USDA-ARS / USWBSI
FY03 Final Performance Report (approx. May 03 – April 04)
July 15, 2004

Cover Page

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Year:	**FY2003 (approx. May 03 – April 04)**
FY03 ARS Agreement ID:	**59-0790-9-051**
FY03 ARS Agreement Title:	**Inoculum level effects, inoculum splash dispersal and uniform fungicide testing for Fusarium head blight.**
FY03 ARS Award Amount:	**$ 52,940**

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Adjusted Award Amount
CBC	Uniform Fusarium head blight fungicide and biological control agent testing in Ohio.	$ 5,854
EDM	Influence of inoculum level on Fusarium head blight and splash dispersal of Gibberella zeae.	$ 47,086
	Total Amount Recommended	**$ 52,940**

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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: ***Uniform Fusarium head blight fungicide and biological control agent testing in Ohio.***

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

Fusarium head blight (FHB), primarily caused by *Fusarium graminearum*, is a serious yield limiting disease in Ohio and other wheat growing states. Although progress is being made in the development of resistant cultivars, most cultivars grown in the US are either susceptible or have a degree of susceptibility that permits yield loss and/or accumulation of DON in the grain. Wheat producers are interested in chemical control options as an additional tool for preventing yield losses. The Chemical and Biological Control Committee of the Wheat and Barley Scab Initiative establishes protocols for evaluation of fungicides each year. Under these protocols fungicides are evaluated by researchers in a number of states on several different classes of wheat in order to develop a data base to be used for possible federal registration of experimental fungicides and on which recommendations for their use can be made. Ohio has been a cooperator in FHB fungicide evaluations since 1998.

2. What were the most significant accomplishments?

Field plots were established at Wooster, Ohio using the susceptible cultivar Elkhart.
Daily mist irrigation favored disease development in spite of relatively cool temperatures during and 1 week after anthesis resulting in very high disease incidence (83% to 100%). Rain occurred on 19 of the 40 days between when disease assessments were made and plots were harvested. Wet weather prevented harvest and kept the heads almost continuously wet during grain maturation. By harvest the grain was severely deteriorated resulting in very low yields (17.8 to 36.1 bu/A) and test weights (26.6 to 34.9 lb/bu). Those treatments that had lower FHB severity levels and lower FHB index generally also had statistically lower percentage of damaged kernels and higher yield and test weight. Both the JUA6476 and V10116 materials appeared to be superior to Folicur in reducing the effects of head blight. There did not appear to be a difference among the rates used for either material or among different application timings for JUA6476. This was the first year we had seen such a severe level of grain deterioration in over 20 years of conducting fungicide trials in Ohio.

Project 2: ***Influence of inoculum level on Fusarium head blight and splash dispersal of Gibberella zeae.***

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

Weather driven risk assessment models for Fusarium head blight (FHB) have been developed and are currently being validated in several states. In order to incorporate variables related to cultural practices and inoculum levels into these models, a thorough understanding of the influence of these factors on disease development under different conditions is necessary. Three major factors influencing disease development include planting date, cultivar and presence of corn residues. Plots were planted to obtain three levels of corn residue (0, 15 and 80% soil coverage), two planting dates (Sep 30 and Oct 21) and three cultivars varying in relative maturity (flowering date). Burkard cyclone spore samplers were used to monitor daily numbers of airborne spores from Feekes growth stage 10 through 11.2. During the same period , wheat heads were collected and assayed directly for spores using head washing. The incidence and severity of FHB was assessed three times each week within each plot.

To examine the role of rain splash in the dispersal of spores, splashed water was collected during rain events at three heights (0, 30, and 100 cm) above the soil surface. Samplers were placed into a reduced tillage wheat field with corn residue and an artificially inoculated plot. After each rain event, 1 ml of rain splash was assayed for presence of *Fusarium* spores.

2. What were the most significant accomplishments?

Disease development at the 80% corn residue levle was comparable with development at 15 and 0% residue levels. There was also very similar levels of inoculum recovered from wheat heads sampled from each residue plot. No clear association was observed between levels of FHB inoculum in the air and on wheat heads. Peaks in the level of airborne spores trapped using the Burkhard sampler corresponded only to subtle increases in the number of spores recovered from wheat heads. There was a marked association between rainfall amounts and number of spores recovered from wheat heads. No overall association was observed between spores recovered through Burkhard spore sampling and rain events. In many cases, peaks in rainfall amounts coincided with reductions in numbers of spores sampled from the air and increases in the number of spores sampled from wheat heads.

Spore flux density (spores recovered per square cm per hour) was determined for each rain event. The intensity of splashed rain (mm/h) was highest at 100 cm, indicating that substantial splashing of incident rain occurs from the upper wheat canopy. Spores were detected in every sampled rain at all heights, with slightly fewer spores at 100 cm than the other two heights. Therefore, in addition to aerial dispersal of spores by wind, rain splash dispersal contributes to the movement of inoculum within canopies and may contribute to FHB epidemics

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 you 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.

