USDA-ARS
U.S. Wheat and Barley Scab Initiative
FY19 Performance Report
Due date: July 24, 2020

Cover Page

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Fiscal Year:	2019
USDA-ARS Agreement ID:	59-0206-8-193
USDA-ARS Agreement Title:	Spring Wheat Breeding for Scab Resistance in South Dakota
FY19 USDA-ARS Award Amount:	$ 98,495
Recipient Organization:	South Dakota State University SAD 133, Box 2201 Brookings, SD 57007
DUNS Number:	929929743
EIN:	46-6000364
Recipient Identifying Number or Account Number:	3F4626
Project/Grant Reporting Period:	4/6/19 - 4/5/20
Reporting Period End Date:	4/5/2020

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
VDHR-SPR	Spring Wheat Breeding for Scab Resistance in South Dakota	$ 98,495
	FY19 Total ARS Award Amount	**$ 98,495**

July 22, 2020

Principal Investigator Date

* MGMT – FHB Management
FST – Food Safety & Toxicology
GDER – Gene Discovery & Engineering Resistance
PBG – Pathogen Biology & Genetics
EC-HQ – Executive Committee-Headquarters
BAR-CP – Barley Coordinated Project
DUR-CP – Durum Coordinated Project
HWW-CP – Hard Winter Wheat Coordinated Project
VDHR – Variety Development & Uniform Nurseries – Sub categories are below:
SPR – Spring Wheat Region
NWW – Northern Soft Winter Wheat Region
SWW – Southern Soft Red Winter Wheat Region

Project 1: *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 for consideration 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 items a-b) below.)*

a) 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.

b) What were the significant results?

Goal 1 - Phenotypic data was collected for entries within the Uniform Regional Scab Nursery, for released cultivars available to South Dakota producers, and for a colleague at University of Minnesota.

Goal 2 - Data were accumulated for 48 Advanced and 72 Preliminary yield trial entries as well as approximately 330 F_4 derived breeding lines.

Goal 3 - Data were accumulated for approximately 350 F_2 and 300 F_4 segregating populations.

c) 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 had the highest levels of end-use quality for further consideration as future cultivar releases and selection as parents in population development activities.

Goal 3 - A greater number of 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. Was this research impacted by the COVID-19 pandemic (i.e. university shutdowns, reduced or lack of support personnel, etc.)? If yes, please explain how this research was impacted or is continuing to be impacted.

Since the virus did not appear until spring 2020, nearly all activities associated with data collection from the 2019 field season were completed. The only exception was that DON data for samples provided to the Virginia Tech DON testing lab were unable to be collected prior to their mandated University shutdown. As of July 2020, the data remains to be provided.

Some University-related (i.e., work from home) difficulties arose with respect to planting 2020 FHB nurseries, though all materials were eventually sown in a timely fashion. Field resistance phenotypes are presently being collected. As harvest time approaches, however, it remains unclear as to what percentage of nursery rows will be harvested. This will in part depend on daycare availability for the Research Assistant that coordinates harvest, availability of student hourly labor, etc. We will attempt to collect everything, though regardless of what is harvested, gathering FDK values and preparing for DON testing may also be delayed for the same reasons.

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

Both undergraduate and graduate students routinely assist with collection of FHB resistance data from screening nurseries. Additionally, the same students assist with collecting *Fusarium* damaged kernel scores and help prepare samples for DON analysis.

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

FHB resistance data collected on released cultivars are 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, Dr. David Garvin, who then makes data available to all participants. Likewise, data collected for other colleagues are emailed once completed.

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY19 award period (4/6/19 - 4/5/20). The term "support" below includes any level of benefit to the student, ranging from full stipend plus tuition to the situation where the student's stipend was paid from other funds, but who learned how to rate scab in a misted nursery paid for by the USWBSI, and anything in between.

1. **Did any graduate students in your research program supported by funding from your USWBSI grant earn their MS degree during the FY19 award period?**
   No.

   If yes, how many?

