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

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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. First, several experimental lines and varieties resistant to FHB have been incorporated into the hard red spring wheat crossing block. A single seed descent program was used to generate head rows at the F4 generation. F5 heads from F4 plants were sent down to Yuma, AZ in November 2024 for advancement to the F6 generation. A total of 2,275 F5 heads were planted in the Yuma, AZ winter nursery. The selected F6 plants were then taken back to Bozeman, MT to be planted as F6 plant rows. 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 FHB inoculated screening nursery located in Sidney, MT. The second activity was a marker assisted selection (MAS) program used to identify lines with major FHB resistance genes.

   What were the significant results?
   In 2024, our growing conditions across the state were average. At Sidney, MT where our FHB screening nursery was located, we had good environmental conditions for onset of disease from which we got good data. We had 78 entries in our screening nursery. Means for FHB Severity was 26.1% (4.9 – 55), FHB Incidence was 73% (32.2 – 92.2) and FHB Index (Severity X Incidence / 100) was 20.8% (1.8 – 43.3). The mean for FDK was 19.4% (2.3 - 35) and DON was 16.3 ppm (6.3 - 28.9).

   List key outcomes or other achievements.
   Key outcomes for 2024 include getting good FHB resistance data from our screening nursery that helps us select lines with moderate resistance for variety release and use in our crossing block. We continue to use markers for FHB1 and FHB 5A, but to date, it appears we are not advancing the FHB1 allele very far into the breeding program. Experimental lines with known FHB resistance genes are dropping out of the breeding pipeline due to poor performance in statewide yield trials. There is likely an allele(s) in the FHB1 region that is not adapted to our environment. The FHB resistance we are retaining in our breeding

program appears to be native FHB resistance genes, genes that are not currently associated with markers. We are able to detect these genes phenotypically using our FHB screening nursery.

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 attending grower conferences. Dr. Frankie Crutcher, the plant pathologist at the Eastern Agricultural Research Center, has developed a screening nursery that serves as an excellent focal point for discussing this research. Our efforts to develop Montana adapted FHB resistant spring wheat varieties have received positive responses from the Montana wheat growing community.

5. **What do you plan to do during the next reporting period to accomplish the goals and objectives?**
   We plan on continuing our current methodology of making crosses to FHB resistant parents and screening the progeny in FHB screening nurseries to identify lines with improved FHB resistance. The goal is to release a sawfly and FHB resistant line with excellent yield and end use quality.