**USDA-ARS/**
**U.S. Wheat and Barley Scab Initiative**
**FY15 Final Performance Report**
**Due date:** July 15, 2016

## Cover Page

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|---|---|
| **Principle Investigator (PI):** | Erick De Wolf |
| **Institution:** | Kansas State University |
| **E-mail:** | dewolf1@ksu.edu |
| **Phone:** | 785-532-3968 |
| **Fiscal Year:** | 2015 |
| **USDA-ARS Agreement ID:** | 59-0206-2-087 |
| **USDA-ARS Agreement Title:** | Prediction Models and Improved Pre-Harvest Estimates of Deoxynivalenol. |
| **FY15 USDA-ARS Award Amount:** | $ 45,154 |
| **Recipient Organization:** | Kansas State University<br>10 Andrerson Hall<br>Manhattan, KS 66506 |
| **DUNS Number:** | 929773554 |
| **EIN:** | 48-0771751 |
| **Recipient Identifying Number or Account Number:** | AR9911 / GAPP602471 |
| **Project/Grant Reporting Period:** | 06/25/15-06/24/16 |
| **Reporting Period End Date:** | 06/24/16 |

## USWBSI Individual Project(s)

| USWBSI Research Category* | Project Title | ARS Award Amount |
|---|---|---|
| MGMT | Continued Deployment of Prediction Models for Fusarium Head Blight. | $ 12,100 |
| MGMT | Development of Prediction Models for Fusarium Head Blight and Deoxynivalenol. | $ 33,054 |
| | **FY15 Total ARS Award Amount** | **$ 45,154** |

Erick D. DeWolf

Principal Investigator

7/25/16

Date

* MGMT – FHB Management
FST – Food Safety & Toxicology
GDER – Gene Discovery & Engineering Resistance
PBG – Pathogen Biology & Genetics
EC-HQ – Executive Committee-Headquarters
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 Prediction Models for Fusarium Head Blight.*

1. **What are the major goals and objectives of the project?**
   **1.** Continued deployment of the disease prediction models in 30 states including the support of the state commentary tools, FHB Alerts and the web-page information explaining the models. **2**. Continued support of the new back-up system for improved system stability. **3**. Refine a version of the FHB Prediction Center for use with mobile devices (cellular-based mobile/"smart" phones and tablets). **4.** Redesign of the expert tools to allow disease specialists to record and display disease observations – for refinement in the delivery of the current and experimental models. **5.** Develop training modules to help state specialists learn to use the prediction tools more effectively. **6.** Verify model inputs and improved capacity for site-specific predictions. **7.** Implement a user survey to document value of the prediction system and its impact on stakeholders.

2. **What was accomplished under these goals?**
   1) major activities
      i. Disease prediction models were delivered to stakeholders in 30 states via web-based tools including. This effort included support for state commentary feature that enables local disease experts to post the assessment of disease risk and recommendations for control. This commentary is also sent to stakeholders via the FHB Alert system**.**
      ii. Continued support and development "behind the scenes" that enhances the stability of the web-based tools and reliability of the forecasts. This includes refinements of a new back-up system for weather information used to develop the disease risk maps.
      iii. Implemented a new protocol that uses additional sources of weather data that improve the accuracy and reliability of the disease risk maps in the US.

   2) specific objectives
      i. Continued support of mobile version of the FHB Prediction Center for use with cellular-based mobile/"smart" phones and tablets
      ii. Refined expert tools that allow disease specialists to evaluate the next generation of prediction models prior to deployment were also developed this year. These tools were used extensively to develop case studies that compared current models to new models that were candidates for public use.
      iii. Developed case studies on new predictive models as training modules for disease experts in the US. These were presented to wheat disease specialist at scientific meetings and via conference calls to help state specialists learn to use the prediction tools more effectively.

   3) significant results
      i. Disease prediction models were delivered to stakeholders in 30 states via web-based tools including.
      ii. FHB Alerts distributed timely information regarding disease risk and management recommendations in key areas affected by FHB.

