U.S. Wheat and Barley Scab Initiative
FY02 Final Performance Report (approx. May 02 – April 03)
July 15, 2003

Cover Page

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Year:	**FY2002 (approx. May 02 – April 03)**
Grant Number:	**59-0790-9-051**
Grant Title:	**Fusarium Head Blight Research**
FY02 ARS Award Amount:	**$ 53,659**

Project

Program Area	Project Title	USWBSI Recommended Amount
CBC	Uniform fungicide trial in Ohio to identify products effective against Fusarium head blight.	$6,000
EDM	Disease Forecasting System for Fusarium Head Blight and the Splash Dispersal of Gibberella zeae.	$49,000
	Total Amount Recommended	**$55,000**

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Principal Investigator Date

Project 1: Uniform fungicide trial in Ohio to identify products effective against Fusarium head blight.

1. What major problem or issue is being resolved and how are you resolving it?
Although recent advances in host resistance to Fusarium Head Blight (FHB) are beginning to improve disease managemnet in some wheat production regions, many wheat and barley producers have few management options. Effective fungicides could provide growers with management options when susceptible cultivars are grown. We tested three fungicides (Folicur, AMMS21619 and BAS505) and two biological control agents (Trigo Cor 1448, OH182.9) for control of FHB in replicated trials that were inoculated and maintained under mist irrigation to favor disease development. Biological abents and fungicides w3re applied as sprays in 26.2 gal of water/A at growth stage 10.5.1. Disease assessments were made three times a week in one foot long sections of row in 15 locations in each plot. Plots were harvested to obtain grain weights and the level of DON in the grain.

2. What were the most significant accomplishments?
Plots treated with Folicur, AMS21619 and BAS 505 had significantly lower rates of disease increase, low maximum disease severity, and lower area under the disease progress curves than the untreated control. Plots treated with Folicur, AMS21619 and BAS 505 had significantly higher yield than the untreated control plots, but there were no statistical differences (P=0.05) in test weight and DON levels among the various treatments. The biological control agents were not effective in lowering disease levels, DON levels in the grain or increasing yield. Results indicated the AMS21619 and BAS 505 fungicides have the greater potential for management of FHB than the other treatments tested.

Project 2: Disease Forecasting System for Fusarium Head Blight and the Splash Dispersal of Gibberella zeae.

1. What major problem or issue is being resolved and how are you resolving it?
Wheat producers need a reliable FHB predictive system on which to base fungicide applications decisions and to have sufficient time to implement harvest and marketing decisions with the prognosis of serious disease levels. As part of a cooperative to obtain epidemiological information from several locations, we are monitoring inoculum levels, weather conditions and diseases levels in replicated field plots at two Ohio locations to provide needed epidemiological information to develop and validate FHB forecasting systems. A disease risk forecasting system developed from historical weather and disease level information was used to predict the risk of FHB in Ohio during 2002. Disease data taken at multiple locations in the state indicated reasonable correlations with predictions and final FHB levels.

A rain simulation study was conducted to evaluate the capacity of rain splash to distribute inoculum within a wheat canopy. In brief, drops of either 3.9, 3.3, or 2.7 mm diameter were released from height of 50, 75, 100, and 125 cm in order to obtain a wide range of kinetic energies at drop impact. A phase Doppler particle analyzer (PDPA) was used to measure the velocity and diameter of all splash droplets from the point of impact. From these measurements, the distribution of vertical (i.e., movement up a wheat tiller) and horizontal (i.e., spread from a point source) distances traveled by droplets was determined.

The generated water drops impacted dry infected corn stalks with mature perithecia and sporodochia; saturated (soaked) infected corn stalks; and wheat leaves covered with previously deposited ascospores. The diameter of splash droplets was on average, 100 μm larger for splashes from wheat leaves compared with corn stalks ($P < 0.05$), suggesting that spores can be efficiently transported from wheat leaves during rain episodes. On the other hand, mean velocity of splash droplets was higher from corn stalks than wheat leaves ($P < 0.05$), suggesting that spores can be transported greater distances from corn residue than from wheat leaves.

2. What were the most significant accomplishments?

The most significant accomplishments were: the successful collection of environmental and FHB epidemiological data from two locations in the state, continued development and validation testing of FHB risk assessment models, deployment of FHB risk models for use by growers on the Ohio Field Crop Disease web site (http://www.oardc.ohio-state.edu/ohiofieldcropdisease), and determination of the effect of cultivar and planting date on FHB severity. Additional studies were conducted to determine the relationship between incidence and severity of FHB in order to estimate FHB severity from incidence data and evaluation of the spatial aspects of FHB. Regression models indicated a highly significant relationship between incidence and severity (R^2 ranged from 0.69 to 0.91). Although there was considerable variability of severity for a given incidence in some data sets, there was a highly significant relationship between severity and incidence each year, indicating the functional relationship was very consistent between years.

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.

Journal articles

1. De Wolf, E. D., Madden, L. V., and Lipps, P. E. 2003. Risk assessment models for wheat Fusarium head blight epidemics based on within-season weather data. Phytopathology 93:428-435.

Abstracts

1. Dufault, N. S., De Wolf, E. D., Lipps, P. E. and Madden, L. V. 2002. Weathervariables related to *Gibberella zeae* perithecia development. Phytopathology 92:S21.

