

**USDA-ARS/  
U.S. Wheat and Barley Scab Initiative  
FY09 Final Performance Report  
July 15, 2010**

**Cover Page**

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<b>Fiscal Year:</b>	2009
<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>FY09- USDA-ARS Award Amount:</b>	\$ 51,718

**USWBSI Individual Project(s)**

<b>USWBSI Research Category*</b>	<b>Project Title</b>	<b>ARS Adjusted Award Amount</b>
HW-CP	Winter Wheat Breeding for Scab Resistance in South Dakota.	\$ 51,718
	<b>Total Award Amount</b>	<b>\$ 51,718</b>

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Principal Investigator

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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 Winter Wheat Region  
 SWW – Southern Sinter Wheat Region

**Project 1:** *Winter 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?**

Scab often is a major problem in the winter wheat production areas of South Dakota, particularly in the more eastern, higher rainfall areas of the state. Moreover, it is within this scab-prone region where production is expanding and where a program sponsored by Ducks Unlimited and Bayer Crop Science is targeting the expansion of winter wheat. Severe epidemics in SD often result in substantial economic production losses due to reduced grain yield and contamination of the grain with scab mycotoxins. Epidemics causing significant economic losses in SD have occurred several times within the last five years.

We are attempting to resolve the problem by developing disease resistant SDSU winter wheat varieties. Indigenous SD germplasm sources of resistance, such as is represented by Lyman winter wheat are being hybridized to known sources of resistance, such as breeding lines carrying the *FHB1* gene. We believe that by combining these sources of resistance, we will maximize the level of resistance to FHB in new variety releases. Furthermore, in collaboration with the University of Nebraska, we are screening Wesley *FHB1* backcross lines for FHB resistance to identify more adapted sources of resistance. We are also using a seed color sorter developed by the USDA-ARS to sort for FHB-damaged and non-damaged seed among segregating headrow populations to try and "enrich" our early breeding populations for resistance to FHB.

**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):**

**Accomplishments:**

- Release of 'Lyman' hard red winter wheat
- Field testing of Nebraska Wesley backcross lines with *FHB1* source of resistance
- Participation and entry of SD breeding lines in the Uniform Regional Hard Winter Wheat Scab Nursery (formerly known as the Tri-state Scab Nursery)
- Use of seed color sorter to differentiate Fusarium -damaged from non-damaged seed and to select for non-damaged seed among segregating winter wheat populations

**Impact:**

The release of Lyman winter wheat will continue to have a significant impact on the economics of winter wheat production in SD. Its level of resistance to FHB will insure that SD growers will experience less grain yield loss and less loss due to the production of mycotoxins in the grain. The commercial production acres of Lyman over the next several years are expected to increase, and as it replaces more FHB susceptible varieties, such as Wesley in SD, it will have even more of an economic impact within the state and region. The identification of *FHBI* Wesley backcross lines and lines in the Uniform Regional Scab Nursery with high levels of resistance to FHB is expected to impact our breeding effort by providing us with parental breeding material with which to combine indigenous sources of resistance. The resulting progeny are anticipated to have the highest level of expressed resistance among the currently available winter wheat germplasm.

The use of a seed color sorter to help distinguish and select between FHB-damaged and non-damaged seed is expected to have a significant positive impact on our breeding program and ultimately the release of scab resistant varieties. We project that saving non-damaged seed from selections within early segregating breeding populations will impact the breeding program by "enriching" it with more FHB resistant germplasm. Consequently, more lines and varieties with higher levels of FHB resistance will be available to growers, and the development of these varieties will be quicker and more efficient.

**Include below a list 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.**

Release of 'Lyman' Hard Red Winter Wheat (Officially released by SD Agric. Exp. Stn.)

In regional performance trials up until its release, Lyman exhibited superior resistance to Fusarium head scab. For example:

*Fourth lowest* FHB Disease Index in 2004 NRPN

*Second lowest* FHB Disease Index in 2006 Tri-State FHB Screening Nursery (KS, NE, SD)

\* Both nurseries had about 40 total entries

Note: Lyman's resistance to FHB is sufficiently high enough for it to routinely be used as a resistant check variety in the Uniform Regional Hard Winter Wheat Scab Nursery.

**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.**

Bockus, W.W., P.S. Baenziger, and W. Berzonsky. 2009. Reaction of Kansas, Nebraska, and South Dakota winter wheat accessions to *Fusarium* head blight (FHB), 2009. Plant Dis. Mgmt. Rpt. 4:CF013

Malla, S., A.M.H. Ibrahim, Y. Yen, W. Berzonsky, K.D. Glover, and J. Stein. 2010. QTL Analysis of a putative novel source of resistance to *Fusarium* head blight in hard winter wheat. (*in press*) Int. J. Plant Breed.

Malla, S., A.M.H. Ibrahim, Y. Yen, W. Berzonsky, and K.D. Glover. 2010. Association of *FHB1* and *Qfhs.ifa-5A* in spring versus winter growth habits in bread wheat (*Triticum aestivum* L.). (*submitted*). Can. J. Plant Sci.