4) key outcomes or other achievements

This forecasting system uses web-based tools to provide daily estimates of disease risk for 30 states with a history of Fusarium head blight. More than 4,300 users use the system annually. A survey of these users indicates that the annual impact of the Fusarium predictive models exceeds $65 million annually.

User surveys indicate that the information provided by the disease forecasting effort and FHB Alerts influence disease management decisions on 3,000,000 acres of wheat and barley.

**3. What opportunities for training and professional development has the project provided?**

The training modules and case studies supported by this project were used to improve the skill of disease experts in the states involved in the disease forecasting effort and commentary tools. These presentation and discussion sessions were presented at multiple venues and involved more than 20 wheat disease experts.

**4. How have the results been disseminated to communities of interest?**

Disease prediction models were delivered to thousands of stakeholders in 30 states via web-based tools including. This effort included support for state commentary feature that enables local disease experts to post the assessment of disease risk and recommendations for control. This commentary is also sent to stakeholders via the FHB Alert system**.**

**Project 2:** *Development of Prediction Models for Fusarium Head Blight and Deoxynivalenol.*

1. **What are the major goals and objectives of the project?**
   *The overall goal of the modeling effort is to provide accurate predictions of FHB and DON that will improve the management of the disease and reduce its impact on growers and the agricultural industries using wheat and barley products.*

   The specific objectives for this project include: (1) Coordinate the collection of new observations from the IM-CP used in developing and testing future models; (2) Conduct quality checks on the new observations before including them in the expanded dataset; (3) Improve the prediction accuracy of models for FHB and DON by (i) including predictors from time periods not considered by the current models, and (ii) by using functional data analysis to identify signal locations within the expanded time series; (4) Evaluate the potential value of prediction models as part of the integrated management program for FHB and DON using Bayesian decision theory.

2. **What was accomplished under these goals?**
   1) major activities
      Coordinated the collection of new observations with cooperators from Ohio State University and members of the IM-CP.

      Combined these new observations with weather data and conducted quality checks on the new observations before including them in the expanded dataset used in disease modeling.

   2) specific objectives
      Improve the prediction accuracy of models for FHB and DON by (i) including predictors from time periods not considered by the current models, and (ii) by using functional data analysis to identify signal locations within the expanded time series

   3) significant results
      The expanded data sets and functional data analysis has identified that it may be possible to identify FHB epidemics 3 to 4 weeks prior to the crop growth stages critical disease management. This is significantly earlier that the current prediction models that make predictions just days prior to the critical growth stages.

   4) key outcomes or other achievements
      These results will serve as the foundation for improved disease prediction models that could provide more timely estimates of disease risk for stakeholders. This information will enable growers to better determine when and if fungicide applications are needed to suppress the risk of FHB and DON.

**3. What opportunities for training and professional development has the project provided?**

None

**4. How have the results been disseminated to communities of interest?**

Presentations and posters and scientific meetings and stakeholders.

## Training of Next Generation Scientists

**Instructions:** Please answer the following questions as it pertains to the FY15 award period. The term "support" below includes any level of benefit to the student, ranging from full stipend plus tuition to the situation where the student's stipend was paid from other funds, but who learned how to rate scab in a misted nursery paid for by the USWBSI, and anything in between.

1. **Did any graduate students in your research program supported by funding from your USWBSI grant earn their MS degree during the FY15 award period?**
   - None-
   **If yes, how many?**

2. **Did any graduate students in your research program supported by funding from your USWBSI grant earn their Ph.D. degree during the FY15 award period?**
   -None-
   **If yes, how many?**

3. **Have any post docs who worked for you during the FY15 award period and were supported by funding from your USWBSI grant taken faculty positions with universities?**
   -None-

   **If yes, how many?**

4. **Have any post docs who worked for you during the FY15 award period and were supported by funding from your USWBSI grant gone on to take positions with private ag-related companies or federal agencies?**
   - None-
   **If yes, how many?**

## Release of Germplasm/Cultivars

**Instructions:** In the table below, list all germplasm and/or cultivars released with full or partial support through the USWBSI during the FY15 award period. All columns must be completed for each listed germplasm/cultivar. Use the key below the table for Grain Class abbreviations. *Leave blank if you have nothing to report or if your grant did NOT include any VDHR-related projects.*

| **Name of Germplasm/Cultivar** | **Grain Class** | **FHB Resistance** (S, MS, MR, R, where R represents your most resistant check) | **FHB Rating** (0-9) | **Year Released** |
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Add rows if needed.

