

**USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY10 Final Performance Report
July 15, 2011**

Cover Page

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Fiscal Year:	FY10
USDA-ARS Agreement ID:	59-0206-9-060
USDA-ARS Agreement Title:	Development and Validation of FHB and DON Predictive Models for Barley.
FY10 USDA-ARS Award Amount:	\$ 34,900

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
BAR-CP	Validation and Refinement of DON Models in Barley for the Northern Great Plains.	\$ 30,998
HWW-CP	Using Association Mapping to Identify and Validate New FHB Resistance QTL and Integrate the QTL into HWW.	\$ 3,902
	Total ARS Award Amount	\$ 34,900

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: *Validation and Refinement of DON Models in Barley for the Northern Great Plains.*

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

Fusarium head blight (FHB) of barley continues to be a serious problem for producers in the Northern Great Plains. Barley production in the Dakotas and Minnesota has declined steadily since the early 1990's and this can be attributed to, at least in part, the re-emergence of *Fusarium* head blight. Of particular importance to barley production is the accumulation of deoxynivalenol (DON) in the grain. Models exist for predicting disease development in wheat, however they are not effective for DON in barley. We are addressing this issue by developing and validating models for forecasting systems that can predict disease and/or DON accumulation in malting barley. The information provided by this model will offer extension specialists, consultants, and producers the information required to make effective management decisions or recommendations.

The objectives of the proposed research were to 1) contribute to the development of an experimental database containing information on cultural practices, weather, and resulting field disease and mycotoxin levels for barley and 2) validate and refine the models for FHB and DON accumulation in barley. Objective 1 was conducted in collaboration with researchers at North Dakota State University. Plots were planted at ~10 locations throughout the region and the environment monitored at each location during the growing season. Field ratings of disease were taken and DON concentration in the grain was quantified. For objective 2, predicted risk was calculated at all locations using the 2-dimensional Weibull model developed from the five growing seasons prior to 2010. This was then compared with the observed risk to estimate the model efficiency. In addition, logistic regression models were developed for each cultivar individually to obtain different cut-off thresholds based on the resistance levels.

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:

Three significant accomplishments occurred during the period in question. First, a significant correlation between disease incidence and economically significant DON accumulation in malting barley was observed, which confirms our previous observation. Second, the 2-dimensional Weibull model was validated with 10 locations from the region and found that the model had a prediction accuracy of 79% using 2010 weather data. It should be noted that the environmental conditions in 2010 were unusually wet. Finally, this model was deployed on small grain disease forecasting model web site at North Dakota State University (<http://www.ag.ndsu.nodak.edu/cropdisease/barley-don.html>).

Impact:

In spring 2011, the model was deployed on NDSU disease forecasting web site to predict the risk of economic DON accumulation (≥ 0.5 mg/kg) for several locations in the North Dakota region. This website helps the consultants and producers to make informed decisions about FHB and DON in Barley.

Project 2: *Using Association Mapping to Identify and Validate New FHB Resistance QTL and Integrate the QTL into HWW.*

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

Major scab epidemics have occurred in the HWW region. Genetically improved seed coupled with appropriate management practices are the quickest and most cost effective way to reduce DON in the grain supply. However, little is known concerning the genetic basis of native resistance in the Great Plains germplasm and how best to effectively utilize it. Using association mapping techniques, we will be able to validate reported QTLs and identify new QTLs in HWW germplasm, and move from molecular mapping to marker-assisted breeding. To achieve this, we are conducting greenhouse experiments to generate phenotypic data of FHB resistance of HWW accessions.

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:

Due to the departure of principle investigator at the Small Grains Pathology laboratory, SDSU, the project was delayed. However, greenhouse experiments are being carried out to get phenotypic data.

Impact:

The phenotypic data of the population collected from greenhouse environment will be important for breeders to select right parents for crosses because the population mainly consisted of elite breeding materials and new varieties that they use most often as parents in their crosses.

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.

Poster Abstracts:

- K. Bondalapati and J. Stein. 2010. Validation of Barley DON Risk Prediction Model. Poster: Proceedings of the 2010 National Fusarium Head Blight Forum, Milwaukee, WI. Canty, S., Clark, A., Anderson-Scully, A., Ellis, D., and Van Sanford, D. (Eds.), University of Kentucky, Erlanger, KY. pp. 71-73.
- K. D. Bondalapati, and J. Stein. 2010. Modeling Fusarium Head Blight and Deoxynivalenol Content in Barley in Response to Field Temperature and Wetness Durations. Poster: American Phytopathological Society Annual Meeting, Charlotte, NC. Phytopathology 100:S15.