USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY06 Final Performance Report (April 06 – April 08)
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Cover Page

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Fiscal Year:	2006
USDA-ARS Agreement ID:	59-0790-6-074
USDA-ARS Agreement Title:	Improved and Continued Deployment of Prediction Models for FHB and Integration of Inoculum and Host Resistance into Predicition Models.
FY06 ARS Award Amount:	$ 76,974

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Award Amount
EEDF	Improved and Continued Deployment of Prediction Models for Fusarium Head Blight.	$ 38,248
EEDF	Integrating Inoculum and Host Resistance into Prediction Models for Head Scab.	$ 38,726
	Total Award Amount	**$ 76,974**

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Principal Investigator Date

* CBCC – Chemical, Biological & Cultural Control
EEDF – Etiology, Epidemiology & Disease Forecasting
FSTU – Food Safety, Toxicology, & Utilization of Mycotoxin-contaminated Grain
GET – Genetic Engineering & Transformation
HGR – Host Genetics Resources
HGG – Host Genetics & Genomics
PGG – Pathogen Genetics & Genomics
VDUN – Variety Development & Uniform Nurseries

Project 1: *Improved 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?

Fungicides are an important part of the integrated management for head scab. These fungicide applications are expensive for growers and may not be needed when the risk of disease is low. We are developing and deploying disease prediction models that help growers evaluate the risk of disease and make timely fungicide application it and when they are needed.

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:

- These models we deployed to 24 states where the head scab has been a significant production issue. The disease prediction effort was expanded to provide daily estimates of disease risk in Tennessee. This move increases the number of states covered by the national level deployment to 24, and helps expand the coverage in winter wheat areas that have been impacted by FHB.

- The Fusarium head blight prediction center began using the Real Time Mesoscale Analysis (RTMA), a new hourly weather analysis tool developed by the National Weather Service, to create daily maps of disease risk. This modification improves the resolution of the risk maps from 20 km to 5 km, and helps to improve the accuracy of the disease forecasts.

- The system was modified to take advantage of the new tools available in weather forecasting known as the National Digital Forecast (NDFD). These tools were integrated into disease prediction tools and allow for more detailed and accurate disease prediction up to 48 hours in advance.

- The capacity of the prediction center was expanded to include inputs from Agricultural weather networks in North Dakota, and Michigan. The addition of these weather stations to the system greatly improves the resolution of station specific estimates of disease risk that supplement the risk maps this these states.

Impact:

The system was expanded to allow plant disease specialists in 24 states provide text commentary describing their evaluation of the model results and disease risk in their area. The disease prediction models received 7,047 visits between April and August of 2007. This level of web activity represents an increase of 1,073 and 2,347 more visits than were received during this same time period in 2006 and 2005, respectively.

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?

Disease prediction models are available in 24 states where head scab is a significant problem. These tools are an important part of the disease management for head scab for many producers throughout this region.

Project 2: *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 epidemiology group has been working to develop the next generation of empirical models that predict the risk of FHB. The prediction accuracy of these models has stabilized between 70 and 80%. Additional accuracy is desired. Our analysis of model errors indicates that the weather 21 days prior to flowering influences disease development and resulted in the misclassification of risk of disease in some years.

Variability in the level of host resistance to FHB clearly impacts the potential development of disease epidemics. We have already incorporated variables describing the impact of host resistance into the prediction models for spring wheat, and we are now collecting the data needed to incorporate resistance level into the winter wheat models.

Within field sources of inoculum (i.e. planting wheat into corn residue) can also alter the risk of disease and influence model accuracy. We have completed a multi-year experiment evaluating the interaction of host resistance, planting date, corn residue level, and fungicide on the incidence and severity of FHB and DON.

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 developed and are currently verifying modifications to the spring wheat models that incorporate variables quantifying the impact of abnormally wet or dry conditions three weeks prior to flowering on the risk of disease epidemics. Our preliminary results indicate that these modifications may correct up to 40% of the errors made by the current spring wheat model.

Disease models have been modified to account adjust risk predictions for cultivars with differing levels of disease resistance in the spring wheat, and better describe the production of inoculum by the fungus that causes head scab.

Impact:

Wheat and barley growers throughout the United States now have access to more accurate disease prediction models. These models now allow growers to customize their use of the model to account for differences in cultivar resistance level. These models are more

accurate than the previous generation of models. This improved accuracy contributed to timely and effective disease management.

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?

We have been able to successfully test the next generation of prediction models. This testing will in time allow us to provide another more accurate models in the national level deployment effort.

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. Paul, P.A., Lipps, P.E., De Wolf, E.D., Shaner, G., Buechley, G., Adhikari, T., Ali, S., Stein, J., Osborne, L. and Madden, L.V. 2007. A distributed lag analysis of the relationship between Gibberella zeae inoculum density on wheat spikes and weather variables. Phytopathology 97:1608-1624.

2. De Wolf. E.D. and Isard, S.A. 2007. Disease cycle approach to plant disease prediction. Annual Review of Phytopathology 45:9.1-9.18.