

**USDA-ARS/  
U.S. Wheat and Barley Scab Initiative  
FY08 Final Performance Report (approx. May 08 – April 09)  
July 15, 2009**

**Cover Page**

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<b>Fiscal Year:</b>	2008
<b>USDA-ARS Agreement ID:</b>	59-0790-4-120
<b>USDA-ARS Agreement Title:</b>	Breeding and Genetics of Fusarium Head Blight Resistance in Barley.
<b>FY08 USDA-ARS Award Amount:</b>	\$ 140,080

**USWBSI Individual Project(s)**

<b>USWBSI Research Category*</b>	<b>Project Title</b>	<b>ARS Adjusted Award Amount</b>
BAR-CP	Breeding FHB Resistant Six-rowed Varieties.	\$86,545
BAR-CP	Mapping and Validating FHB Resistance QTL in Barley.	\$ 53,535
	<b>Total Award Amount</b>	<b>\$ 140,080</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  
HWW-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

(Form FPR08)

**Project 1:** *Breeding FHB Resistant Six-rowed Varieties.*

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

None of the currently grown malting barley varieties are more resistant than the variety Robust which has dominated the barley acreage in the Midwest since 1986. We are conducting a comprehensive field-based breeding effort along with implementation of marker assisted selection (MAS) to develop new barley varieties with enhanced FHB resistance. In order for these new varieties to be adopted by growers they must also be agronomically competitive with current varieties and meet the quality standards of the malting and brewing industries. We conduct extensive field evaluation of FHB resistance in inoculated and mist-irrigated nurseries in three locations in Minnesota. Last year we evaluated over 12,000 plots for FHB resistance and submitted over 3,000 grain samples for DON analysis. Our most promising lines enter industry malting and brewing tests.

**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 (repeat sections for each major accomplishment):**

**Accomplishment:**

One of our variety candidates, M122, is currently in AMBA plant-scale brewing evaluations. If this variety is rated satisfactory in its first year (results expected in October), we will release it as a variety in January 2010. M122 accumulates about half the level of DON compared to Robust.

Two recent variety candidates, M135 and M136, were rated satisfactory for quality in their first year of AMBA pilot testing. These lines are not as resistant as M122, but have higher yields. They will be evaluated for their second year with the 2009 crop.

**Impact:**

The impact of this work will be felt after our first release with enhanced resistance to FHB.

**Project 2:** *Mapping and Validating FHB Resistance QTL in Barley.*

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

Progress in breeding for FHB resistance in barley to date has relied entirely on field-based phenotypic selection for disease severity and DON concentration of grain samples. Use of marker assisted selection (MAS) in early generations could provide a valuable tool to enrich breeding populations for resistance alleles at quantitative trait loci (QTL) prior to screening in the field. A major hurdle to using currently available QTL information for MAS is linkage of the resistance alleles to several undesirable traits (late heading, high grain protein concentration, tall plant height). Our project is focused on characterizing several important QTL regions in barley and resolving undesirable linkages. This information will lead to the implementation of MAS for FHB resistance in barley to complement ongoing traditional breeding efforts. We are currently involved in fine mapping two QTL regions (chromosomes 2H and 6H). We are also using association mapping with breeding germplasm to identify new QTL that have not been discovered in traditional bi-parental mapping populations and that are presumably free of undesirable linkages due to selection within the breeding programs. The association mapping is collaborative with the Busch Agriculture and North Dakota State University breeding and pathology programs and is primarily supported by the USDA Barley Coordinated Agricultural Project (CAP).

**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:**

We have completed the first phase (years 1 and 2) of the FHB association mapping project. Eight QTL for DON association were confidently identified, of which four have not been previously described. Several of these QTL are currently being validated and will be included in MAS work in the coming year. In addition, this data set along with additional data will be used to develop a genomic selection model that will be implemented in the next two year funding period of the Barely CP.

Several breeding populations have been developed using MAS for the 2H and 6H QTL and are being evaluated this summer.

**Impact:**

Results from this study have encouraged researchers to attempt a genomic selection approach to improve FHB resistance in addition to standard MAS for individual QTL.

**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.**

Smith, K.P., R. Horsley, B. Cooper. 2009. Development of Barley Varieties for the Upper Midwest . 37<sup>th</sup> Barley Improvement Conference, San Diego CA, 1-6-2009.

Smith, K.P., J. Massman, R. Horsley, B. Cooper, S. Neate, R. Dill-Macky, S. Chao, Y. Dong, P. Schwarz. 2008. Association mapping of Fusarium Head Blight resistance using elite Midwest breeding germplasm. 2008 North American Barley Researchers Workshop, October, 26-29, 2008, Madison, WI.

Massman, J.M and K.P. Smith. 2008. Locating resistance QTL for Fusarium head blight using association mapping in contemporary barley breeding germplasm. American Phytopathological Association Centennial Meeting, Minneapolis, MN, July 27-31, 2008. Phytopathology 98:S99.

Massman, J. M. and K. P. Smith. 2008. Investigating the Suitability of Contemporary Breeding Populations For Association Mapping of Fusarium Head Blight Resistance in Barley. Plant & Animal Genomes XVI Conference, January 12-16, 2008, Town & Country Convention Center, San Diego, CA. P329.

**If your FY08 USDA-ARS Grant contained a VDHR-related project, 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. If this is not applicable (i.e. no VDHR-related project) to your FY08 grant, please insert ‘Not Applicable’ below.**

None.