

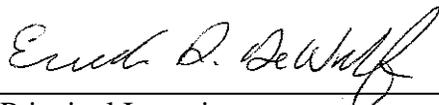
**USDA-ARS/  
U.S. Wheat and Barley Scab Initiative  
FY10 Final Performance Report  
July 15, 2011**

**Cover Page**

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<b>Fiscal Year:</b>	FY10
<b>USDA-ARS Agreement ID:</b>	59-0790-7-072
<b>USDA-ARS Agreement Title:</b>	Prediction Models and Improved Pre-Harvest Estimates of Deoxynivalenol.
<b>FY10 USDA-ARS Award Amount:</b>	\$ 45,275

**USWBSI Individual Project(s)**

<b>USWBSI Research Category*</b>	<b>Project Title</b>	<b>ARS Award Amount</b>
MGMT	Deployment of Models Predicting the Risk of Disease Epidemics and DON.	\$ 13,025
MGMT	A First-Generation Model for DON Prediction in Multiple Wheat Classes in the US.	\$ 32,250
	<b>Total ARS Award Amount</b>	<b>\$ 45,275</b>

  
 Principal Investigator

July 8, 2011  
 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:** *Deployment of Models Predicting the Risk of Disease Epidemics and DON.*

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

Fusarium head blight is currently managed with a combination of genetic resistance and timely use of fungicides when weather conditions favor the disease development. Evaluating the need for fungicides at a given location is difficult, and avoiding unnecessary applications helps farmers maintain their profitability.

**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:**

This past year the cooperative effort to deploy the prediction models for FHB and DON has resulted in the application of the disease prediction models in 25 states in 2010. This effort includes the support of the state commentary tools, and partnerships with the NFO to implement the new FHB Alert System. The FHB Alert System sends the commentary developed by the state specialists via email to subscribers and automatically posts the information on the USWBSI blog. The alert system can also send text messages to subscribers notifying them that new commentary has been submitted for their region directing them to the disease risk map and blog site for more information. The system was expanded in 30 states in 2011.

Additional technical accomplishments included:

(1) The overall stability of the predictions system was enhanced through use of a dedicated server and several new back-up procedures that automatically switch the alternate sources of weather inputs when missing observations occur. (2) The system was also expanded to include weather inputs from Agnets in OH, IN, KY, and MO. (3) A specialized user interface was used to produce risk maps based on the first generation of DON models developed by the cooperative model development team (KSU, OSU, PSU). (4) The weather forecasts used to drive the prediction models were increased from 48 to 72 hours.

**Impact:**

The prediction tools received over 7,814 visits during the 2010-growing season in the U.S. (April – August). Interestingly, this number is slightly lower than 2009. The lower number of visits may be due to reduced acres of wheat in 2010. The new FHB Alert system appeared to encourage many state specialists to develop more commentaries. Nearly all of the wheat disease specialists in the 25 states covered by the disease prediction system contributed commentary to the disease prediction effort. A total of 135 commentaries were submitted in 2010 (45 more than in 2009) with specialists in IN, KS, KY, MD, MI, MN, ND, NY, OH, OK, PA, SD and VA each contributing more than 5 commentary updates to the prediction system. User statistics indicate that the commentary from the web-based tools was accessed more than 13,000 times in during the 2010-growing season. The commentary from KS, KY,

MI, ND and OH was accessed more than 1000 times, and commentary from IL, IN, MD, NC, NE, NY, PA, VA and WI were accessed more than 200 times. The FHB Alerts sent commentary to over 450 subscribers.

A survey of 356 users of the prediction models and the FHB Alerts in 2010 indicates that farmers, farm advisors and university extension personnel are the primary users of these resources. The survey documented that 89% of the users reported a moderate or high level of improved awareness of the risk of FHB epidemics in their area. More than 60% of those that participated in the survey reported that the information provided by the tools influenced their perception of risk and motivated them to take action or seek additional advise. The survey indicated that nearly 50% of the users of the prediction tools influenced more than 1000 acres of wheat. The survey also documented that more than 93% of the users considered the information provided by the system to be of high or moderate value for their operation.

**Project 2:** *A First-Generation Model for DON Prediction in Multiple Wheat Classes in the US.*

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

The current prediction models do not account for genetic resistance in recent winter wheat varieties or crop residues as potential sources of local inoculum. Incorporating these variables into the prediction models should improve the accuracy of predictions available to farmers.

**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:**

The effort to develop new models for FHB and DON continued during FY10. The cooperative effort has collected 419 cases covering FHB/DON observations through 2008. Through collaboration with the integrated management cooperative project (integrated management cp), more than 400 additional observations were gathered in 2009 and collection of the 2010 observations is ongoing. The entire data set has undergone extensive evaluation this past year using data cleaning and verification algorithms. This analysis focused on identifying and correcting inconsistent disease ratings, as well as, missing observations and out of range values in the associated weather data. This analysis identified 75 hourly weather files with either missing or out-of-range values. Time-series-based imputation methods were used to impute missing values within the hourly weather data. The effort to identify and fix missing or erroneous observations has repaired cases that would have been excluded from model development. The data set generated by this effort is now the foundation for model development effort.

The modeling is now focused on incorporating variable describing the impact of genetic resistance in winter wheat and crop residues that may contribute to local inoculum. We are also expanding the search to consider new representations of weather conditions that influence the risk of FHB epidemics and DON. Recent results indicate a number of candidate models that may offer improvements accuracy relative to the current prediction models.

**Impact:**

The prediction models developed as part of this project contribute to the FHB forecasting effort in 30 states. The next generation of models is currently being evaluated, and preliminary results indicate that they could improve the accuracy of information available to farms 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. Please reference each item using an accepted journal format. If you need more space, continue the list on the next page.**

1. Haran, M., Bhat, K., Molineros, J. and De Wolf, E. 2010. Estimating the risk of crop epidemics from coincident spatiotemporal processes. *Journal of Agricultural, Biological and Environmental Statistics* 15:158-175.
2. De Wolf, E. 2010. Integrating genetic resistance and fungicide for Fusarium head blight management. Hard Red Winter Wheat Workers Workshop, 2010. March 7-9, Lincoln, NE.
3. De Wolf, E., Shah, D., Paul, P., Madden, L., Willyerd, K., Knight, P., and Miller, D. 2010. Advances in the development and application of prediction models for FHB and DON. In: S. Canty, A. Clark, A. Anderson-Scully, D. Ellis, and D. Van Sanford (Eds.), *Proceedings fo the National Fusarium Head Blight Forum; 2010 Dec 7-9; Milwaukee, WI. Lexington, KY: University of Kentucky. P. 79.*
4. De Wolf, E. 2010. Prediction models for Fusarium head blight in the U.S. University of Manitoba, Plant Science Department Seminar Series. Winnipeg, MB Canada, Oct. 29, 2010.
5. Hane, D. S., Canty, S., De Wolf, E., Crawford, S., and Van Sanford, D. 2010. The U.S. Wheat and Barley Scab Initiative's FHB alert system. In: S. Canty, A. Clark, A. Anderson-Scully, D. Ellis, and D. Van Sanford (Eds.), *Proceedings fo the National Fusarium Head Blight Forum; 2010 Dec 7-9; Milwaukee, WI. Lexington, KY: University of Kentucky. P. 177.*