

**USDA-ARS/  
U.S. Wheat and Barley Scab Initiative  
FY15 Final Performance Report  
Due date: July 15, 2016**

**Cover Page**

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<b>Fiscal Year:</b>	2015
<b>USDA-ARS Agreement ID:</b>	59-0200-3-005
<b>USDA-ARS Agreement Title:</b>	Molecular Characterization and Pyramiding of Novel Scab Resistance Sources Adapted to the Northern Plains Growing Region.
<b>FY15 USDA-ARS Award Amount:</b>	\$ 28,202
<b>Recipient Organization:</b>	South Dakota State University SAD 133, Box 2201 Brookings, SD 57007
<b>DUNS Number:</b>	929929743
<b>EIN:</b>	46-6000364
<b>Recipient Identifying Number or Account Number:</b>	3F4428
<b>Project/Grant Reporting Period:</b>	05/01/15-04/30/16
<b>Reporting Period End Date:</b>	04/30/16

**USWBSI Individual Project(s)**

<b>USWBSI Research Category*</b>	<b>Project Title</b>	<b>ARS Award Amount</b>
HWW-CP	Validating Multiple FHB Resistance QTLs in Different Winter Wheat Backgrounds.	\$ 11,224
VDHR-SPR	Validating Multiple FHB Resistance QTLs in Different Spring Wheat Backgrounds.	\$ 16,978
	<b>FY15 Total ARS Award Amount</b>	<b>\$ 28,202</b>



July 15, 2016

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: Validating Multiple FHB Resistance QTLs in Different Winter Wheat Backgrounds.**

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

The goal of this project was to deliver germplasm combining multiple resistance genes with multiple elite germplasm to the spring wheat breeders in this region. The rationale is the need to introgress additional FHB resistance QTLs, as well as to study their effect on diverse genetic backgrounds.

The objective of this project was to characterize a set of double haploid HWW lines derived from a series of 4 ways crosses that combined multiple resistant line, each with potentially different resistance genes, into the same genetic background. The phenotypic characterization was done in collaboration with the regional breeding programs, and the best lines are being incorporated into breeding crossing blocks as appropriate.

**2. What was accomplished under these goals?**

- 1) *Major Activities.* The main activity was characterizing of a DH population derived from 4-way crosses among resistant lines from our previous project. In the first growing season (2014-2015) we had planted our lines in SD and ND FHB nurseries; unfortunately extreme weather during the winter resulted in 100% loss in ND and 40% loss in SD. To compensate for this circumstance we conducted additional greenhouse tests during the 2015-2016 season and repeated the screening of selected lines in the FHB nurseries in SD and ND. In 2015-2016 season we also planted some selected lines in a one location PYT.
- 2) *Specific Objectives.* The main objective was to select specific double haploid lines to be used in pre-breeding and breeding efforts to deliver improved parental germplasm.
- 3) *Significant Results.* We have found 6 lines that consistently in all trials (greenhouse and field) have FHB severity of 5% or lower. Resistant checks (Overland and Wesley-FHB1-BC6) are consistently at 10-20% severity. Susceptible check (Wesley) is consistently at 60% severity. These group of selected lines will be publically released later this year. Genotyping of the DH lines is being finished this month. This growing season our SD yield trials were affected by stripe rust, which allowed us to evaluate the DHs and found lines with significant resistance levels. Of the 6 lines with greatest FHB resistance 3 had also the greatest stripe rust resistance levels. This is a fortunate circumstance that will facilitate the incorporation and use in breeding programs.
- 4) *Key Outcomes or Other Achievements.* A set of DH lines derived from multiple resistance sources that is available to breeding programs and will be publicly released this year.

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

The training of one PhD student has been funded thru this project. A MSc student was trained in scab readings as he helped during the high peak periods in field or greenhouse screenings.

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

DH lines had been shared with winter wheat breeding programs in the region. Progress has been shared thru presentations at the Annual forum.

**Project 2: Validating Multiple FHB Resistance QTLs in Different Spring Wheat Backgrounds.**

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

The goal of this project was to deliver germplasm combining multiple resistance genes with multiple elite germplasm to the spring wheat breeders in this region. The rationale is the need to introgress additional FHB resistance QTLs, as well as to study their effect on diverse genetic backgrounds.

