistant varieties quickly and efficiently. The DH technique shortens the variety development time in SRWW by approximately 3-4 years. We are expanding the use of this technique for the whole Southern Winter Wheat region by the coordinated development of at least five breeding populations through DH production followed by collaborative phenotyping across the region once the DH lines are developed and seed is increased for testing. The DH are currently produced in collaboration with the Heartland/Plant Innovations Facility at Kansas State University.

### **2. What was accomplished under these goals or objectives? (For each major goal/objective, address these three items below.)**

#### **a) What were the major activities?**

The DH technique allows us to generate rapidly homozygous lines with many FHB resistance QTL from various sources without going through many generations of segregation. In 2024-25, we have evaluated 438 DH lines in the field as head rows. In addition, six DH were included in the EYT and State yield trials (one in EYT and five GA OVT). Selection in the field of the DH head rows are being made (about 100 DH lines) will be advanced to the EYT in 2024-2025 crop season. The DH with FHB resistance sources originated from different breeding programs in the region will be entered in the UGA and regional/SUNGRAINS FHB scab nursery. These will be evaluated for FHB disease and genotyped for Fhb1 and QTL derived from Jamestown, Hilliard, MD03W61-09-7 (Fhb1), MD08-26-H2-7 (Fhb1 5AS 2DL), MD08-29-E9-26 (Fhb1 5AS 2DL), AGS 3030 (GA JT141-14E45), AGS 3015(GA 09129-16E55), AGS 4023, and AGS 4043. Additionally, several UGA elite DH with FHB resistance are being used in crosses to generate new DH with scab resistance from various sources and elite lines in GA and regional trials.

#### **b) What were the significant results?**

Elite DH lines selected from previous years from UGA DH and the coordinated program with FHB resistance were tested in Elite, GA State or regional trials in 2023-2024. Among these DH lines, several of them were candidates for release. This includes AGS4043 (GA15VDH-FHB-MAS23-18LE43F) released in 2021 and several lines from the 20-23 series. Another DH UGA line GA151313-DH224-19E38 was released in 2022. Among other lines with high yield, many DH lines with a wide array of pyramided scab QTL (Fhb1, 2DL, 5AS, 1B, 1A, 4A and 3B) were found also to have good resistances to other foliar disease and Hessian fly. These include UGA DH GA151313-LDH-192 -20E48 and GA161240LDH-113 -20LE6F, two DH from 21 series and one elite lines from the 22 series that are being increased as potential release in 2024 and 2025, respectively. Currently, GA151313-LDH-192 -20E48 is increased by GSD and will be submitted for release in Summer 2024.

#### **c) List key outcomes or other achievements.**

Many cultivars including GA131246DH-18E35 and GA15VDH-FHB-MAS23-18LE43F were released as DH in 2021. These two lines were licensed to private companies under the name of USG3725 and AGS 4043. Another cultivar among the 19 series, GA 151313-DH224-19E38, a DH line was released in 2022. Currently, several DH lines from the 20, 21 and 22 series are being tested and increased for potential release. Among these GA151313-LDH-192 -20E48 is a DH with enhanced FHB resistance, is potential for release in 2024.

### **3. What opportunities for training and professional development has the project provided?**

Three graduate students and score of undergraduate students were trained in protocol for screening and evaluating germplasm for scab resistance. Similarly, a lab/field tour was given to graduate students and teachers involved in the PBGG6000 practicum course in 2023 and 2024 highlighting the importance of scab, research being conducted, and achievements made.

**4. How have the results been disseminated to communities of interest?**

Four articles related to FHB were published in different journals (see section below). Field, Lab/Greenhouse tours were given to graduate students and teachers involved in the PBGG 6000 practicum course in 2023 and 2024 highlighting the importance of scab, research being conducted, and achievements made. Many visitors have been also updated on current FHB research and achievements made because of USWBSI funding. Reaction of major grown cultivars are also published in Georgia Wheat Performance Bulletin and /or GA 2022-2023/2023-2024 Small Grain Performance Tests.

**5. What do you plan to do during the next reporting period to accomplish the goals and objectives?**

Test intensively, the DH produced from previous cycles for FHB. The DH will be included in the FHB mist irrigated and artificially inoculated nursery at Plains and other locations managed by SUNGRAINS and SRWW breeders in the SE region. Similarly, these DH will be evaluated under field natural FHB infection. All these data will be combined and used to screen the most resistant DH with good agronomic performance.