

**USDA-ARS/  
U.S. Wheat and Barley Scab Initiative  
FY13 Final Performance Report  
July 15, 2014**

**Cover Page**

<b>PI:</b>	Melanie Caffe-Treml
<b>Institution:</b>	South Dakota State University
<b>Address:</b>	Plant Science Department Seed Technology Laboratory 2380 Research Parkway Brookings, SD 57006
<b>E-mail:</b>	Melanie.caffe@sdstate.edu
<b>Phone:</b>	605-688-5950
<b>Fax:</b>	
<b>Fiscal Year:</b>	FY13
<b>USDA-ARS Agreement ID:</b>	59-0206-9-051
<b>USDA-ARS Agreement Title:</b>	Winter Wheat Breeding for Scab Resistance in South Dakota.
<b>FY13 USDA-ARS Award Amount:</b>	\$ 46,008

**USWBSI Individual Project(s)**

<b>USWBSI Research Category*</b>	<b>Project Title</b>	<b>ARS Award Amount</b>
HWW-CP	Enhancing the FHB Resistance of Varieties and Reducing Mycotoxins in the Grain of South Dakota Winter Wheat.	\$ 46,008
	<b>FY13 Total ARS Award Amount</b>	<b>\$ 46,008</b>

\_\_\_\_\_  
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:** *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?**

The occurrence of Fusarium head blight (FHB) epidemics is frequent in South Dakota. FHB infected wheat exhibit reduced yield and grain quality which can lead to significant economic losses. This issue is being resolved by developing cultivars adapted to the region with increased FHB resistance. Several native sources of resistance are being combined with *Fhb1* to develop new genotypes with improved FHB resistance. Experimental breeding lines are evaluated in a mist-irrigated FHB inoculated field nursery. Only the most resistant breeding lines with the lowest disease index, FDK, and DON content are being advanced. Data collected in the 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. In addition, a student successfully completed his PhD. His project aimed at determining the impact of kernel color on deoxynivalenol accumulation in FHB infected grain.

**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:**

Approximately 100 hybridizations were made involving locally adapted native sources of resistance such as Lyman, Overland, and Everest, and other adapted genotypes with QTL *Fhb1*. Wesley-Fhb1 backcrosses were evaluated for yield and other agronomic characteristics in the field in Brookings and Dakota Lakes, SD and in the mist-irrigated inoculated FHB nursery. Three breeding lines resulting from crosses with Wesley-FHB1 were advanced in Preliminary Yield Trials. Approximately 1500 rows were screened in a mist-irrigated and inoculated field nursery in Volga, SD, including breeding lines from SDSU breeding programs and materials from regional nurseries (Northern Hard Winter Wheat FHB Public and Private Nurseries, Northern Regional Performance Nursery, Southern Regional Performance Nursery, and Regional Germplasm Observation Nursery). In addition, a new cultivar, Redfield, was released.

**Impact:**

Cultivar 'Redfield' is very similar in appearance to Wesley, with the same straw strength, but with higher yield potential and higher test weight. It is intended to be a replacement for Wesley. Based on data collected in our mist-irrigated inoculated field nursery over several years, Redfield exhibits a higher level of resistance to FHB than the cultivar Wesley. We expect that the release of Redfield will reduce the impact of scab in South Dakota and the region.

**Accomplishment:**

Near-isogenic lines (NIL) of red and white winter wheat were used to identify the impact of bran color on the deoxynivalenol (DON) accumulation in the bran of infected grain. Parental lines, NILs, and check cultivars were inoculated with FHB in a fourth greenhouse experiment. Kernel samples from inoculated and non-inoculated plants were collected and pearl-milled to produce bran and non-bran fractions. DON accumulation was evaluated in bran and non-bran fractions. Results indicated that DON accumulation was higher in bran than non-bran fractions. Also, although not statistically significant DON accumulation was generally higher in the bran fractions of red colored kernel than in white colored kernel. Significant differences in bran thickness between red and white genotypes were observed.

**Impact:**

Due to health benefits, the interest in whole wheat product has increased. Understanding factors affecting DON accumulation in grain should help breeders and end-users in minimizing the impact of DON in whole-wheat products.

**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.**

Cultivar ‘Redfield’ was released by the South Dakota Agricultural Experiment Station on September 2013. Based on data collected in the mist-irrigated inoculated field nursery over several years, Redfield exhibits a higher level of resistance to FHB than cultivar Wesley.

**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.**

Damecharla H. D. P. 2014. Evaluation of mycotoxin accumulation and bran thickness between red and white wheat (*Triticum aestivum* L.) near-isogenic lines. Ph.D. Dissertation.

Bockus, W.W., G. Zhang, A. K. Fritz, M. A. Davis, P. S. Baenziger, and W. Berzonsky, 2013. Reaction of Kansas, Nebraska, and South Dakota winter wheat accessions to Fusarium head blight (FHB). Plant Disease Management Reports.