Technical reports:

1. Lipps, P. E. El-Allaf, S. M. and Johnston, A. L. 2003. Evaluation of foliar fungicides for control of Fusarium head blight on winter wheat in Ohio, 2002. Fungicide and Nematicide Tests (online.) Report 58:CF002. DOI: 10.1094/FN58. The American Phytopathological Society, St. Paul, MN.

Abstracts:

1. El Allaf, S. M., Madden, L. V. and Lipps, P. E. 2003. Rain splash dispersal of *Gibberella zeae* in a wheat canopy. Phytopathology 93: S23.

2. El Allaf, S. M.,. Lipps, P. E. and Madden L. V. 2003. Fusarium species and population levels associated with head blight of wheat in Ohio. Phytopathology 93:S23.

3. El Allaf, S. M., Madden, L. V. and Lipps, P. E. 2003. Incidence-severity relationship for Fusarium head blight on wheat. Phytopathology 93:S23

4. Core, A. B., Schisler, D. A., Hicks, T. E., Lipps, P. E. and Boehm, M. J. 2003. Survival of the Fusarium head blight agent *Cryptococcus nodaensis* OH182.9. Phytopathology 93:S17.

5. De Wolf, E. D., Lipps, P. E., and Madden, L. V. 2003. Factors affecting the accuracy of disease forecasting models for Fusarium head blight of wheat. Phytopathology 93: S20-S21.

6. Lipps, P. E., Mills, D., De Wolf, E. D. and Madden, L. V. 2003. Fusarium head blight risk forecasting for wheat in Ohio. Phytopathology 93:S53.

7. Dufault, N. S., De Wolf, E. D., Lipps, P. E. and Madden, L. V. 2003. Influence of temperature and moisture on *Gibberella zeae* perithecial development on corn residue. Phytopathology 93:S133.

Proceedings:

1. Core, A. B., Schisler, D. A., Hicks, T. E., Zhang, S., Lipps, P. E. and Boehm, M. J. 2003. Population dynamics of the Fusarium head blight biocontrol agent *Cryptococcus nodaensis* OH182.9 on wheat. Page 65 in: 2003 National Fusarium Head Blight Forum Proceedings, Bloomington, MN. Dec. 13-15, 2003.

2. De Wolf, E. D., Molineros, J., Wei, C., Lipps, P. E., Madden, L. V. and Farncl, L. 2003. Development and deployment of the next generation prediction models for Fusarium head blight. Pages 125-128 in: 2003 National Fuasrium Head Blight Forum Proceedings, Bloomington, MN. Dec. 13-15, 2003.

3. El-Allaf, S. M., Madden, L. V. and Lipps, P. E. 2003. Rain splash dispersal of *Gibberella zeae* spores in a wheat canopy. Page 137 in: 2003 National Fusarium Head Blight Forum Proceedings, Bloomington, MN. Dec. 13-15, 2003.

4. Lipps, P. E. Mills, D., De Wolf, E. D. and Madden, L. V. 2003. Fusarium head scab risk forecasting for Ohio, 2002-2003. Page 148 in: 2003 National Fusarium Head Blight Forum Proceedings, Bloomington, MN. Dec. 13-15, 2003.

5. Lipps, P. E., Johnston, A. L. and Madden, L. V. 2003. Results of the uniform Fusarium head blight fungicide test on winter wheat in Ohio, 2003. Pages 92-93 in: 2003 National Fusarium Head Blight Forum Proceedings, Bloomington, MN. Dec. 13-15, 2003.

6. Paul, P. A., El-Allaf, S. M., Lipps, P. E. and Madden, L. V. 2003. Development of Fusarium head blight of winter wheat in Ohio as influenced by planting date, cultivar maturity and inoculum level.. Page 156-159 in: 2003 National Fusarium Head Blight Forum Proceedings, Bloomington, MN. Dec. 13-15, 2003.

7. Paul. P. A.., Madden, L. V. and Lipps, P. E. 2003. Splash dispersal of spores of Fusarium graminearum using a single-drop generator. Page 160 in: 2003 National Fusarium Head Blight Forum Proceedings, Bloomington, MN. Dec. 13-15, 2003.

8. Schisler, D. A, Slininger, P. J., Behle, R. W., Zhan, S., Boehm, M. J., Lipps, P. E. and Palmquist, D. E. 2003. USDA-ARS, Ohio State University cooperative research on biologically controlling Fusarium head blight 1: In vitro and field testing of the effect of UV protectants on FHB antagonists. Pages 105-108 in: 2003 National Fusrium Head Blight Forum Proceedings, Bloomington, MN. Dec. 13-15, 2003.

Extension:

1. Lipps, P. E. and Mills, D. 2003. Forecasting Fusarium Head Scab of Wheat in Ohio, 2003. Ohio Agricultural Research and Development Center, Plant Pathology Department Series 119. August 2003. 16 pages.

2. Engle, J. E., Lipps, P. E. and Mills, D. 2003. Fusarium head blight severity scale for winter wheat. Ohio State University Extension Fact Sheet. AC-49-03

Web sites:

1. Lipps, P. E. and Mills, D. 2003. Forecasting Fusarium head blight of wheat in Ohio. http://www.oardc.ohio-state.edu/ohiofieldcropdisease.