USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY13 Final Performance Report
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Cover Page

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Fiscal Year:	FY13
USDA-ARS Agreement ID:	59-0206-9-052
USDA-ARS Agreement Title:	Spring Wheat Breeding Scab Resistance in South Dakota.
FY13 USDA-ARS Award Amount:	$ 85,593

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
VDHR-SPR	Spring Wheat Breeding for Scab Resistance in South Dakota.	$ 85,593
	FY13 Total ARS Award Amount	**$ 85,593**

June 4, 2014

Principal Investigator Date

* MGMT – FHB Management
FSTU – Food Safety, Toxicology, & Utilization of Mycotoxin-contaminated Grain
GDER – Gene Discovery & Engineering Resistance
PBG – Pathogen Biology & Genetics
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 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 continually poses 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 2013 growing season was good 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. Within the past several years, five 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 ‘Select’ were 25.2, 19.8, 22.1, and 23.6, respectively, compared to ‘Brick’, (18.5) the resistant check. 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, other breeding programs strive to further increase FHB resistance among germplasm pools that will eventually result in the release of continually improved cultivars.

Include below a list of all germplasm or cultivars released with full or partial support of the USWBSI during the FY13 award period. List the release notice or publication. Briefly describe the level of FHB resistance.

'Prevail' HRSW cultivar was released in fall 2013 (Notice of release in preparation).

Brick is the most resistant cultivar that has been released by this program, and is also one of the most resistant available in the upper Midwest. When disease index, percentage FDK values, and DON concentrations of Prevail (22.1, 13.4, and 5.6, respectively) are compared with those of Brick (18.5, 11.0, and 2.3 respectively) it is apparent that Prevail is not quite as highly resistant, however, it should still be considered moderately resistant.

Glover K. D., J. C. Rudd, R. N. Devkota, R. G. Hall, Y. Jin, L. E. Osborne, E. B. Turnipseed, J. A. Ingemansen, J. R. Rickertsen, and G. A. Hareland. 2013. Registration of Forefront Wheat. Journal of Plant Registrations. 7:184-190.

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 FY13 grant. Please reference each item using an accepted journal format. If you need more space, continue the list on the next page.

Eckard, J.T., J.L. Gonzalez-Hernandez, K.D. Glover, J. Anderson, and M. Mergoum. 2013. "Multiple Fusarium Head Blight Resistance QTL Pyramided onto Elite Spring Wheat *Fhb1* Back-Grounds using a Family-Based Mapping Approach." In: S. Canty, A. Clark, Y. Salat and D. Van Sanford (Eds.), *Proceedings of the 2013 National Fusarium Head Blight Forum* (p. 16). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative.

ElFatih ElDoliefy, Ahmed, James A. Anderson, Karl D. Glover, Ajay Kumar, Elias Elias, Shiaoman Chao, Mohammed S. Alamri, and Mohamed Mergoum. 2013. "Molecular Mapping of Fusarium Head Blight Resistance in Glenn, A High Quality and Adapted Hard Red Spring Wheat Cultivar." In: S. Canty, A. Clark, Y. Salat and D. Van Sanford (Eds.), *Proceedings of the 2013 National Fusarium Head Blight Forum* (p. 18-22). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative.

Ali, S., S. Abdullah, P. Gautam, E. Byamukama, J.S. Rohila, M. Eldakak, K. Glover and J. Gonzalez. 2013. "Determination of *Fusarium graminearum* Chemotypes Prevalent on Oat, Rye Heads, and Wheat Roots in South Dakota." In: S. Canty, A. Clark, Y. Salat and D. Van Sanford (Eds.), *Proceedings of the 2013 National Fusarium Head Blight Forum* (pp. 51-54). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative.

Eldakak, Moustafa, Ansuman Roy, Yongbin Zhuang, Karl Glover, Shaukat Ali, Yang Yen, and Jai S. Rohila. 2013. "Discovery and Revalidation of Scab Responsive Genes in Wheat by 2D-DIGE and Q-PCR." In: S. Canty, A. Clark, Y. Salat and D. Van Sanford (Eds.), *Proceedings of the 2013 National Fusarium Head Blight Forum* (p. 67). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative.

Ruden, K.R., G.S. Redenius, K.D. Glover, J.L. Kleinjan, B.H Bleakley, and E. Byamukama. 2013. “2013 Uniform Fungicide Performance Trials for the Suppression of Fusarium Head Blight in South Dakota.” In: S. Canty, A. Clark, Y. Salat and D. Van Sanford (Eds.), *Proceedings of the 2013 National Fusarium Head Blight Forum* (pp. 113-114). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative.