USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY14 Final Performance Report
July 15, 2015

Cover Page

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Fiscal Year:	FY14
USDA-ARS Agreement ID:	59-0206-4-003
USDA-ARS Agreement Title:	Spring Wheat Breeding for Scab Resistance in South Dakota.
FY14 USDA-ARS Award Amount:	$ 85,185

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
VDHR-SPR	Spring Wheat Breeding for Scab Resistance in South Dakota.	$ 85,185
	FY14 Total ARS Award Amount	**$ 85,185**

July 13, 2015
Principal Investigator Date

* MGMT – FHB Management
FSTU – Food Safety, Toxicology, & Utilization of Mycotoxin-contaminated Grain
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
WES-CP – Western 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 major problem or issue is being resolved relevant to Fusarium head blight (scab) and how are you resolving it?

Fusarium head blight (FHB) is a serious wheat disease that continues to pose a threat to production within South Dakota as well as the North Central region of the USA. In an attempt to alleviate this threat, development of resistant cultivars is a high priority within the spring wheat breeding program at South Dakota State University. An aggressive program was initiated to speed development of spring wheat cultivars with improved FHB resistance and desirable agronomic traits. Established off-season nurseries and mist-irrigated greenhouse and field screening nurseries are utilized to accelerate breeding efforts to improve resistance along with desirable agronomic characteristics. Three early generations of breeding materials are evaluated for resistance each year: two generations in the greenhouse and one in the field. Approximately 8,000 individual hills are evaluated in the greenhouse nurseries and 3,000 head-rows are screened in the field nursery. Both the field and greenhouse nurseries are inoculated with infested corn and conidial suspensions. A mist-irrigation system is used to provide a favorable environment for infection and disease development. Each year we make approximately 400 crosses to introduce new resistance genes and create new resistance gene combinations. Sources of resistance used in the crosses include material from the Uniform Regional Scab Nursery (URSN) for spring wheat parents, (a cooperative regional effort to identify and utilize sources of scab resistance) newly identified germplasm provided through introduction and evaluation efforts, other introduced sources, as well as both cultivars and advanced breeding lines with various levels of resistance. The off-season nursery aids in the simultaneous selection for resistance and desirable agronomic characteristics.

2. List the most important accomplishments and their impact (i.e. how are they being used) to minimize the threat of Fusarium Head Blight or to reduce mycotoxins. Complete both sections; repeat sections for each major accomplishment:

Accomplishment:

The 2014 growing season was very conducive for FHB screening in South Dakota. Symptomology was good and DON was present within samples which allowed for selections in the breeding program to be made based on both characteristics. Since 2012, four cultivars have been released to growers by our program. Over four years of simultaneous testing, the FHB disease index ratings recorded for ‘Advance’, ‘Forefront’, ‘Prevail’, and ‘Focus’ were 25.1, 19.0, 21.9, and 16.2, respectively, compared to our resistant check ‘Brick’ (18.0). This program also provides germplasm each year to the Uniform Regional Scab Nursery.

Impact:

Elevated resistance levels in released cultivars are immediately utilized by the most apparent beneficiaries of our work; HRSW producers. Through utilizing cultivars with elevated resistance levels, growers are more able to protect themselves from suffering devastation of fields in the presence of a severe FHB epidemic. Elevated resistance levels in germplasm is also quite often utilized by a less immediately apparent group; HRSW breeders. Through utilizing both germplasm and released cultivars, breeding programs strive to further increase FHB resistance among germplasm pools that will eventually result in the release of continually improved cultivars.

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY14 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 FY14 award period?** Yes

   If yes, how many? One

2. **Did any graduate students in your research program supported by funding from your USWBSI grant earn their Ph.D. degree during the FY14 award period?** No

   If yes, how many? None

3. **Have any post docs who worked for you during the FY14 award period and were supported by funding from your USWBSI grant taken faculty positions with universities?**

   If yes, how many? None

4. **Have any post docs who worked for you during the FY14 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? None

Include below a list of all germplasm or cultivars released with full or partial support of the USWBSI during the FY14 award period. List the release notice or publication. Briefly describe the level of FHB resistance. *If not applicable because your grant did NOT include any VDHR-related projects, enter N/A below.*

'Focus' HRSW cultivar was released in fall 2014 (Notice of release in preparation). **'**Brick' has proven itself as one of the most resistant cultivars released by this program, and is also one of the most resistant that is available in the upper Midwest. When disease index, percentage FDK values, and DON concentrations of Focus (16.2, 16.3, and 6.2, respectively) are compared with those of Brick (18.0, 15.3, and 2.5 respectively) it appears that Focus is quite similar with respect to disease index and percentage FDK values. DON concentrations of Focus are, however, significantly higher than those of Brick.

Include below a list of the publications, presentations, peer-reviewed articles, and non-peer reviewed articles written about your work that resulted from all of the projects included in the FY14 grant. Please reference each item using an accepted journal format. If you need more space, continue the list on the next page.

Eckard, Jonathan T., Karl D. Glover, Mohamed Mergoum, James A. Anderson, Jose L. Gonzalez-Hernandez. 2014. Multiple Fusarium head blight resistance loci mapped and pyramided onto elite spring wheat Fhb1 backgrounds using an IBD-based linkage approach. Euphytica. DOI 10.1007/s10681-014-1333-8.

Glover K. D., R. G. Hall, Y. Jin, L. E. Osborne, J. A. Ingemansen, E. B. Turnipseed, and G. A. Hareland. 2015. Registration of Advance Wheat. Journal of Plant Registrations. 9:83-88.

ElFatih ElDoliefy, Ahmed, James A. Anderson, Karl D. Glover, Ajay Kumar, Elias Elias, Shiaoman Chao, Mohammed S. Alamri, and Mohamed Mergoum. 2014. 'Parshall': An Indigenous and Novel FHB Resistance Source for Fusarium Head Blight with High Quality and Adapted Hard Red Spring Wheat Cultivar. In: S. Canty, A. Clark, J. Mundell, E. Walton, D. Ellis and D. Van Sanford (Eds.), Proceedings of the National Fusarium Head Blight Forum; 2014, 7-9 December; Milwaukee, WI. Michigan State University, East Lansing, MI. p. 80.

Thurston, Yaqoob, Jonathan T. Eckard, Karl D. Glover, James A. Anderson, Mohamed Mergoum, Melanie Caffe, Shaukat Ali, Sunish K. Sehgal, Francois G. Marais, and Jose L. Gonzalez-Hernandez. 2014. Validation of Fusarium Head Blight Resistance QTLs in Wheat using Double Haploids Derived from Four-Way Crosses. In: S. Canty, A. Clark, J. Mundell, E. Walton, D. Ellis and D. Van Sanford (Eds.), Proceedings of the National Fusarium Head Blight Forum; 2014, 7-9 December; Milwaukee, WI. Michigan State University, East Lansing, MI. p. 98.