USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY06 Final Performance Report (approx. May 06 – April 07)
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Cover Page

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FY06 ARS Award Amount:	$ 23,426

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Award Amount
EEDF	Effect of Inoculum Levels, Host Resistance, Fungicide and Weather on FHB.	$ 23,426
	Total Award Amount	**$ 23,426**

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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: *Effect of Inoculum Levels, Host Resistance, Fungicide and Weather on FHB.*

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

Wheat production and its related industry have drastically impacted due to Fusarium head blight (FHB) or scab multiple epidemics occurred between 1993 and 2005. The disease not only affects yield production due to lack of grain fill, but also reduces quality by contaminating grain with multiple mycotoxins, especially DON. Majority of the wheat breeders and plant pathologists have diverted their resources to combat this menace. At present, few wheat cultivars with moderate resistance to scab are available to North Dakota. However, it is still far to manage this disease using only these moderately resistant cultivars. The regional cereal growers have adopted an integrated approach to manage wheat scab using: crop rotation, fungicide application and cultivars with the best available resistance.

Two major constraints in using fungicides to protect small grain from scab are (i) increase in cost production, and (ii) appropriate timing of their application. To resolve these two issues, a decision support system (disease forecasting system) is needed to accurately predict when an economic threshold of disease will occur. Plant disease epidemiologists located at Ohio, Penn State, Nebraska, South Dakota, North Dakota, and Kansas State land-grant universities are collaborating to provide wheat growers and agricultural industries with timely and reliable disease forecasts for wheat scab and continuously trying to improve the decision support system. Knowledge of sources of inoculum, inoculum level, profitability of fungicide use on cultivars with different levels of resistance and favorable weather for the disease development is crucial in the refinement of any decision support system. In 2006, we studied the effect of different inoculum levels, fungicide application on wheat cultivars with different levels of resistance on the development of FHB under North Dakota field conditions. Two FHB susceptible cultivars, Argent (hard white spring wheat and early flowering) and Granite (hard red spring wheat and late flowering), and one FHB resistant cultivar, Alsen (hard red spring wheat), were planted on April 29, 2005. The plots with inoculum were created by distributing corn kernels (80g/m2) infested with *Fusarium graminearum* in the plots at 6-leaf stage. The fungal population present on heads and in the air was monitored daily from Feeks scale 10-11.2 daily. Additionally, 50 heads from each treatment were monitored thrice a week to observe the synchrony of heads development. The grain samples from all treatments were analyzed for DON contamination.

Due to prevalence of high temperature and dry conditions at the time of wheat flowering, a critical stage for fungal infection to cause FHB, minimized the chances of disease development. FHB incidence was less than 1% regardless the treatment. DON, 15A-DON, and Nivalenol levels were not significantly different among the treatments and were <0.5 PPM. All cultivars took 3 days from beginning to ending flowering. Similarly, no significant differences were observed in the pathogen prevalence on wheat heads from plots with different inoculum levels.

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

Accomplishment:

The results indicate that unfavorable weather conditions only have a great impact on the outcome of disease development and mask the effect of other factors such as fungicide application, host resistance, and inoculum levels. In 2005, weather conditions were more favorable for the disease development than in 2006. Thus, we observed a significant difference in FHB incidence and DON contamination among the treatments in 2005. For example, low disease incidence was observed in plots with low inoculum as compared to plots with high inoculum level. Similarly, fungicide application reduced the DON contamination and disease severity. On an average, wheat heads take three days to begin and complete flowering, a crucial stage for scab infection.

Impact:

Incorporating information about local sources and levels of pathogen inoculum, host resistance and fungicide application on the disease development may help in the refinement of currently available FHB disease forecasting model.

3. A list of the publications, presentations, peer-reviewed articles, and non-peer reviewed articles.

Nita, M., E. DeWolf, L. V. Madden, Paul, P. G. Shaner, T. Adhikari, S. Ali, J. Stein and L. Osborne. 2006. Effect of corn residue level on disease intensity of Fusarium head blight (FHB) and deoxyvalenol (DON) concentration: A multi-state field study. Phytopathology 96:S85.

Nita, M., E. DeWolf, L. V. Madden, Paul, P. G. Shaner, T. Adhikari, S. Ali, J. Stein and L. Osborne. 2006. Effect of corn residue level, fungicide application, and cultivar resistance level on disease incidence and severity of Fusarium head blight and DON concentration. 2006 National Fusarium Head Blight (NFHB) Forum, December 10-12, 2006, Sheraton Imperial Hotel & Convention Center Durham, North Carolina.

Paul, P. A., L. V. Madden, P. E. Lipps, E. DeWolf, G. Shaner, G. Buechley, T. Adhikari, S. Ali, J. Stein, and L. Osborne. 2006. Modeling the abundance of propagules of *Gibberella zeae* within wheat canopy. Phytopathology 96:91.

Paul, P. A., L. V. Madden, P. E. Lipps, E. DeWolf, G. Shaner, G. Buechley, T. Adhikari, S. Ali, J. Stein, and L. Osborne. 2006. Influence of weather on the abundance of *Gibberella zeae* propagules within wheat canopies: A lag regression analysis. 2006 National Fusarium Head Blight (NFHB) Forum, Dcember 10-12, 2006, Sheraton Imperial Hotel & Convention Center Durham, North Carolina.

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