

**USDA-ARS / USWBSI
FY04 Final Performance Report
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Cover Page**

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Year:	FY2004 (approx. May 04 – April 05)
FY04 ARS Agreement ID:	59-0790-1-068
FY04 ARS Agreement Title:	Development and Deployment of Prediction Models for Fusarium Head Blight.
FY04 ARS Award Amount:	\$ 103,773

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Adjusted Award Amount
EDM	Deployment of Prediction Models for Fusarium Head Blight.	\$ 30,602
EDM	Prediction Models for Fusarium Head Blight: Influence of Inoculum and Weather on Disease.	\$ 73,171
	Total ARS Award Amount	\$ 103,773

Principal Investigator

Date

* 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: *Deployment of Prediction Models for Fusarium Head Blight.*

1. What major problem or issue is being resolved and how are you resolving it?

This grant addresses the delivery of a disease forecasting system for Fusarium head blight in 23 states that have been most heavily impacted by the disease during the last decade. The rationale for providing the forecast is to support the decision making process regarding if and when to apply a fungicide. Thus, individual decision makers and advisers will have the scientifically based information needed to regain control over production costs and product quality. The proposed system is among the largest disease forecasting system ever attempted.

The history of the forecasting system shows an orderly progression through iterative model development, now in its third generation; expansion from the diverse state and local area information providers to a regional system; and, new thrusts in research projects that likely will contribute to the accuracy of the forecasting system. The proposed step not only will provide virtually all clientele impacted by scab with access to a local forecast, but also lays the foundation for the future improvements.

The forecasting system consists of disease prediction models with prediction accuracy over the first generation models (80% and 83% accuracy); a data stream from Automated Surface Observation System, which is interpolated hourly by the Rapid Update Cycle to a 20 km resolution throughout the entire region; and finally, a web interface that has been several seasons of operation. These components will provide a reliable information stream in 2004 and beyond.

2. What were the most significant accomplishments?

The Fusarium Head Blight Prediction Center was successfully deployed for 23 states that have been most heavily impacted by the disease. The system provided a uniform interface and reliable information stream to thousands of clientele, represents a significant advancement in the management of Fusarium head blight. The system performed well during the 2004 season and predicted the disease accurately in most states. In a few locations within IN, KY and MI, it appears the models underestimated the risk of disease based on pre-flowering weather information. Our error analysis indicates that these high disease levels were the result of post-flowering weather conditions that were not considered by the pre-flowering models. Our efforts to verify the accuracy of the weather inputs used by the models indicates that the both temperature and dew point temperature were estimated within 1.5 C in most locations. The radar estimates of rain fall were less accurate than anticipated. Based on our experience in 2004 we have made adjustments to the models and processing of the weather information. The refined system was deployed in 2005, and we are in the process of evaluating the results.

Project 2: *Prediction Models for Fusarium Head Blight: Influence of Inoculum and Weather on Disease.*

1. What major problem or issue is being resolved and how are you resolving it?

The central goal of the cooperative epidemiology group, consisting of researchers in PA, OH, IN, ND, and SD is to provide growers and the agricultural industry with timely and reliable predictions for Fusarium head blight. The efforts of this cooperative project have already produced forecasting models that are currently being used throughout the regions of the U.S. that have been most impacted by the disease.

In this grant we requested funds to support further improvements in model accuracy by incorporation of variables that more fully describe the relationships between weather and inoculum production. To accomplish this we have established replicated field plots to investigate the role of inoculum density and weather in the development of epidemics. We have also evaluated the role of environment in the development of *G. zeae* perithecia under controlled and wheat field conditions.

2. What were the most significant accomplishments?

The information gathered by the cooperative epidemiology effort has enabled the development of disease forecasting models that accurately predicted epidemics with between 80% and 83% accuracy. These second generation models have been deployed via the Fusarium Head Blight Prediction Center and provide timely and reliable disease forecasts for 23 states. The information provided is also used extensively by state extension specialists to make communicate the risk of disease to wheat and barley producers throughout this region.

Our investigations of perithecia development under controlled and within a wheat field environment has produced the data needed to refine temperature range used by the disease forecasting models, and is in part responsible for the increases in model accuracy. The field observations of perithecia development have also contributed to the development of models specifically for the development of inoculum. These models predict conditions favorable for the development of perithecia with accuracies near 80%. The next generation of disease forecasting models will use this information to improve predictions and allow us to initiate new methods of model development.

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 your grant. Please reference each item using an accepted journal format. If you need more space, continue the list on the next page.

De Wolf, E. D. 2004. Wheat head scab prediction models available Field Crop News 04:02.
URL: fcn.agronomy.psu.edu

De Wolf, E. D. 2004. Next generation of head scab forecasting models deployed. Fusarium Focus, Spring 2004.
URL: scabusa.org.

De Wolf, E. D. 2004. Will Scab be back this year? Crop Management News. 5/11/04.

De Wolf, E. D. 2004. Wheat diseases on the move in PA. Crop Management News. 5/18/04.

De Wolf, E.D. 2004. Glume blotch and wheat head scab. Crop Management News. 6/18/04.

De Wolf, E.D. 2004. Concerns about low germ on wheat seed. Crop Management News. 9/25/04.

De Wolf, E., Lipps, P., Miller, D., Knight, P., Molineros, J., Francl, L. 2004. Evaluation of prediction models for wheat Fusarium head blight in the U.S., 2004. Page 438 in: Proceedings of the 2nd International Symposium on Fusarium Head Blight. Orlando, FL.

Dufault, N.S., De Wolf, E. D., Lipps, P. E. and Madden, L.V. 2004. Development of Gibberella zeae perithecia under controlled temperature and moisture conditions. Phytopathology 94:S164.

Molineros, J., Madden, L., Lipps, P., Shaner, G., Osborne, L., Ali, S., Francl, L. and De Wolf, E. 2004. Comparison of methods for developing Fusarium head blight forecasting models. Page 475 in: Proceedings of the 2nd International Symposium on Fusarium Head Blight. Orlando, FL.

Molineros, J. E., Madden, L., Lipps, P., Shaner, G., Osborne, L., Francl, L., and De Wolf, E. 2004. Comparison of forecasting methods for Fusarium head blight. Phytopathology 94:S72