2. Engle, J. S., Lipps, P. E., Graham, T. L., and Boehm, M. J. 2002. Effect of wheat floral structure extracts and endogenous compounds on the growth of *Fusarium graminearum.* Phytopatholgy 92:S23.

3. Engle, J. S., Lipps, P. E., and Madden, L. V. 2002. Evaluation of inoculation methods to determine differences in resistance to *Fusarium graminearum* in wheat genotypes. Phytopathology 92:S23.

4. El-Allaf, S. M., Lipps, P. E., and Madden, L. V. 2002. Effect of biocontrol agents and fungicides on Fusariuim head blight development on winter wheat in Ohio. Phytopathology 92:S23.

5. El-Allaf, S. M., Lipps, P. E., and Madden, L. V. 2002. Spatial and temporal development of Fusarium head blight epidemics on winter wheat in Ohio. Phytopathology 92:S23.

Proceedings:

1. Core, A. B., Schisler, D. A., Hicks, T. E., Lipps, P. E. and Boehm, M. J. 2002, Population dynamics in the field of a biocontrol agent for Fusarium head blight. Page 61 in: 2002 National Fusarium Head Blight Forum Proceedings, Erlanger, KY. Dec. 7-9, 2002.

2. El-Allaf, S. M., Lipps, P. E., and Madden, L. V. 2002. Fusarium head blight: Epidemics and Control. Pages 69-73 in: 2002 National Fusarium Head Blight Forum Proceedings, Erlanger, KY. Dec. 7-9, 2002.

3. De Wolf, E. D., Lipps, P. E., Madden, L. V. and Farncl, L. 2002. Influence of corn residue and cultivar susceptibility on the accuracy of Fusrium head blight

risk assessment models. Pages 137- 139 in: 2002 National Fuasrium Head Blight Forum Proceedings, Erlanger, KY. Dec. 7-9, 2002.

4. Engle, J. S., Lipps, P. E., Graham, T. L. and Boehm, M. J. 2002. Effect of wheat floral structure extracts and endogenous compounds on the growth of *Fusraiium graminearum*. Pages 151-153 in: 2002 National Fusarium Head Blight Forum Proceedings, Erlanger, KY. Dec. 7-9, 2002.

5. Dufault, N., De Wolf, E., Lipps, P. and Madden, L 2002. Identification of Environmental variables that affect perithecial development of *Gibberella zeae*. Page 141 in: 2002 National Fusarium Head Blight Forum Proceedings, Erlanger, KY. Dec. 7-9, 2002.

6. Dufault, N., De Wolf, E. Lipps, P. and Madden, L. 2002. Relationship of temperature and moisture to *Gibberella zeae* perithecial development in a controlled environment. Pages 142-143 in: 2002 National Fusarium Head Blight Forum Proceedings, Erlanger, KY. Dec. 7-9, 2002.

7. El-Allaf, S. M., Madden, L. V. and Lipps, P. E. 2002. Incidence-Sverity relationships for Fusarium head blight on wheat. Page 145 in: 2002 National Fusarium Head Blight Forum Proceedings, Erlanger, KY. Dec. 7-9, 2002.

8. El-Allaf, S. M., Madden, L. V. and Lipps, P. E. 2002. Spatial aspects of Fusarium head blight epidemics on wheat in Ohio. Pages 146-150 in: 2002 National Fusarium Head Blight Forum Proceedings, Erlanger, KY. Dec. 7-9, 2002.

9. Schisler, D. A, Boehm, M. J., Hicks, T. E., and Lipps, P. E. 2002. USDA-ARS, Ohio State University cooperative research on biologically controlling Fusarium head blight 2: 2002 field tests of antagonists/ fungicide mixtures. Pages 119-122 in: 2002 National Fusrium Head Blight Forum Proceedings, Erlanger, KY. Dec. 7-9, 2002.

10. Lipps, P. E. Mills, D., De Wolf, E. D. and Madden, L. V. 2002. Fusarium head scab risk forecasting for Ohio, 2002. Page 166 in: 2002 National Fusarium Head Blight Forum Proceedings, Erlanger, KY. Dec. 7-9, 2002.

11. Lipps, P. E., De Wolf, E. D., Mills, D. and Madden, L. V. 2002. Practical Application of Fusarium head blight risk predictions. Pages 167-170 in: 2002 National Fusarium Head Blight Forum Proceedings, Erlanger, KY. Dec. 7-9, 2002.

12. Sneller, C., Lipps, P. E. and Herald, L. 2002. Summary report on the 2002 northern uniform winter wheat scab nursery (NUWWSN). Pages 261-264 in:

2002 National Fusarium Head Blight Forum Proceedings, Erlanger, KY. Dec. 7-9, 2002.

Technical reports

1. Lipps, P. E. El-Allaf, S. M. and Johnston, A. L. 2002. Evaluation of foliar fungicides for control of Fusarium head blight on winter wheat in Ohio, 2001. Fungicide and Nematicide Tests (online.) Report 57:CF14. DOI: 10.1094/FNN57. The American Phytopathological Society, St. Paul, MN.

Web sites

1. Lipps, P. E., and Mills, D. 2002. Foresasting Fusarium head scab of wheat in Ohio. Ohio State University Extension. http://www.oardc.ohio-state.edu/ohiofieldcropdisease/wheat/scab%20forecasting%webpage.htm.