

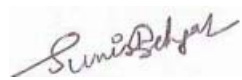
**USDA-ARS/  
U.S. Wheat and Barley Scab Initiative  
FY16 Final Performance Report  
Due date: July 28, 2017**

**Cover Page**

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<b>Fiscal Year:</b>	2016
<b>USDA-ARS Agreement ID:</b>	59-0206-4-004
<b>USDA-ARS Agreement Title:</b>	Breeding Winter Wheat for FHB Resistance in South Dakota.
<b>FY16 USDA-ARS Award Amount:</b>	\$ 50,097
<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>	SA1400627
<b>Project/Grant Reporting Period:</b>	4/6/16 - 4/5/17
<b>Reporting Period End Date:</b>	04/05/17

**USWBSI Individual Project(s)**

<b>USWBSI Research Category*</b>	<b>Project Title</b>	<b>ARS Award Amount</b>
HWW-CP	Winter Wheat Breeding for Scab Resistance in South Dakota.	\$ 50,097
	<b>FY16 Total ARS Award Amount</b>	<b>\$ 50,097</b>



Principal Investigator

7/27/17

Date

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\* 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:** *Winter Wheat Breeding for Scab Resistance in South Dakota.*

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

Fusarium head blight (FHB) is a serious wheat disease in South Dakota. Scab infection in wheat leads to significant economic losses because of lower yield and poor grain quality. The goal of the project is to develop high yielding and high-quality hard winter wheat varieties with improved resistance to FHB and lower DON content. The major objectives of the project are to utilize several native sources of resistance like Overland, Lyman, Everest, Emerson and combine them with *Fhb1* to develop new genotypes with improved FHB resistance. More than 1000 entries from hard winter wheat germplasm and experimental breeding lines are evaluated in a mist-irrigated FHB inoculated field nursery in 2-3 replications. Only the most resistant breeding lines with the lowest disease index, FDK, and DON content are being advanced. Crosses are being developed based on the FHB screening data. The scab data from inoculated nursery is shared with other breeding programs and level of FHB resistance of released and currently grown cultivars is reported to producers during field days.

**2. What was accomplished under these goals? Address items 1-4) below for each goal or objective.**

- 1) *major activities*; the project evaluated Hard Winter Wheat (HWW) cultivars, advanced breeding lines, and germplasm in the mist-irrigated inoculated FHB nursery, identified parents and developed crosses, and advanced most resistant breeding lines with the lowest disease index, FDK, and DON content.
- 2) *specific objectives*; to develop more than 100 hybridizations involving locally adapted native sources of resistance such as Lyman, Overland, and Everest, and other adapted genotypes with QTL *Fhb1*, and the number of crosses was increased to 150 in FY16. Approximately 1,000 entries were screened in a mist-irrigated and inoculated field nursery in Volga, SD, including breeding lines and DH lines from SDSU breeding programs and materials from regional nurseries (Northern Hard Winter Wheat FHB Public and Private Nurseries, Northern Regional Performance Nursery, and Regional Germplasm Observation Nursery). A total of 310 samples were analyzed for DON content.
- 3) *significant results*:  
A new hard red winter wheat variety ‘Oahe’ (SD10257-2) was released in Fall 2016 for certified seed growers. Oahe has higher yield potential and an excellent disease resistance package. SD10257-2 consistently ranked 1<sup>st</sup> for mean grain yield across all NRPN locations for three consecutive years (2013-2015). It is moderately resistant to stripe rust, leaf rust, and wheat streak mosaic virus (WSMV). Oahe has better FHB resistance as compared to Wesley and Ideal, and similar to Overland in most trials.

In addition, two advanced lines showing better FHB resistance SD110085-1 and SD110060-7 were evaluated in Crop Performance Trials (CPT) and NRPN trials. The advanced lines SD110060-7 and SD110085-1 also ranked 6<sup>th</sup> and 7<sup>th</sup> in the NRPN trials

respectively. Several lines with *Wesley-Fhb1* have entered in the early yield trials (EYT).

Sixty DH lines from Jose Gonzalez's and 126 DH lines Guihua Bai's were selected for winter hardiness, stripe rust and other agronomic traits in 2016 and are being evaluated in short two-row plots in 2016-17. Selected lines from this set will be evaluated 2017-18 EYT. Meanwhile, 10 DH lines are being evaluated in 2016-17 EYT in two locations.

- 4) *key outcomes*; Oahe is the new HRW cultivar released in during this period. Redfield released in 2013 is moderately resistant to FHB and has picked up 16% winter wheat acres in the state based on a recent variety survey conducted by South Dakota Wheat Commission. Lyman, another cultivar developed from the program is grown on 4-5% winter wheat acreage in SD. Breeding materials with better scab resistance and superior yield will be moved to next breeding cycle and parents for new crosses identified. Ultimately, these efforts are expected to lead to the release of FHB resistant winter hardy cultivars and result in reducing grower losses due to FHB epidemics across the region.

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

One graduate student (partially supported by the project) got hands-on training/experience in day-to-day operations of the breeding program and FHB screening nursery during this period. He will have sufficient data to presentations in FY 17.

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

The results from this project were shared at panel discussion at AgHorizons conference (producer centric meetings) and 6-7 farmer field days (every year) and through articles in appropriate popular press sources, word of mouth, brochures, and Extension press releases from the Agricultural Experiment Station.

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## **Training of Next Generation Scientists**

**Instructions:** Please answer the following questions as it pertains to the FY16 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 FY16 award period?**

**If yes, how many? No**

- 2. Did any graduate students in your research program supported by funding from your USWBSI grant earn their Ph.D. degree during the FY16 award period?**

**If yes, how many? No**

- 3. Have any post docs who worked for you during the FY16 award period and were supported by funding from your USWBSI grant taken faculty positions with universities?**

**If yes, how many? No**

- 4. Have any post docs who worked for you during the FY16 award period and were supported by funding from your USWBSI grant gone on to take positions with private ag-related companies or federal agencies?**

**If yes, how many? No**

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### 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 FY16 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
OAHE	HRW	MR-MS	4	2016

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

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## **Publications, Conference Papers, and Presentations**

**Instructions:** Refer to the FY16-FPR\_Instructions for detailed instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY16 grant. Only include citations for publications submitted or presentations given during your award period (4/6/16 - 4/5/17). 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.**

Thurston Y, Eckard JT, Caffè M, Ali S, **Sehgal SK**, Marais FG, Gonzalez-Hernandez J (2016) Development of Fusarium Head Blight resistance germplasm in highly adapted winter wheat background. National Fusarium Head Blight Forum, December 4-6, 2016, St. Louis, MO.

Status: Abstract Published and Poster Presented  
Acknowledgment of Federal Support: YES (poster)

Yabwalo D, Geppert R, Ali S, **Sehgal S**, Byamukama, E (2016) Development of Fusarium head blight in winter wheat during the 2016 season in South Dakota. National Fusarium Head Blight Forum, December 4-6, 2016, St. Louis, MO.

Status: Abstract Published and Poster Presented  
Acknowledgment of Federal Support: YES (poster)