

Project FY22-BA-025: Screening for Scab Resistance in Barley Lines Adapted for South Dakota

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

The overall goal of the project is to fulfill the need for locally adapted FHB resistant barley varieties for South Dakota growers. In the state of South Dakota, the eastern region suits for major agricultural crops including barley production. The eastern SD is generally wetter, thus provides a more congenial environment for FHB development in the barley, posing a challenge for quality production. Therefore, there is an urgent need to develop and characterize adapted winter and spring barley varieties suitable for the state with an acceptable level of resistance to FHB, both for feed and food uses to combat this ever-challenging foe.

Specific objectives of the proposed research project are to

- (i) Evaluate winter and spring barley lines for FHB resistance response as a breeding trait for growing in the eastern region of South Dakota and neighboring states and,

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

What were the major activities?

The 29 winter barley lines (only SD Barley survived after 2022 winters and in 2023 due to mild winters 20 survived and are currently FHB testing is ongoing) and the 29 spring barley lines at the Volga plot were inoculated with *F. graminearum* using a grain spawn method and also macroconidial suspension spray at heading when the spikes are out of flag leaf and subjected to mist irrigated to promote the establishment of FHB disease. Four replicates of each line were tested in a randomized complete block design in the field plots. We used susceptible checks controls for the experimental evaluations. Disease evaluation data were collected at 21 and 28 days after inoculation by severity scoring of FHB infection by visual estimation of 10 arbitrary spikes from each plot. The disease severity data was indicated in the percentage of infected kernels in each spike and is analyzed on the R software platform for tests of significance and to quantitatively visualize the disease ratings to establish the breeding value for the FHB resistance in testing progeny. The plots were hand-harvested, threshed, and prepped for DON testing at the University of Minnesota DON testing Lab.

What were the significant results?

The 2024 evaluations of winter barley lines have resulted in 20 lines that are winter-hardy, due to mild winters and are currently getting field FHB disease evaluation data. However, in the past, only few lines have survived with poor stand count due to lacking winter-hardiness. The spring barley genotypes tested have been very successful in the field FHB disease evaluations and DON content estimation. Below is the summary for the year 2023 of field evaluation of the 29 barley genotypes for fusarium head blight severity and DON accumulations.

