

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

**Cover Page**

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<b>Fiscal Year:</b>	FY12
<b>USDA-ARS Agreement ID:</b>	59-0206-9-055
<b>USDA-ARS Agreement Title:</b>	Enhance Variety Development of Scab Resistant Hard Winter Wheat Varieties in Nebraska.
<b>FY12 USDA-ARS Award Amount:</b>	\$ 48,741 *

**USWBSI Individual Project(s)**

<b>USWBSI Research Category **</b>	<b>Project Title</b>	<b>ARS Award Amount</b>
HW-CP	Increase Wheat Acreage Planted to FHB Tolerant, Low DON Varieties.	\$ 48,741
<b>Total ARS Award Amount</b>		<b>\$ 48,741</b>

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Principal Investigator

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Date

\* Award Amount does not include additional funding awarded in September of 2012 earmarked for other PIs at same institution

\*\* 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:** *Increase Wheat Acreage Planted to FHB Tolerant, Low DON Varieties.*

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

In 2007 and 2008, major scab epidemics occurred in eastern NE (approximately 600,000 acres of wheat production). In 2009, scab was found in every part of the state (1,700,000 acres), fortunately at low levels. In 2010, scab was found mainly in the southeastern, south central and southwestern NE, again fortunately at low levels. In 2013, we had 6-8 inches (15 – 20 cm) of rain in the last week of May which completely bracketed the flowering period for early to late flowering winter wheat in eastern Nebraska. It is a little early to know the full extent of the damage, but scab is clearly present in the eastern Nebraska wheat crop. In most of the rest of the state, there is drought, so the disease is limited. Genetically improved seed coupled with appropriate management practices (cultural practices and fungicide uses) are the quickest and most cost effective ways to reduce DON in the grain supply. In this project, we are using conventional breeding methods of crossing elite adapted lines to lines with known scab resistance/tolerance QTLs (*Fhb1*, *5As*, and *Fhb3*) coupled with molecular markers to breed elite adapted lines with major scab resistance/tolerance QTLs. In the 2012-2013 crossing blocks we made 42 designed crosses involving named *Fhb* resistance/tolerance genes (mainly *Fhb1*). We also have additional crosses to lines with native resistance/tolerance. The highlight of our crossing was a joint collaboration with Dr. Guihua Bai who has backcrossed (BC) *Fhb1* into Overland (the most popular wheat cultivar in Nebraska) which has the best native FHB tolerance of the commercially grown cultivars in Nebraska. He sent us a number BC lines and we used 6 lines with the best FHB tolerance based upon greenhouse tests for crossing. Overland also has excellent leaf, stripe, and stem rust resistance, as well as the best bacterial streak tolerance. Hence this new line should be an excellent parent for elite crosses. We continue to use the previously created Wesley *Fhb1* BC lines and *Fhb1* lines with good agronomic attributes from the Ph.D. research of Dr. Ali Bakhsh. In the research of Dr. Bakhsh, we determined that *Fhb1* is not detrimental on grain yield and end-use quality for hard winter wheat. We were perplexed at why after making numerous crosses, we have relatively few *Fhb1* lines advance to the elite trials. We now believe our lack of success was due to using predominantly unadapted germplasm that added too many poor adaptation genes to effectively develop elite cultivars. As such, we modified our crossing strategy to use adapted *Fhb1* lines or spring wheat lines with *Fhb1* and other genes. Basically we can easily remove the spring segregants from the segregating progeny of these spring by winter crosses (spring types readily winterkill) and we now rarely use the soft wheat *Fhb1* lines as parents because it was difficult to recover end-use quality. We continue to test all later generation lines in our mist nurseries to identify *Fhb1* and native resistance. We test Northern Hard Winter Wheat FHB Public and Private Nurseries (coordinated by Dr. Bill Bockus) and NUWWSN nurseries along with the regional Germplasm Observations Nursery (RGON) at misted inoculated locations to provide regional data to better understand our germplasm and its level of tolerance to this devastating disease.

- 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:**

In 2013, we released NE06545 which will be marketed as Husker Genetics Brand ‘Freeman’. It is moderately susceptible to Fusarium head blight (caused by *Fusarium graminearum*, data from greenhouse and field observations in Nebraska). However, it is an improvement over the more susceptible cultivars that it replaces.

**Impact:**

It is too early to know the impact of Freeman, however, a previous release with very good native resistance, Overland, is now the most popular cultivar in Nebraska and is grown in South Dakota, North Dakota, Minnesota, and Kansas. Freeman will be an excellent complementary wheat cultivar to Overland and combined with Lyman (South Dakota State University), Art (Syngenta), Hitch (Westbred/Monsanto), and Everest (Kansas State University), wheat producers in the northern Great Plains have excellent lines to grow that will reduce the effects of scab.

**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.**

In 2013, we released NE06545 which will be marketed as Husker Genetics Brand ‘Freeman’. It is moderately susceptible to Fusarium head blight (caused by *Fusarium graminearum*, data from greenhouse and field observations in Nebraska). However, it is an improvement over the more susceptible cultivars that it replaces. We have shared our best FHB tolerant Wesley *Fhb1* lines as parents and awaiting one more year of field data before we formally publish the results as germplasm release. We expect to do the same with the Overland *Fhb1* lines and to share the better lines from the Bakhsh *et al* (2013) study.

**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.**

Hernandez Nopsa, J. F., P. S. Baenziger, K. M. Eskridge, K. H. S., Peiris, F. E. Dowell, S. D. Harris, and S. N. Wegulo. 2012. Differential accumulation of deoxynivalenol in two winter wheat cultivars varying in FHB phenotype response under field conditions. *Can. J. Plant Pathol.* 34:380-389.

Bakhsh, A. N. Mengistu, P. S. Baenziger, I. Dweikat, S. N. Wegulo, D. Rose, G. Bai, and K.M. Eskridge. Effect of Fusarium head blight (FHB) resistance gene *Fhb1* on agronomic and end-use quality traits of hard red winter wheat. *Crop Sci.* 53:793-801.

Bockus, W. W., Zhang, G., Fritz, A., Davis, M., Baenziger, P., and Berzonsky, W. 2013. Reaction of Kansas, Nebraska, and South Dakota winter wheat accessions to Fusarium head blight (FHB), 2012. (online) *Plant Disease Management Reports* 7:CF019. DOI:10.1094/PDMR07. The American Phytopathological Society, St. Paul, MN.