

**USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY11 Final Performance Report
July 13, 2012**

Cover Page

PI:	William Berzonsky
Institution:	South Dakota State University
Address:	Plant Science Department Rm. 248A NPB Box 2140C Brookings, SD 57007-2141
E-mail:	William.Berzonsky@sdstate.edu
Phone:	605-688-5334
Fax:	605-688-4502
Fiscal Year:	FY11
USDA-ARS Agreement ID:	59-0206-9-051
USDA-ARS Agreement Title:	Winter Wheat Breeding for Scab Resistance in South Dakota.
FY11 USDA-ARS Award Amount:	\$ 52,053

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
HW-CP	Developing FHB Resistant Red and White Winter Wheat Varieties for SD.	\$ 52,053
	Total ARS Award Amount	\$ 52,053

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
 HW-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: *Developing FHB Resistant Red and White Winter Wheat Varieties for SD.*

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

Winter wheat production in South Dakota is frequently threatened by scab and the economic losses associated with scab epidemics and higher levels of DON in grain. We are resolving this by developing resistant breeding genotypes and varieties and determining the impact of white and red bran on DON levels. The genotype and variety development approach includes utilizing markers to *Fhb1* to combine this source of resistance with the high level of native resistance expressed in ‘Lyman’, a hard red winter wheat variety released by the South Dakota Agricultural Experiment Station in 2008. We are also combining *Fhb1* with other regionally adapted resistant varieties, such as Everest and Overland. Backcross Wesley *Fhb1* germplasm is being developed in anticipation of a germplasm release and to provide an enhanced, adapted source of resistance for regional breeders. The impact of bran type on DON levels is being assessed by pearl-milling infected grain from red and white-seeded near-isogenic lines (NILs) and comparing the concentration of bran DON derived from the NILs.

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:

Approximately 100 crosses were made involving winter wheat varieties with moderate to excellent levels of resistance to FHB (Overland, Everest, and Lyman). A dozen headrows derived from initial crosses involving Wesley *Fhb1*, Lyman, and other regionally adapted genotypes and varieties were advanced and derived lines will be genotyped for *Fhb1*. Progeny from these headrows will also be evaluated for resistance to scab, and top resistant breeding genotypes will be advanced and planted to yield trial nurseries. In addition to the Regional Hard Winter Wheat FHB Nursery, another yield trial was completed that compared backcross Wesley *Fhb1* genotypes and resistant checks for performance and resistance to FHB.

Impact:

This is expected to result in the development and identification of several breeding lines expressing FHB resistance higher than either parent. These lines will represent potential variety releases and varieties that assure reduced FHB and/or mycotoxin levels in the grain. Results from the Regional HWW FHB Nursery were disseminated to regional producers and utilized to make recommendations for ScabSmart. This information helps producers decide on what resistant variety to grow to optimize production and limit DON contamination of grain. The yield trial evaluation of Wesley *Fhb1* genotypes relative to resistant checks will ultimately result in the release of resistant winter wheat germplasm for breeders to use as parents in developing new resistant varieties.

Accomplishment:

A second graduate student greenhouse experiment involving red and white-seeded wheat was completed, and some results corroborate those of a previous experiment that indicated that bran derived from white seeded NILs had lower levels of DON than bran derived from red-seeded ones. As in the previous experiment, accumulation of DON was primarily in the bran fraction of the grain.

Impact:

Utilizing the NILs in a third and final experiment, we expect to determine if the bran derived from the white-seeded NILs contains lower levels of DON compared with the red-seeded NILs. We also expect quantifying bran layer thickness by microscopy will aid in determining if the differences are due to significant differences in bran morphology. Confirming the DON level differences and determining why there are differences will help breeders and end-users of wheat decide how to minimize FHB and its impact on whole-wheat products.

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 developed with full or partial USWBSI support was 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.

Bai, G., P.S. Baenziger, W. Berzonsky, G. Bai, and A. Bakhsh. 2011. Breeding for scab resistant hard winter wheat: The thrill of victory and the agony of defeat. Oral presentation, Dec. 4-6, National FHB Forum, St. Louis, MO.

Baenziger, P.S., S.N. Wegulo, W. Berzonsky, A. Bernardo, P. St. Amand, D. Zhang, J. Cai, F. Jin, T. Li, J. Yu, W. Bockus, and F. Kolb. 2011. Using marker-assisted selection to improve selection for Fusarium head blight (FHB) resistance in hard winter wheat. Oral presentation, Dec. 4-6, National FHB Forum, St. Louis, MO.

Damecharla, H.D.P., W.A. Berzonsky, and P.G. Krishnan. 2011. Investigating the impact of histological and/or chemical differences in the bran of white and red wheat near-isogenic lines on Fusarium mycotoxin accumulation. Poster presentation, Dec. 4-6, National FHB Forum, St. Louis, MO.

Demarchala, H.D., W.A. Berzonsky, and P.G. Krishnan. 2011. Potential differences in the bran of red compared with white wheat near-isogenic lines: Impact on Fusarium mycotoxin levels in the grain. Oral presentation, Oct. 16-19, AACCI Meetings, Palm Springs, CA.

Eckard, J.T., J.L. Gonzalez-Hernandez, K.D. Glover, and W.A. Berzonsky. 2011. Simultaneous mapping and pyramiding of scab resistance QTL by family-based mapping in early generation wheat breeding populations. Poster presentation, Dec. 4-6, National FHB Forum, St. Louis, MO.

Bockus, W.W., P.S. Baenziger, W. Berzonsky, T. J. Martin, A. K. Fritz, and M. A. Davis. 2011. Reaction of Kansas, Nebraska, and South Dakota winter wheat accessions to Fusarium head blight (FHB). Plant Disease Management Reports (online), The American Phytopathological Society, St. Paul, MN.