2. **Did any graduate students in your research program supported by funding from your USWBSI grant earn their Ph.D. degree during the FY19 award period?**
   No.

   If yes, how many?

3. **Have any post docs who worked for you during the FY19 award period and were supported by funding from your USWBSI grant taken faculty positions with universities?**
   No.

   If yes, how many?

4. **Have any post docs who worked for you during the FY19 award period and were supported by funding from your USWBSI grant gone on to take positions with private ag-related companies or federal agencies?**
   No.

   If yes, how many?

Release of Germplasm/Cultivars

Instructions: In the table below, list all germplasm and/or cultivars released with full or partial support through the USWBSI during the FY19 award period. All columns must be completed for each listed germplasm/cultivar. Use the key below the table for Grain Class abbreviations.

NOTE: Leave blank if you have nothing to report or if your grant did NOT include any VDHR-related projects.

Name of Germplasm/Cultivar	**Grain Class**	**FHB Resistance** (S, MS, MR, R, where R represents your most resistant check)	**FHB Rating** (0-9)	**Year Released**
SD4740	HRS	MS	3	2019
SD4834	HRS	MR	7	2019
SD4859	HRS	MR	6	2019
SD4865	HRS	MS	4	2019
SD4868	HRS	MS	3	2019
'Driver' SD4625	HRS	MR	6	2019
ND2710 (CHECK)	HRS		9	1999

Add rows if needed.

NOTE: List the associated release notice or publication under the appropriate sub-section in the 'Publications' section of the FPR.

Abbreviations for Grain Classes

Barley - BAR
Durum - DUR
Hard Red Winter - HRW
Hard White Winter - HWW
Hard Red Spring - HRS
Soft Red Winter - SRW
Soft White Winter - SWW

Publications, Conference Papers, and Presentations

Instructions: Refer to the FY19-FPR_Instructions for detailed more instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY19 grant award. Only citations for publications published (submitted or accepted) or presentations presented during the **award period (4/6/19 - 4/5/20**) should be included. If you did not publish/submit or present anything, state 'Nothing to Report' directly above the Journal publications section.

NOTE: Directly below each citation, you **must** indicate the Status (i.e. published, submitted, etc.) and whether acknowledgement of Federal support was indicated in the publication/ presentation. See example below for a poster presentation with an abstract:

De Wolf, E., D. Shah, P. Paul, L. Madden, S. Crawford, D. Hane, S. Canty, R. Dill-Macky, D. Van Sanford, K. Imhoff and D. Miller. 2019. "Impact of Prediction Tools for Fusarium Head Blight in the US, 2009-2019." In: S. Canty, A. Hoffstetter, H. Campbell and R. Dill-Macky (Eds.), *Proceedings of the 2019 National Fusarium Head Blight Forum* (p. 12), Milwaukee, WI; December 8-10. University of Kentucky, Lexington, KY.
Status: Abstract Published and Poster Presented
Acknowledgement of Federal Support: YES (Abstract and Poster)

Journal publications.

ElDoliefy, Ahmed ElFatih A., Ajay Kumar, James A. Anderson, Karl D. Glover, Sujan Mamidi, Elias M. Elias, Raed Seetan, Mohammed S. Alamri, Shahryar F. Kianian, Suraj Sapkota, Andrew Green, and Mohamed Mergoum. 2020. Genetic dissection of Fusarium head blight resistance in spring wheat cv. 'Glenn'. Euphytica. 216: 71. https://doi.org/10.1007/s10681-020-02610-0
Status: Published
Acknowledgement of Federal Support: YES

Merrick, Lance F, Karl D. Glover, Dalitso Yabwalo, and Emmanuel Byamukama. 2020. Use of Genotype by Yield*Trait (GYT) Analysis to Select Hard Red Spring Wheat with Elevated Performance for Agronomic and Disease Resistance Traits. Crop Breed Genet Genom. 2020;2(2):e200009. https://doi.org/10.20900/cbgg20200009
Status: Published
Acknowledgement of Federal Support: YES

Books or other non-periodical, one-time publications.

Other publications, conference papers and presentations.