

**USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY05 Final Performance Report (approx. May 05 – April 06)
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Cover Page

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Fiscal Year:	2005
FY05 ARS Agreement ID:	59-0790-1-068
Agreement Title:	Developing and Deployment of Prediction Models for Fusarium Head Blight.
FY05 ARS Award Amount:	\$ 105,990

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Adjusted Award Amount
EDM	Integrating Inoculum and Host Resistance into Prediction Models for Head Scab.	\$ 63,415
EDM	Improvement and Continued Deployment of Prediction Models for Fusarium Head Blight.	\$ 42,575
	Total Award Amount	\$ 105,990

Principal Investigator

Date

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 BIO – Biotechnology
 CBC – Chemical & Biological Control
 EDM – Epidemiology & Disease Management
 FSTU – Food Safety, Toxicology, & Utilization
 GIE – Germplasm Introduction & Enhancement
 VDUN – Variety Development & Uniform Nurseries

Project 1: *Integrating Inoculum and Host Resistance into Prediction Models for Head Scab.***1. What major problem or issue is being resolved and how are you resolving it?**

The cooperative disease forecasting group has made iterative progress in developing prediction models for head scab. At the outset of this stage, the operational prediction models were based entirely on weather conditions observed seven days prior to flowering. These models were able correctly distinguish major epidemics of head scab with an accuracy of 70%. Our evaluation of model errors suggested that additional improvements in accuracy would be possible if sources of local inoculum (crop residues) and variety susceptibility could be accounted for within the models estimate of risk. Our objective was to improve the accuracy of the pre-flowering models by accounting for these sources of variation.

**2. List the most important accomplishment and its impact (how is it being used?).
Complete all three sections (repeat sections for each major accomplishment):****Accomplishment:**

We have successfully incorporated crop residues into the models for winter wheat and host resistance into prediction models directed at spring wheat. These modifications have improved the accuracy of pre-flowering models for head scab from 70 to near 80%.

Impact:

Wheat and barley growers now have access to disease prediction models for head scab that are 80% accurate. These models also allow users to customize the model estimates of risk for specific production practices including the presence of corn residue and host resistance.

As a result of that accomplishment, what does your particular clientele, the scientific community, and agriculture as a whole have now that they didn't have before?:

This work has improved the understanding of the weather patterns that trigger major epidemics of head scab and management practices that influence the risk of disease. More importantly, these improvements in model accuracy will enhance the ability of farmers to evaluate the risk of disease given the weather conditions and their production practices. This information is an important part of the integrated management strategies for head scab and is also used by the milling and malting industries to help them deal with the prognosis of regional epidemics of head scab and potential mycotoxin contamination.

Project 2: *Improvement and Continued Deployment of Prediction Models for Fusarium Head Blight.***1. What major problem or issue is being resolved and how are you resolving it?**

Small grain farmers and the agriculture industries need information that will help them assess the risk of head scab in their region. This information can be used for a wide range of purposes including timely application of fungicide, or preparations for grain that is potentially contaminated with mycotoxins. We have developed prediction models to help meet the needs of producers, as well as the wheat milling and barely malting industries. Prior to this project the delivery of these models was inconsistent among states. In 2004 our cooperative epidemiology group successfully deployed the prediction models via the Fusarium Head Blight Prediction Center. This web-based tool provides a daily estimate of the risk of head scab in 23 states that have experienced severe epidemics of the disease. In this project we proposed to continue this deployment effort with the most recent generation of prediction models, and to improve the system by incorporating 24 and 48 hour forecasts of weather into the models predictions.

2. List the most important accomplishment and its impact (how is it being used?).

Complete all three sections (repeat sections for each major accomplishment):

Accomplishment:

The most recent generation of disease prediction models were deployed uniformly in 23 states that have experienced severe head scab epidemics. These tools allow farmers to customize their predictions of crop production practices that influence the risk of disease including the presence of crop residues as a local inoculum source and the susceptibility of their crop. We also successfully integrated 24 and 48 hour forecasts into the disease forecasting system.

Impact:

Farmers in 23 states have access to the disease prediction models of head scab of wheat and barley. The website used to deploy these model received more than 4,700 visits and 121,371 hits during the 2005 growing season (April – August).

As a result of that accomplishment, what does your particular clientele, the scientific community, and agriculture as a whole have now that they didn't have before?:

The farmers, wheat millers and barley malting industry have access to most recent disease the prediction models. These models are delivered uniformly throughout 23 states impacted by epidemics of head scab. The models are an important part of the integrated management strategies needed to reduce the impact of head scab 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.

Dufault, N.S., De Wolf, E.D., Lipps, P.E., Madden, L.V. 2006. Role of temperature and moisture in the production and maturation of *Gibberella zeae* peritheica. *Plant Disease* 90:637-644.

Molineros, J. E., De Wolf, E. D., Madden, L. V., Paul, P. and Lipps, P. E. 2005. Incorporation of host reaction and crop residue level into prediction models for Fusarium head blight. Pages 119-122 in: Canty, S. M., Lewis, J., Siler, L. and Ward, R. W. (Eds.), *Proceedings of the National Fusarium Head Blight Forum; 2005*. Milwaukee, WI. East Lansing: Michigan State University.

Nita, M. Tilley, K. De Wolf, E. and Kuldau, G. 2005. Effects of moisture during and after moisture on the development of Fusarium head blight of wheat and mycotoxin production. Page 125-128 in: Canty, S. M., Lewis, J., Siler, L. and Ward, R. W. (Eds.), *Proceedings of the National Fusarium Head Blight Forum; 2005*. Milwaukee, WI. East Lansing: Michigan State University.

De Wolf, E.D., Molineros, J. E., Madden, L. V., Lipps, P. E., Knight, P. G., and Miller, D. A. 2005. Future directions in the development and application of risk assessment models for Fusarium head blight. Page 117 in: Canty, S. M., Lewis, J., Siler, L. and Ward, R. W. (Eds.), *Proceedings of the National Fusarium Head Blight Forum; 2005*. Milwaukee, WI. East Lansing: Michigan State University.

Molineros, J. E., De Wolf, E. D., Francl, L. J., Madden, L. V. and Lipps, P. E. 2005. Modeling epidemics of Fusarium head blight: trials and tribulations. *Phytopathology* 95:S71

Molineros, J. E., De Wolf, E. D. and Haran, M. 2005. Application of hotspot detection analysis to the prediction of Fusarium head blight epidemics. Page 118 in: Canty, S. M., Lewis, J., Siler, L. and Ward, R. W. (Eds.), *Proceedings of the National Fusarium Head Blight Forum; 2005*. Milwaukee, WI. East Lansing: Michigan State University.

Nita, M., De Wolf, E., Madden, L. V., Paul, P., Shaner, G., Adhikari, T., Ali, S., Stein, J., Osborne, L. 2005. Effect of corn residue level on the incidence of Fusarium head blight. Page 124 in: Canty, S. M., Lewis, J., Siler, L. and Ward, R. W. (Eds.), *Proceedings of the National Fusarium Head Blight Forum; 2005*. Milwaukee, WI. East Lansing: Michigan State University.