

**USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY11 Final Performance Report
July 13, 2012**

Cover Page

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Fiscal Year:	FY11
USDA-ARS Agreement ID:	59-0790-7-072
USDA-ARS Agreement Title:	Prediction Models and Improved Pre-Harvest Estimates of Deoxynivalenol.
FY11 USDA-ARS Award Amount:	\$ 48,045

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
MGMT	Continued Deployment of Models Predicting the Risk of Severe FHB and DON.	\$ 11,455
MGMT	Continued Development of Prediction Models for FHB and DON.	\$ 36,590
	Total ARS Award Amount	\$ 48,045



Principal Investigator 7-13-12
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: *Continued Deployment of Models Predicting the Risk of Severe FHB and DON.*

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

Fungicides are an important part of the integrated management of Fusarium head blight; however, these fungicide applications may not be needed when the risk of disease development is low. The goal of this project is to help farmers better evaluate the risk of disease and determine if fungicides are needed to reduce disease related yield losses. The prediction models also help farmers avoid unnecessary fungicide applications and production costs when the risk of disease is low.

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: During FY11, disease prediction models for Fusarium head blight (FHB) were applied in 30 states with a history of problems with FHB. To accomplish this, the prediction models are combined with weather information to provide daily maps of disease risk that are delivered via web-based tools. The risk maps are accompanied by commentary developed by wheat disease specialists in each state that further helps growers evaluate the risk of disease. This project also includes a partnership with the USWBSI-NFO to implement the FHB Alert System, which sends the state commentary to subscribers via email and automatically posts the information on the USWBSI blog. The alert system also sends text messages to mobile devices notifying subscribers that new commentary has been submitted for their region and directing them to the risk tools and blog site for more information.

Impact: The prediction tools received over 13,000 visits during the 2011-growing season in the U.S. (April – August) representing 6,579 visitors. The new FHB Alert system encouraged the state specialists to develop commentaries. A total of 132 commentaries were submitted in 2011 with specialists in AR, IN, KS, KY, MD, MN, NC, ND, OH, OK, PA and WI each contributing more than 5 commentary updates to the prediction system. The FHB Alerts sent commentary to over 880 subscribers in 2011 almost doubling the number of participants from 2010.

The impact of the disease prediction effort was documented by a survey of the web-based tools and FHB Alert System. The FY11 results were combined with previous years to provide a more comprehensive summary of project impact. The survey included 1,486 respondents between 2009-2011. The survey results indicate that 65% of these users were either farmers or farm advisors and that 71% of the users applied the information directly on their farm, or used it to make recommendations about disease management to others. A subset of questions targeting the influence of this information on grower decisions suggests that more than 90% of the users experienced a moderate or great improvement in their awareness of the disease risk in their area. The results also showed that the information influenced disease management decisions directly for 35% of the respondents, and motivated another 26% to seek advice from others. Between 2009-2011, 94% of the users considered the information to be of high or moderate value for their farms and businesses.

Project 2: *Continued Development of Prediction Models for FHB and DON.*

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

The overall objective of the modeling effort is to provide accurate predictions of FHB risk that can be used by growers to better determine if fungicides are warranted and to inform agricultural industries using wheat and barley products of potential mycotoxin problems. Although considerable progress has already been made toward reaching this goal, additional improvements are desirable. These additional improvements in model accuracy could enhance performance of the models as part of the integrated management of the disease. The greatest improvements will likely result from the addition of most recent data generated by the scientists cooperating through the USWBSI. This new data incorporates observations representing the new varieties with moderate resistance to FHB and DON accumulation.

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: During the last year, the major thrusts of the modeling project were to 1) work with project cooperators to gather, evaluate and clean new observations generated by the FHB integrated management CP; 2) develop logistic regression models that assess the risk of FHB epidemics. This included evaluation of >500 predictor variables representing weather conditions both prior to anthesis and during the early stages of grain development for potential value in predicting FHB. Weather-based predictors were evaluated in combination with variables describing genetic resistance of wheat varieties, grain production class and presence of crop residues likely to support large populations of *Fusarium*. Several rounds of extensive model evaluations narrowed the possible candidate models to 15 and we are currently testing 4 of these models for potential deployment. Preliminary results indicate that while these new models perform better than currently deployed models given the expanded data set, the overall accuracy of these models is similar to the benchmarks (70-80% accuracy) set in previous iterations of model development. Having established the baseline for the logistic modeling approaches, we are now ready to evaluate whether the Boosted Regression Tree and other modeling approaches can further improve model accuracy.

Impact: The prediction models developed as part of this project contribute to the FHB forecasting effort in 30 states. Four of the 15 candidate models are currently being evaluated for public deployment with a specialized user interface for model testing. These models are more accurate than the current models on the expanded data set and should improve the accuracy of information available to farmers in the U.S.

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.

Journal publications:

1. McMullen, M., Bergstrom, G., De Wolf, E. Dill-Mackey, R., Hershman, D., Shaner, G. and Van Sanford, D. 2012. A unified effort to fight an enemy of wheat and barley: Fusarium head blight. *Plant Disease*: (Accepted 6/13/12, In Press).
2. Wegulo, S. N., Bockus, W.W., Hernandez Nopsa, J., De Wolf, E. D. Eskridge, K. M., Peiris, K. H. S. and Dowell, F. E. 2011. Effects of integrating cultivar resistance and fungicides application on Fusarium head blight and deoxynivalenol in winter wheat. *Plant Disease* 95:554-560.

Technical reports (peer reviewed):

1. Bockus, W.W., De Wolf, E. D. and Wegulo, S. N. 2011. Effect of foliar fungicide application on Fusarium head blight in eight winter wheat cultivars, 2010. *Plant Disease Management Reports* 5:CF009.

Abstracts for presentations:

1. Bockus, W., Davis, M. and De Wolf, E. 2011. Effect of seed treatment of scabby seed on plant stands and grain yields of winter wheat. In S. Canty, A. Clark, A. Anderson-scully, D. Ellis, and D. Van Sanford (Eds.), *Proceedings of the 2011 National Fusarium Head Blight Forum* (pp. 123). East Lansing, MI/Lexington, KY: U.S. Wheat and Barley Scab Initiative.
2. De Wolf, E. 2012. Forecasting epidemics of Fusarium head blight in the United States. *Proceedings of the National Integrated Pest Management Symposium, 2012. March 27-29; Memphis, TN.*
3. De Wolf, E., Paul, P., Hane, D., Canty, S., Van Sanford, D., Knight, P. and Miller, D. 2011. Evaluating the impact of the FHB prediction models and FHB alerts, 2009-2011. In S. Canty, A. Clark, A. Anderson-scully, D. Ellis, and D. Van Sanford (Eds.), *Proceedings of the 2011 National Fusarium Head Blight Forum* (pp. 134). East Lansing, MI/Lexington, KY: U.S. Wheat and Barley Scab Initiative.
4. De Wolf, E., Shah, D., Paul, P., Madden, L. and Willyerd, K. 2011. The risk of FHB epidemics based on weather, host resistance and corn residue. In S. Canty, A. Clark, A. Anderson-scully, D. Ellis, and D. Van Sanford (Eds.), *Proceedings of the 2011 National Fusarium Head Blight Forum* (pp. 135). East Lansing, MI/Lexington, KY: U.S. Wheat and Barley Scab Initiative.
5. Sparks, A., Shah, D., De Wolf, E., Madden, L., Paul, P., and Willyerd, K. 2011. Refined empirical models for predicting Fusarium head blight epidemics in the United States. *Phytopathology* 101:S170.