**NOTE:** List the associated release notice or publication under the appropriate sub-section in the 'Publications' section of the FPR.

**Abbreviations for Grain Classes**

Barley - BAR
Durum - DUR
Hard Red Winter - HRW
Hard White Winter - HWW
Hard Red Spring - HRS
Soft Red Winter - SRW
Soft White Winter - SWW

## Publications, Conference Papers, and Presentations

Refer to the FY15-FPR_Instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY15 grant. If you did not have any publications or presentations, state 'Nothing to Report' directly above the Journal publications section.

**Journal publications.**

**Books or other non-periodical, one-time publications.**

1. Bockus, W.W., De Wolf, E. D. and Wegulo, S. N. 2015. Effect of Prosaro fungicide application on Fusarium head blight in eight winter wheat cultivars, 2014. *Plant Disease Management Reports* 9:CF003.
   Status: Technical Report
   Acknowledged Fed. Support: Yes

2. Lingenfelser, J., Bockus, W., De Wolf, E., Fritz, A., Knapp, M., Whitworth, J., Miller, R, Shroyer, J., Evans, P., Kusel, K., Mengarelli, L., Schlegel, A., Seaman, C., Spangler, M., Zhang, G., Adee, E., Cramer, G., Esser, A., Kimball, J., Larson, M., Chen, M., McLaughlin, L., Knopf, J. and Bohnert, C. 2015. Winter Wheat Varieties: Report of Progress. Kansas Agricultural Experiment Station; No. 1119.
   Status: Technical Report
   Acknowledged Fed. Support: Not Allowed for this publication type

3. Appel, J. A., De Wolf, E., Todd, T., and Bockus, W. W. 2015. Preliminary 2015 Kansas Wheat Disease Loss Estimates. Kansas Cooperative Plant Disease Survey Report. (https://agriculture.ks.gov/docs/default-source/pp-disease-reports-2012/2015-ks-wheat-disease-loss-estimates35b3d4002e6262e1aa5bff0000620720.pdf?sfvrsn=0)
   Status: Technical Report
   Acknowledged Fed. Support: Not Allowed for this publication type

4. De Wolf, E. D., Bockus, W. W., and Whitworth, J. R. 2015. Wheat Variety Disease and Insect Ratings 2015. Kansas Cooperative Extension Service publication MF-991. 4 pp.
   Status: Technical Report
   Acknowledged Fed. Support: Not Allowed for this type of publication

**Other publications, conference papers and presentations**.

1. De Wolf, E. 2015. Efforts to verify the performance of new predictive models for Fusarium head blight. 2015 National Fusarium Head Blight Forum, St. Louis, MO. Dec 6-8, 2015.
   Status: Presentation
   Acknowledged Federal Support: Yes

2. Bockus, W.W., Appel, J.A., **De Wolf, E.D**., Todd, T.C., Davis, M.A., and Fritz, A. K. 2015. Impact of wheat cultivar Everest on yield loss in Kansas from Fusarium head blight during 2015. In: S. Canty, A. Clark, S. Vukasovich and D. Van Sanford (Eds.), *Proceedings of the 2015 National Fusarium Head Blight Forum* (pp. 77-78). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative.
   Status: Presentation and Abstract
   Acknowledged Fed. Support: Yes

3. Shah, D.A., **De Wolf, E.D.,** Paul, P.A., and Madden, L.V. 2015. A functional exploration of temperature as a predictor of Fusarium head blight epidemics. In: S. Canty, A. Clark, S. Vukasovich and D. Van Sanford (Eds.), *Proceedings of the 2015 National Fusarium Head Blight Forum* (pp. 30). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative.
   Status: Abstract published
   Acknowledgement of Federal Support: Yes