

**USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY12 Final Performance Report
July 16, 2013**

Cover Page

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| Fiscal Year: | FY12 |
| USDA-ARS Agreement ID: | 59-0206-9-051 |
| USDA-ARS Agreement Title: | Winter Wheat Breeding for Scab Resistance in South Dakota. |
| FY12 USDA-ARS Award Amount: | \$ 46,053* |

USWBSI Individual Project(s)

| USWBSI Research Category** | Project Title | ARS Award Amount |
|-----------------------------------|--|-------------------------|
| HWW-CP | Enhancing the FHB Resistance of Varieties and Reducing Mycotoxins in the Grain of South Dakota Winter Wheat. | \$ 46,053 |
| | Total ARS Award Amount | \$ 46,053 |

Principal Investigator

Date

* Partial funding for this research is under ARS agreement # 59-0206-9-052

** 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: *Enhancing the FHB Resistance of Varieties and Reducing Mycotoxins in the Grain of South Dakota Winter Wheat.*

1. What major problem or issue is being resolved relevant to Fusarium head blight (scab) and how are you resolving it?

Scab is a major disease of hard red winter wheat produced in South Dakota. Scab epidemics cause yield reduction and grain contamination by mycotoxins, leading to significant economic losses. This issue is being resolved by breeding and selecting genotypes resistant to scab. The aim is to release new FHB resistant cultivars with excellent agronomic and quality characteristics. More specifically, advanced breeding lines and cultivars adapted to the region are being evaluated for FHB resistance so that new sources of resistance can be identified, hybridized, and advanced to potential release. Different sources of FHB resistance are being combined to create new genotypes with improved resistance. All breeding materials are evaluated for FHB resistance in a mist-irrigated inoculated field nursery so that only the most resistant breeding lines are advanced. Backcross Wesley *Fhb1* germplasm is being evaluated and used as a *Fhb1* source of resistance in hybridizations. In addition, the physical and chemical properties of wheat bran that limit DON accumulation in the grain are being evaluated using unique near-isogenic lines of 'OK Bullet' expressing red and white kernel color.

2. List the most important accomplishment and its impact (i.e. how is it being used) to minimize the threat of Fusarium head blight or to reduce mycotoxins. Complete both sections (repeat sections for each major accomplishment):

Accomplishment (1):

Approximately 100 hybridizations were made involving Wesley *Fhb1* backcrosses and other native sources of resistance such as; Lyman (released from the South Dakota Agricultural Experiment Station in 2008), Everest (released from Kansas in 2009), and Overland (released from Nebraska in 2006).

Approximately 50 F₃ derived F₄ headrows with Wesley *Fhb1* in their pedigree were selected and included in an Early Yield Trial (EYT) nursery. Those with good yield potential and scab resistance will be advanced to a Preliminary Yield Trial nursery. Seed of breeding lines from the EYT were passed through a fractionating aspirator. Lines with a low heavy seed: light seed ratio were discarded as a means of enriching early populations for resistance to FHB.

Approximately 1800 rows were screened in a mist-irrigated field nursery, including breeding lines and regionally adapted cultivars from several public and private nurseries. Wesley *Fhb1* backcrosses continued to be evaluated at several South Dakota locations in anticipation of a potential germplasm release.

Impact:

Thanks to the USWBSI, the winter wheat breeding program at South Dakota State University has been successful in developing breeding lines with good agronomic performance and excellent resistance to FHB. In the latest Regional FHB Evaluation Nursery, of 48 entries evaluated for FHB resistance by Kansas State University, the breeding line with the lowest FHB index was SD09113, a line developed by the SDSU winter wheat breeding program. Ultimately this effort is expected to lead to the release of FHB resistant cultivars and result in reducing grower losses due to FHB epidemics across the region.

Accomplishment (2):

Results from two greenhouse experiments indicated that bran derived from white near-isogenic lines (NILs) accumulated lower levels of DON in comparison to red seeded NILs. Bran layer thickness from white and red seeded NILs was measured and compared from micrograph measurements of kernel cross-sections. It was observed that white seeded NILs had a significantly thinner bran layer than red seeded ones. The impact of bran extract on fungal growth in vitro is in the process of being evaluated.

Impact:

Additional microscopic measurements are being conducted to confirm bran morphological differences between red and white seeded genotypes. Results from these additional comparisons and a better understanding of the underlying cause of bran layer defense to FHB should help breeders and end-users reduce the impact of FHB and DON contamination on whole-wheat products, the production of which is a rapidly growing wheat market segment.

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

No germplasm or cultivars were released during the funding period.

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

Damecharla H. D. P., W. A. Berzonsky, R. N. Reese and P. G. Krishnan. 2012. Impact of bran properties on *Fusarium* mycotoxin levels in winter wheat (*Triticum aestivum* L.) kernels. In: S. Canty, A. Clark, A. Anderson-Scully, D. Ellis and D. Van Sanford (Eds.), *Proceedings of the 2012 National Fusarium Head Blight Forum* (pp.37). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative.

Bockus, W.W., G. Zhang, A. K. Fritz, M. A. Davis, P.S. Baenziger, and W. Berzonsky. 2012. Reactions of Kansas, Nebraska, and South Dakota winter wheat accessions to *Fusarium* head blight (FHB). *Plant Disease Management Reports* 7:CF019.