

## Project FY22-SW-009: Developing FHB Resistant Soft Red Wheat Cultivars for Maryland

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

- 1) Breeding soft red winter wheat adapted to the Mid-Atlantic environment with resistance to scab and to increase the adaptation of FHB resistant lines by the wheat growers in Mid-Atlantic region.
- 2) Map and integrate new sources for FHB resistance in breeding germplasm and to enhance the collaborations with regional breeders.
- 3) Evaluation of advanced MD lines in Uniform Scab nurseries, Maryland State Test and Uniform Regional Nurseries and release of improved MD cultivars.

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

We made 300 hundred new crosses and ensured at least one prominent FHB resistant QTL was included in all the parental lines in the three-way crosses. New crosses were made to incorporate additional sources of FHB resistance in our breeding germplasm. Germplasm Jamestown, Bess/Truman, Neuse, and lines with major Fhb1, 2DL, 5AS have shown high resistance and increased grain yields. MAS, DH, and GS will be used to identify and incorporate resistant germplasm combining FHB with high yield, and resistance other biotic stresses. The resulting F1s from various FHB resistance sources will pyramid scab resistance in 3-way crosses. These crosses will include FHB-R parent, a rust-R parent, and a high-yielding adapted parent (powdery mildew-resistant) which will be used as female in the last cross. To accelerate the development of scab resistant germplasm, we have recently established the speed breeding protocol in our greenhouse that allowed us to advance 4 generations per year. Following this, marker-assisted selection was used in selected crosses to increase the number of scab resistant progenies by enriching breeding populations with markers. We used three independent approaches to combine FHB resistance with high yielding background to develop SRWW cultivars with improved FHB resistance: 1) Speed Breeding; 2) Double Haploids; 3) Genomic Selection. This year, a set of 50 advanced lines coming out of advanced yield and DH trials were tested in the statewide test along with highly competitive public and commercial cultivars.

#### What were the major activities?

Making FHB resistant germplasm using two-way and three-way crosses  
Top 25 crosses were used for the speed breeding pipeline (100 lines per population)  
Another top 12 crosses were used for DH generation (40 per population)  
The rest of the germplasm was used for GS and marker assisted breeding pipeline.

#### What were the significant results?

Enhanced FHB resistance in the MD germplasm. In our advanced lines that we tested under 2023-2024 trial cycle about 75% of our germplasm contained Fhb1, about 65 percent of lines contained a combination of at least two Fhb resistance genes including Fhb1. Our nine MD lines (with excellent FHB resistance) were in the top 25 entries compared against several public and commercial wheat cultivars. Three of our lines ranked 1, 4, and 6th ranks.

**List key outcomes or other achievements.**

Based on three years of yield results and field performance, we are advancing to license two wheat cultivars to two seed companies. These prospective cultivars have excellent FHB resistance. MDW148 is an awnless, high yielding moderately resistant to FHB with two stacked FHB R QTL and MDW23-2 is an awned with moderately susceptible to scab and has 6A and 3A QTL.

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

Three PhD students, one MS student, one postdoc, and three undergraduate students were trained under this project. All the trainees worked with the PI to conduct the nursery and collect and analyze data. These students also participated in conferences and commodity board meetings with their work.

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

The PI presented the results in oral presentations and disseminated updates on FHB in wheat and barley through emails. PI presented the research updates in the FHB forum as well as online project update meetings. The graduate students in the team presented the results as posters and handouts to the stakeholders in commodity board meetings. The results were published as wheat trial Factsheets and was disseminated via emails and the UMD extension system to the broader grower community.

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

PI plan to continue employing Speed Breeding to fast pace the integration of FHB resistant QTL and genes and to release FHB tolerant wheat cultivars.