

**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:	59-0790-4-112
FY04 ARS Agreement Title:	Splash Dispersal, Inoculum Level and Fungicide Effects on Fusarium Head Blight.
FY04 ARS Award Amount:	\$ 54,634

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, 2004.	\$ 5,854
EDM	Effect of Inoculum Level on Fusarium Head Blight and Splash Dispersal of Gibberella zeae.	\$ 48,780
	Total ARS Award Amount	\$ 54,634

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, 2004.*

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

No single disease management protocol has been highly effective in preventing yield reductions or DON accumulation in grain affected by Fusarium head blight. Results of fungicide testing for efficacy against Fusarium head blight indicate that certain triazole products have better efficacy when used on spring wheat in the Northern Great Plains regions than on winter wheat in the Midwest and Eastern wheat growing regions of the US. Continued testing of new chemistry is essential in providing efficacy data to justify labeling new products for use on wheat for Fusarium head blight control. The Chemical and Biological Control Research Committee of the Wheat and Barley Scab Initiative establishes protocols for evaluation of fungicides each year. These protocols are used by researchers in a number of states in 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 Fusarium head blight fungicides evaluations since 1998.

2. What were the most significant accomplishments?

Field plots were established at Wooster, Ohio in the fall of 2004 using the susceptible cultivar Elkhart. Daily mist irrigation favored disease development during and 1 wk following anthesis. Rain occurred on 16 of the 27 days between when disease assessments were made and plots were harvested resulting in very high disease incidence (69 to 90%). Frequent rain events kept the heads almost continuously wet during grain maturation. By harvest, the deterioration of grain resulted in very low yields (25 to 33 bu/A) and test weights (43.3 to 46.1 lb/bu). Based on analysis of variance, the effect of treatment was significant for all disease assessments, percentage damaged kernels, yield and test weight. Only the JUA6476 5.0 fl oz /A treatment significantly reduced FHB incidence, FHB severity, FHB index, and percentage damaged kernels and significantly increased yield and test weight compared to untreated control. Folicur and Tilt were similar in their effect in reducing disease and impacting yield and test weight. Plots treated with the combination of JUA6476 and Folicur had the lowest disease levels(FHB index =9), but these were not always significantly lower than other treatments. JUA6476 (5.0 fl oz/A), V10116 (6.0 fl oz/A) and the combination of JUA6476 plus Folicur reduced the level of DON in grain as compared to the untreated control, but the DON levels detected were very high regardless of the treatment applied (22 to 31 ppm). Results indicate that none of the fungicides or fungicide combinations were effective in reducing Fusarium head blight or DON levels to acceptable amounts.

3. Impact: The lack of fungicide consistency in achieving lowered DON levels and yield improvements has limited some winter wheat growing states from requesting Section 18 emergency labels for Folicur. Our results, and those of other cooperating states, indicate that fungicides currently available for testing have limited efficacy in the soft red winter wheat areas of the eastern U.S. Not requesting section 18 registration for these fungicides have saved growers from increased production costs that in all likelihood would not result in an economic return.

Project 2: *Effect 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?

Several factors influence the development of Fusarium head blight (FHB). Among these factors, crop residue (a local source of inoculum) is thought to be one of the most important because *Gibberella zeae* (causal agent of the disease) overwinters in the residue left on the soil surface, providing a readily available source of inoculum for the development of the disease. However, the importance of a local source of inoculum relative to an external source in an area (such as Ohio) with high background levels of inoculum has been the subject of debate among researchers. In addition, it is unclear whether the relative importance of local inoculum is dependent on other key factors such as planting date, cultivar maturity (flowering), and weather conditions. To address these questions, two experiments were conducted during the 2003-2004 growing season. In the first experiment, plots were planted to obtain three levels of corn residue (0, 15 and 80% soil coverage), two planting dates (Oct 3 and Oct 20) and three cultivars varying in relative maturity (flowering date). In one plot of each residue level, 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 spikes 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.

In the second experiment, the development of FHB and the abundance of propagules of *G. zeae* relative to distance from a local source of inoculum was investigated in field plots. Maize kernels infested with *G. zeae* were placed on the soil surface at the corner of each plot. Disease intensity was assessed and samples of wheat spikes and rain splash (at 30 and 100 cm above the soil surface) were collected at regular intervals in three directions from the source of inoculum. Rain splash and wheat spikes were assayed for spores of *G. zeae*.

2. What were the most significant accomplishments?

Residue level, planting date, and cultivar maturity all had a significant effect on the development of FHB. However, interactions involving residue level and the other two factors were not significant, suggesting that under the conditions of this study, the role of residue in the development of FHB was independent of planting date and cultivar maturity. Mean disease intensity was higher in plots with 80% residue than in plots with 15 and 0% residue on the soil surface. Very similar levels of disease occurred in plots with 15 and 0% residue. Similar patterns of spore recovery from air samples (Burkard) were observed in each residue plot. The mean number of spores per spike was slightly higher in plots with 80% residue than in plots with 15 and 0% residue. Peaks in the number of spores per spike coincided with major rainfall events.

Spores were recovered from rain splash and wheat spikes at each distance and direction from the local source of inoculum. Distance, height, and their interaction significantly affected the number of spores recovered per ml of splashed rain and spore flux density (spores recovered per square cm per hour). FHB intensity and number of spores per spike decreased by 30 and 12%, respectively, with increasing distance from the source of inoculum.

3. Impact

In spite of the fact that background levels of (airborne) spores of *G. zeae* is generally very high in Ohio due to the high acreage of reduced-tillage corn, our results showed that local (within field) sources of inoculum still play a key role in the development of FHB. Head wash spore counts and disease intensity were higher in plots with higher levels of inoculum, and both spore counts and disease intensity decreased as distance from the local source of inoculum increased. This suggests that crop residue on the soil surface beneath the wheat canopy contributes more inoculum for the development of FHB than spores blown in from outside sources. The use of crop residue as a predictor (along with weather) of Fusarium head blight risk is currently being evaluated in 23 states as part of a web-based risk assessment model.

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.

Engle, J. S., L. V. Madden and Lipps, P. E. 2004. Effects of choline, betaine, and wheat floral extracts on growth of *Fusarium graminearum*. Plant Dis. 88:175-180.

Paul, P. A., El-Allaf, S. M., Lipps, P. E. and Madden, L. V. 2004. Rain splash dispersal of *Gibberella zeae* within wheat canopies in Ohio. Phytopathology 94:1342-1349.

Khan, N. I., Schisler, D. A., Boehm, M. J., Lipps, P. E. and Shininger, P. J. 2004. Field testing of antagonists of Fusarium head blight incited by *Gibberella zeae*. Biological Control 29:245-255. doi:10.1016/S1049-9644(03)00157-9.

Lipps, P. E., