

**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: | NA |
| USDA-ARS Agreement Title: | Identification and Deployment of FHB Resistance QTL in US Hard Winter Wheat. |
| FY12 USDA-ARS Award Amount: | \$ 55,608 |

USWBSI Individual Project(s)

| USWBSI Research Category* | Project Title | ARS Award Amount |
|----------------------------------|--|-------------------------|
| HW-CP | Identification and Deployment of FHB Resistance QTL in US Hard Winter Wheat. | \$ 55,608 |
| Total ARS Award Amount | | \$ 55,608 |



Principal Investigator

6/12/2013

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: Identification and Deployment of FHB Resistance QTL in US Hard Winter Wheat.**1. What major problem or issue is being resolved relevant to Fusarium head blight (scab) and how are you resolving it?**

Severe FHB epidemics have caused about 10-15% of yield losses in many HWW fields in the Great Plains except Texas. In 2010, FHB moved south to Oklahoma where FHB has never been seen before. Current used commercial HWW cultivars in these regions are highly susceptible, thus FHB is becoming one of the major breeding objectives in HWW breeding programs in 5 out of 7 states in the Great Plains.

A major FHB resistance QTL (*Fhb1*) from Sumai 3 has been mapped and widely used in breeding programs worldwide. *Fhb1* can significantly improve the resistance in diverse genetic backgrounds. However, it has not been deployed in HWW growing in the Great Plains. Because of poor adaptation of Sumai 3 in the Great Plains, direct use of Sumai 3 as *Fhb1* donor has not been successful. We are using marker-assisted backcross to transfer major FHB resistance QTL *Fhb1* and other QTL from Asian sources into adapted hard winter wheat cultivars to quickly deploy these QTL in hard winter wheat germplasm and cultivars.

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:**

- a. Using marker-assisted backcross, we successfully transferred *Fhb1* and other QTLs from Ning 7840 into US hard winter wheat Jagger (KS), Overland (NE) and Overley (KS). About 300 selected lines with *Fhb1* were genotyped for presence of markers and sent to the breeding programs in NE and SD for further breeding selection. The 300 lines were also evaluated in the Kansas FHB nursery for further FHB and other disease evaluation.
- b. In another MAS project, *Fhb1* from WesleyFhb1 previously developed in my lab was transferred into 11 different elite breeding lines or newly released susceptible cultivars from 5 states. All backcrosses were done and will be ready for DH and MAS this fall.
- c. The cross of Overland/Overley and Lyman/Overley were initiated to develop mapping populations for mapping FHB resistance QTL in the two local cultivars.

Impact:

Developed germplasm using marker-assisted backcross will be important for breeding programs in OK, NE, SD, ND and KS to use them as FHB resistant parents. Because the recurrent parents were contributed from the 5 states, some selected lines will have both *Fhb1* and good local adaptation, and can be directly used as cultivars to quickly relieve FHB damage in HWW growing region where FHB resistant cultivar currently is not available.

Also, these selected lines can be used as breeding parents to quickly move *Fhb1* to their elite breeding lines to develop new cultivars. In addition, this work also demonstrates that marker-assistant backcross can a powerful tool to quickly deploy FHB QTL when breeding programs closely collaborate with the USDA genotyping lab.

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.

1. Feng Jin, Dadong Zhang, William Bochus, P. Stephen Baenziger, Brett Carver and Guihua Bai. 2013. Fusarium head blight resistance in U.S. winter wheat cultivars and elite breeding lines. *Crop Sci.* doi: 10.2135/cropsci2012.09.0531
2. Ali Bakhsh, Neway Mengistu, P.S. Baenziger, I. Dweikat, S.N. Wegulo, D. Rose, Guihua Bai, and K.M. Eskridge. 2013. Effect of Fusarium head blight (FHB) resistance gene *Fhb1* on agronomic and end-use quality traits of hard red winter wheat. *Crop Sci* doi: 10.2135/cropsci2012.06.0364
3. Amy Bernardo¹, Guihua Bai, Jianbin Yu, Fred Kolb, William Bockus, and Yanhong Dong. 2013. Registration of Near-Isogenic Winter Wheat Germplasm Contrasting in *Fhb1* for Fusarium head blight resistance. *J of Plant reg.* (submitted).
4. A.N. Bernardo, S. Chao and G-H. Bai. 2012. Fine mapping of wheat *Fhb1* using Sequenom MassArray SNP genotyping platform. P46. Proceedings of 2012 National Fusarium Head Blight Forum, December 2012, Orlando, FL.
5. W.A. Berzonsky, A. Bakhsh, P.S. Baenziger and G. Bai. 2012. Grain yield performance of Wesley backcross *Fhb1* HRWW germplasm. P47. Proceedings of 2012 National Fusarium Head Blight Forum, December 2012, Orlando, FL.
6. Jin Cai, Guihua Bai and Xiaofei Wang. 2012. Meta analysis of Fusarium head blight resistance QTL in Chinese wheat landraces. P54. Proceedings of 2012 National Fusarium Head Blight Forum, December 2012, Orlando, FL.
7. Feng Jin, Dadong Zhang, Chengsong Zhu, William Bockus. 2012. Association mapping of FHB resistance in US hard winter wheat. P61. Proceedings of 2012 National Fusarium Head Blight Forum, December 2012, Orlando, FL.