Project FY22-NW-003: Accelerating the Development of FHB-Resistant Soft Red Winter Wheat Varieties.

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

1) Breed and release improved scab resistant varieties; 2) Develop and release improved scab resistant germplasm; 3) generate new knowledge on the inheritance of FHB resistance to expedite the breeding process and 4) communicate the importance of best management practices to all stakeholders in the wheat industry: growers, crop consultants, extension agents, millers, bakers and consumers.

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

What were the major activities?

1) Screening: More than 3500 individual headrows were planted to be screened in the scab nursery at Lexington, KY. Material screened included the state variety trial, breeding lines from F4 to F8, entries in the Northern, Prelim Northern and Southern uniform scab nurseries, entries in the Mason-Dixon nursery, and genetic studies focused on pyramided FHB resistance genes. During the nursery season covered by this report – May 1, 2024 - April 30, 2025, rainfall was abundant which increased infection levels.

2) Breeding: Approximately 400 crosses were made during this period, from December 2024 through April 2025, all of which involved at least one scab resistant parent. Many parents were selected through Popvar based on predicted FHB resistance and known QTL. Some lines from the pyramided FHB QTL study were included as parents. Breeding populations from F_2 through F_5 were selected for advancement. Preliminary lines were selected for testing based on genomic predictions. Advanced lines were tested in KY and multi state nurseries and tests.

3) Collaboration – We participated in three uniform scab nurseries (Northern, Prelim Northern and Southern soft winter wheat FHB nurseries) and other collaborative nurseries such as the Mason Dixon. This allows for germplasm sharing and making diverse parents available to other breeders. At meetings we shared genomic selection ideas and information with breeders in the region.

4) Outreach – We communicated findings and observations to stakeholders through newsletters, our website and at meetings and field days. I shared information about our genomic selection program at the 2024 FHB Forum in Austin, TX.

What were the significant results?

• We identified several breeding lines such as X17-1276-30-16-5-2 which had the lowest DON level in the Mason-Dixon nursery.

List key outcomes or other achievements.

• We found that combinations of resistance genes varied significantly in their impact on DON levels. For example the combination of 1A Neuse, 1B Jamestown and Fhb1 had a DON level of 2.0 ppm whereas 4A Neuse, 1B Jamestown and Fhb1 had 10.6 ppm DON.
• All agronomic,quality and FHB traits except yield were most affected by combination of FHB resistance genes; individual resistance genes had a much smaller effect.

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

Two graduate students, Joyce Morris and Maggie Gillum attended the 2024 National FHB Forum in Austin, TX in December as well as the Tri-Societies meetings in San Antonio. They both presented posters at each meeting, interacted with other graduate students, post-docs and PI's. The two of them visited the lab of Dr. Jim Anderson from UMN to work with a technician on KASP assay protocols.

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

Our FHB results were shared at the Winter wheat meeting in Hopkinsville, KY in February 2025 and at our wheat Field Day at Princeton in May 2024. The data are also available on our website.

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

The next reporting period is that one that is actually occurring now in real time. We had a study planted at two locations this year to look at the interaction of DON and grain protein. Though we typically favor low protein in Kentucky, there are some products such as pancakes that require stronger flour, which we can achieve with a late application of extra nitrogen. We have just completed harvest and are set to measure protein and DON as well as bake bread to ascertain the dynamics of this relationship.