

Project FY22-SP-002: Spring Wheat Breeding for Scab Resistance in South Dakota

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

The primary objective was to successfully address USWBSI -VDHR priorities 1, 2, and 3 as goals. VDHR priority 1 was to increase acreage planted with varieties with improved FHB resistance to reduce DON in the US grain supply. Priorities 2 and 3 were to increase efficiency of coordinated project breeding programs to develop and release FHB resistant varieties and develop new breeding technologies and germplasm to further enhance short term and long term improvement of FHB resistance and to efficiently introgress effective resistance genes into breeding germplasm. Briefly, and in terms of this research, Goal 1 sought to accumulate various forms of FHB resistance data for dissemination to regional growers and breeders to enable more informed decisions maximizing the prevalence of productive varieties with enhanced resistance. Goals 2 and 3 were focused on accumulation of various forms of FHB resistance data primarily used within this and other breeding programs for choosing the best experimental lines as future cultivar releases and for use as parents in population development activities.

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

What were the major activities?

Goal 1 - Participation with multi-location regional screening efforts (i.e., Uniform Regional Scab Nursery, as well as phenotyping of released cultivars, mapping, and other experimental populations created by colleagues, etc).

Goal 2 - Combined utilization of USDA-ARS genotyping center in Fargo, ND, our own mist-irrigated and inoculated FHB screening nurseries, and submission of samples for DON testing.

Goal 3 - Utilization of FHB resistance phenotypes collected from our screening nurseries, and molecular marker data, to identify sources of FHB / DON resistance of potential releases and breeding parents.

What were the significant results?

Goal 1 - Phenotypic data was collected for entries within the Uniform Regional Scab Nursery, as well as among released cultivars available to South Dakota and regional producers.

Goal 2 – Marker genotype and resistance phenotypes were accumulated for 48 Advanced and 72 Preliminary yield trial entries. DON concentration data should be available in May or June 2025.

Goal 3 - Marker genotype and resistance phenotype data were collected on approximately 350 F2 and 300 F4 segregating populations.

List key outcomes or other achievements.

Goal 1 - Phenotypic data was utilized within this breeding program, shared with colleagues, and data pertaining to released cultivars was made available to regional producers through Extension publications / presentations.

Goal 2 - Data were used to identify experimental lines which possessed the highest levels of FHB resistance, best agronomic potential, and also the highest levels of end-use quality for further consideration as future cultivar releases and selection as parents in population development activities.

Goal 3 - Selections were made from within segregating populations with the highest levels of resistance which, in future years, should increase the frequency and resistance levels of lines available in the breeding program for consideration as cultivar releases as well as their use as parents for population development.

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

Undergraduate and graduate students assist with collecting FHB resistance data from screening nurseries. Additionally, the same students assist with collecting Fusarium damaged kernel scores and help prepare samples for DON analysis.

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

FHB resistance data collected on released cultivars was made available to growers as a part of the annual South Dakota Crop Performance Testing Hard Red Spring Wheat report and selection guide. This document is made available online as well as in print. Additionally, abridged copies from the previous crop year are available at producer field days each year and FHB resistance levels are routinely points of discussion at the same field days. Data collected for breeding program colleagues, such as Uniform Regional Scab Nursery observations, are provided in the annual report to the nursery coordinator who then makes data available to all participants. Likewise, data collected for other colleagues are emailed once completed.

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

As has been the case with previous reporting periods, the primary objective was to address USWBSI -VDHR priorities 1, 2, and 3 as goals. No major differences are foreseen between previous activities and those to be used in the next reporting period. Specifically, goal 1 will be completed by accumulating various forms of FHB resistance data for dissemination to regional growers and breeders to enable more informed decisions maximizing the prevalence of productive varieties with enhanced resistance. Goals 2 and 3 will focus on accumulation of various forms of FHB resistance data primarily used within this and other breeding programs for choosing the best experimental lines as future cultivar releases and for use as parents in population development activities.