The objective of this project was to characterize a set of double haploid (DH) HRSW lines derived from a series of 4 ways crosses that combined multiple resistant line, each with potentially different resistance genes, into the same genetic background. To understand how these combinations of QTLs may interact with fungicides to provide an even better protection we planed to conduct field trials.

**2. What was accomplished under these goals?**

- 1) *Major Activities.* The main activity was characterizing few DH populations derived from 4-way crosses among resistant lines from our previous project.
- 2) *Specific Objectives.* 1) *Select specific double haploid lines to be used in pre-breeding and breeding efforts to deliver improved parental germplasm.* We conducted field evaluations in ND, MN and SD FHB nurseries in addition to greenhouse evaluations. 2) *Evaluate the potential interactions between resistance QTLs in the populations and fungicide applications.* We conducted a field trial comparing the FHB severity of the DH lines with and without fungicide applications.
- 3) *Significant Results.* We have identified 7 lines that consistently in all trials (greenhouse and field) had severity of 2% or lower. These lines have been shared with regional breeding programs. In the 2015 season fungicide trial the application of Prosaro completely eliminated FHB from the most resistant lines.
- 4) *Key Outcomes Or Other Achievements*  
A set of DH lines derived from multiple resistance sources that is available to breeding programs and will be publicly released this year.

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

The training of one PhD student has been funded thru this project. A MSc student was trained in scab readings as he helped during the high peak periods in field or greenhouse screenings.

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

DH lines had been shared with spring wheat breeding programs in the region. Progress has been shared thru presentations at the Annual forum.

### **Training of Next Generation Scientists**

**Instructions:** Please answer the following questions as it pertains to the FY15 award period. 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 FY15 award period? Yes**

**If yes, how many? 1**

- 2. Did any graduate students in your research program supported by funding from your USWBSI grant earn their Ph.D. degree during the FY15 award period? No**

**If yes, how many?**

- 3. Have any post docs who worked for you during the FY15 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 FY15 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 FY15 award period. All columns must be completed for each listed germplasm/cultivar. Use the key below the table for Grain Class abbreviations. *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

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**

Refer to the FY15-FPR\_Instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY15 grant. If you did not have any publications or presentations, state 'Nothing to Report' directly above the Journal publications section.

### **Journal publications.**

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

### **Other publications, conference papers and presentations.**

1. Yaqoob Thurston, Jose L. Gonzalez-Hernandez, Jonathan T. Eckard, Karl D. Glover, Mohamed Mergoum, and James A. Anderson. Validation of Fusarium head blight resistance QTLs in wheat using double-haploids derived from four-way crosses Edgar S. McFadden Symposium. September 23-24, 2014. Brookings, SD.  
Status: Abstract Published and Poster Presented  
Acknowledgement of Federal Support: Abstract: No; Poster: yes
2. Yaqoob Thurston, Karl D. Glover, Shaukat Ali and Jose L. Gonzalez-Hernandez. Can Multiple Resistance QTL in Combination with Fungicide Applications Reduce Fusarium Head Blight Severity in Spring Wheat? In: S. Canty, A. Clark, S. Vukasovich, and D. Van Sanford (Eds.) *Proceedings of the 2015 National Fusarium Head Blight Forum*. East Lansing, MI/Lexington, KY: U.S. Wheat and Barley Scab Initiative. P.109.  
Status: Abstract Published and Poster Presented  
Acknowledgement of Federal Support: Abstract: No; Poster: yes
3. Yaqoob Thurston, Jonathan T. Eckard, Karl D. Glover, James A. Anderson, Mohamed Mergoum, Melanie Caffé, Shaukat Ali, Sunish K. Sehgal, Francois G. Marais, and Jose L. Gonzalez-Hernandez. Validation of Fusarium head blight resistance QTLs in wheat using double-haploids derived from four-way crosses. In: S. Canty, A. Clark, S. Vukasovich, and D. Van Sanford (Eds.) *Proceedings of the 2015 National Fusarium Head Blight Forum*. East Lansing, MI/Lexington, KY: U.S. Wheat and Barley Scab Initiative. P.110.  
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Acknowledgement of Federal Support: Abstract: No; Poster: yes