Project FY22-SP-011: Fusarium Head Blight Resistance for Montana Spring Wheat

Note: Report must cover the *entire* duration of the project period of performance, May 1, 2022-July 30, 2026.

1. **What are the major goals and objectives of the research project?**
   1.) Integrate FHB resistance genes from FHB resistant spring wheat germplasm into MSU's spring wheat breeding program using both conventional breeding and marker assisted selection (MAS) to increase FHB resistant allele frequencies in the Montana spring wheat breeding program.

   2.) Phenotype Montana adapted spring wheat experimental lines for FHB resistance during the 2024 field season. Experimental lines found to have FHB resistance will be advance in breeding pipeline and used as parents in the crossing block.

   3.) Deployment of FHB resistant spring wheat varieties adapted to Montana will help protect Montana's spring wheat grain producers and end-users from FHB infection and unacceptable deoxynivalenol (DON) levels that would prevent the sale of FHB infected spring wheat.

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

   What were the major activities?
   There were two major activities for this grant proposal. First, several experimental lines and varieties resistant to FHB have been incorporated into our hard red spring wheat crossing block. A single seed descent program was used to generate head rows at the F4 generation. Lines were selected with appropriate height, heading date, grain protein content, and stem solidness for two years prior to advancement to replicated yield trials. Advanced lines with an FHB-resistant parent were entered into our MSU FHB inoculated screening nursery located in Sidney, MT, the Uniform Regional Scab Nursery (URSN) and the Hard Red Spring Wheat Uniform Regional Nursery (HRSWURN). The second activity was using a marker assisted selection (MAS) program used to identify lines with major FHB resistance genes.

   What were the significant results?
   Between May 2022 and July 2026, the most significant result from this work was the release of three new spring wheat varieties; MT Carlson (2023), MT Dutton (2023) and MT Ubet (2024). All three of these varieties were screened for FHB resistance in our Sidney, MT screening nursery and the USHRSW regional nursery. MT Dutton was rated as moderately resistant to FHB, and the other two varieties were susceptible. This information was shared with our producers to inform them how they should manage these varieties if an FHB outbreak occurs in their region. Additionally, we utilized FHB resistance data from our screening nurseries to identify parental lines that have FHB resistance for our crossing blocks to make new breeding populations segregating for FHB resistance alleles.

   Our inoculated FHB screening nursery produced good results in all years of this grant. Levels of DON accumulation varied from year to year. In 2022, DON level mean was 20.3

ppm and ranged 7.3 - 44.9. DON levels in 2025 ranged 10.5 – 81.2 ppm with a mean of 39.6 ppm. Collectively, the results from the screening nursery provided good information about the range of FHB resistance levels we have in Montana varieties and experimental lines.

Other activities and results from this project include a collaboration with Steven Xu to incorporate FHB7 and other novel FHB resistance QTL into our elite breeding lines. This work will increase the number of genetic tools we have in the Montana spring wheat breeding program for improving FHB resistance.

List key outcomes or other achievements.

Outcomes:

1.) Released 3 spring wheat varieties that were evaluated for FHB resistance in our FHB screening nursery.
2.) MT Dutton has moderate FHB resistance.
3.) Successful FHB screening at our Sidney, MT screening nursery of 312 Montana Varieties and advanced experimental lines.
4.) Development and advancement of new breeding populations potentially containing improved FHB resistance
5.) Collaborating with germplasm development geneticist to integrate new FHB resistance genes into our breeding program.

3. What opportunities for training and professional development has the project provided?
None.

4. How have the results been disseminated to communities of interest?
Fusarium head blight resistance ratings and our work with the USWBSI have been communicated to Montana wheat producers and stakeholders using reports, field days and grower conferences. The screening nursery managed by Dr. Frankie Crutcher, plant pathologist at the Eastern Agricultural Research Center, serves as an excellent focal point for discussing this research. Results from the FHB screening nursery have been included in the regional MonDak research reports that reaches approximately 2,500 people in Montana and North Dakota annually.

Results have also been presented to stakeholders at field days, commodity meetings, and advisory meetings.

<u>These events and number of attendees are listed below:</u>

1. 2022 EARC Field Day. Sidney, MT Jul 12. Fusarium head blight management (56 attendees).
2. 2023 Northeastern Montana Women's Conference. Sidney, MT Mar 31. EARC tour and discussion of plant pathology research program (12 attendees).
3. 2023 Pro Coop Presentation Series. Plentywood, MT Feb 17. Plant disease management in northeastern Montana (22 attendees).
4. 2023 Montana Agricultural Business Association Conference. Virtual, Jan 26. Management of fungal pathogens in Eastern Montana: Challenges, opportunities, and updates (450 attendees).

5. 2024 Malt Barley and Sugar Beet Symposium. Billings, MT Jan 9. Fusarium head blight management (157 attendees).
6. 2024 EARC Field Day. Sidney, MT Jun 27. Fusarium head blight management and screening varieties for resistance (69 attendees).
7. 2024 EARC MAES Advisory Committee Meeting. Sidney, MT Dec 18. Plant pathology research program objectives and results (30 attendees). Note: Fusarium head blight resistance screening in our nursery was discussed at length.
8. 2025 EARC Field Day. Sidney, MT Jul 9. Fusarium head blight management and research update (84 attendees).

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

Not applicable, this is the final report for the agreement.