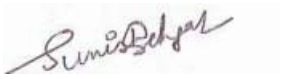
USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY15 Final Performance Report
Due date: July 15, 2016

Cover Page

Principle Investigator (PI):	Sunish Sehgal
Institution:	South Dakota State University
E-mail:	Sunish.Sehgal@sdstate.edu
Phone:	605-688-5709
Fiscal Year:	2015
USDA-ARS Agreement ID:	59-0206-4-004
USDA-ARS Agreement Title:	Breeding Winter Wheat for FHB Resistance in South Dakota.
FY15 USDA-ARS Award Amount:	$ 41,327
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:	SA1400627
Project/Grant Reporting Period:	04/06/15-04/05/16
Reporting Period End Date:	04/05/16

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
HWW-CP	Enhancing FHB Resistance and Reducing DON in Winter Wheat for South Dakota.	$ 41,327
	FY15 Total ARS Award Amount	**$ 41,327**



7/14/16

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: *Enhancing FHB Resistance and Reducing DON in Winter Wheat for 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?

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 with joining of new winter wheat breeder in the middle of FY15. 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 265 samples were analyzed for DON content.

3) *significant results*: Two advanced lines showing better FHB resistance SD110085-1 and SD110060-7 were moved to Crop Performance Trials (CPT) and NRPN trials. Another advanced line (SD10257-2) with FHB resistance comparable to Overland was also evaluated in NRPN and CPT trials and was ranked 1st based on average yield in NRPN trials consecutively for three years (2013-2015), and seed increase has been initiated. The advanced lines SD110060-7 and SD110085-1 also ranked 6th and 7th in the NRPN trials respectively. Several lines with Wesley-*Fhb1* have entered in the early yield trial (EYT) trials. The DH lines from Jose Gonzalez's grant have been seed increased for EYT.

4) *key outcomes*; The most recently released cultivar Redfield (2013 for certified seed growers) has better FHB resistance than Wesley and its acreage in SD has started picking up. Lyman, another cultivar developed from the program is grown on about 10% area 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 MS student (not support 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 was provided opportunities to attend two conferences, two workshops and several seminars. An undergraduate student worker was also trained in the project.

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

The results from this project were shared by presentation at FHB forum and articles in journals, talks at producer centric meetings (AgHorizons) 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.

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?** 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 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**
None				

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.

Cainong, J.C., Bockus, W.W., Feng, Y., Chen, P., Qi, L., Sehgal, S.K., Danilova, T.V., Koo, D., Friebe, B., and Gill, B.S. 2015. Chromosome engineering, mapping, and transfer of native grass resistance to Fusarium Head Blight disease into wheat. *Theor Appl Genet* **128:**1019-27

Status: Published
Acknowledgement of Federal Support: YES

Bockus, W.W., Zhang, G., Fritz, A.K., Davis, M.A., Baenziger, P.S, Marais, G.F., and Sehgal, S.K. 2016. Reaction of Kansas, Nebraska, South Dakota, and North Dakota winter wheat accessions to Fusarium head blight (FHB). *Plant Disease Management Reports* 10:CF043

Status: Published
Acknowledgement of Federal Support: YES

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

None

Other publications, conference papers and presentations.

Thurston, Y., Eckard, J.T., Glover, K.D., Anderson, J.A., Mergoum, M., Caffe, M., Ali, S., Sehgal, S.K., Marais, G.F., and Gonzalez-Hernandez, J. (2015) "Validation of Fusarium Head Blight resistance QTLs in wheat using double haploids derived from four-way crosse." In: S. Canty, 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 & Barley Scab Initiative. p. 110.
Status: Abstract Published and poster presented
Acknowledgement of Federal Support: Abstract: No; Poster: Yes