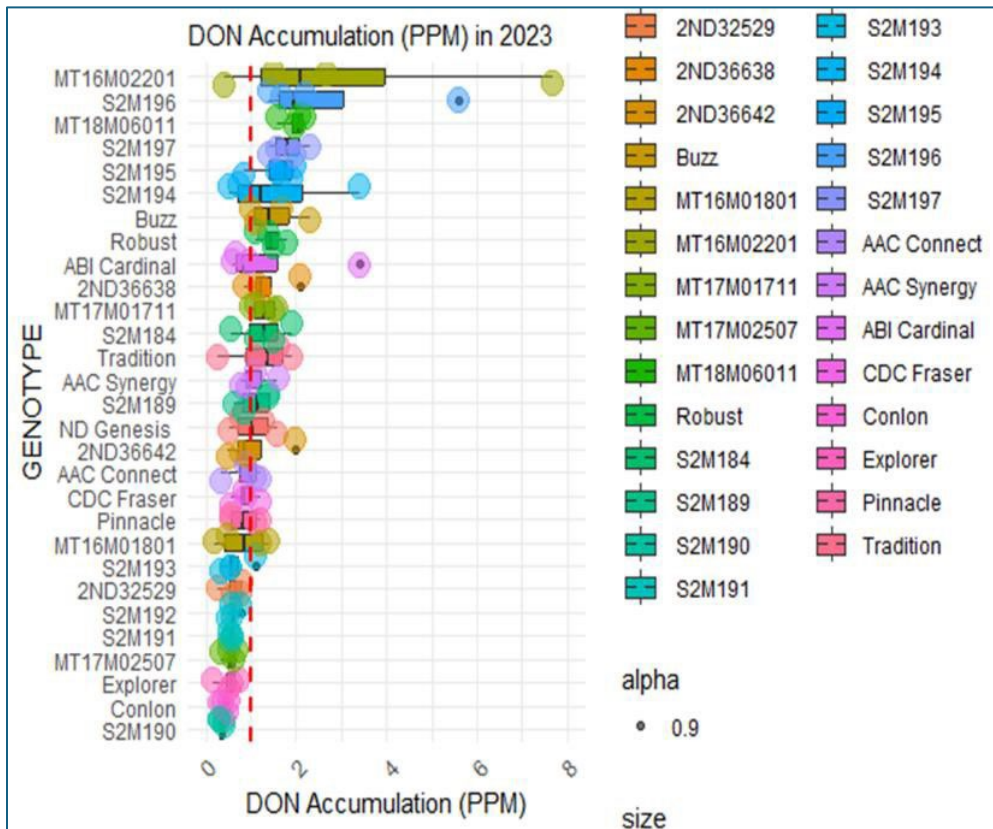
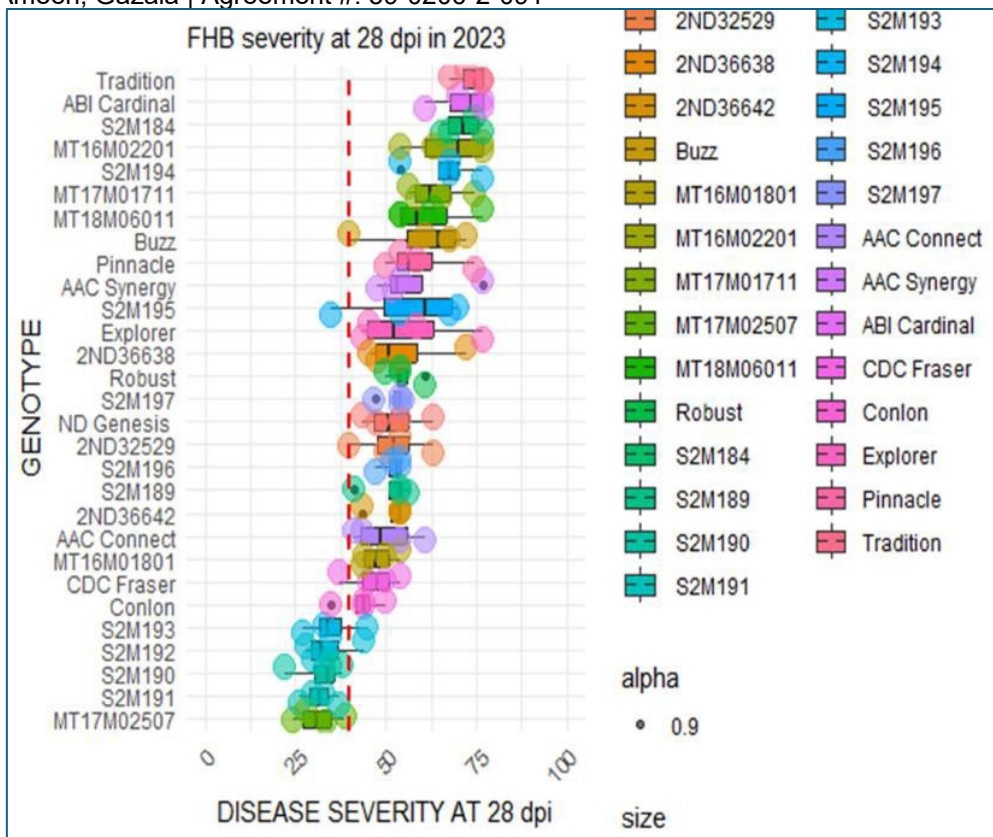


Figure 1. The two winter barley entries tested in the field of South Dakota for fusarium head blight disease severity in 2024. The left picture is a susceptible genotype whereas the right is a moderately resistant genotype.



List key outcomes or other achievements.

To summarize the last two years' research findings,

- We found that the weather parameters in the FHB nursery location were favorable for disease development for both years.
- Moderate resistance was observed in only a few barley genotypes tested.
- The released varieties tested other than Conlon showed moderate resistance to susceptibility and DON accumulation was above 1 PPM
- The barley breeding lines S2M (UMN) exhibited relatively better FHB resistance in terms of disease severity and DON accumulation.
- CONLON and S2M190 (UMN) displayed consistently better resistance in terms of FHB severity, FDK and DON content.

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

Graduate student, Tasneem Fathima, (MS, Spring 2022-Dec, 2023) and the PI both attended the 2022 FHB Forum, Dec 4-6, 2022 in Tampa, FL, and presented the year 1 results in a poster presentation. Tasneem Fathima and the PI both attended the 2023 FHB Forum, Year 2 data will be presented at the 2023 FHB Forum, Dec 3-5 in Cincinnati, Ohio. A new PhD student have been recruited to be partially supported by the USWBSI grant funding.

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

Shared the results at the FHB Forum annually and participated in annual field days for the growers of South Dakota.

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

Year 3 Completed and Ongoing activities –

Part 1: Inoculum preparation, Nursery inoculation of barley with *F. graminearum*, April-May 2024, completed

Part 2: Field evaluation of FHB disease severity, June -August 2024, Ongoing.

Part 3: Harvest, August 2023, post-harvest processing is completed for 2024 along with DON analysis. 2024 field samples are harvested, processed, analyzed and send for DON analysis, awaiting the mycotoxin results.

Projected timeline

Part 4: FHB resistance trials planting, September 2024 for winter barley and again in April/May 2025 for Spring Barley.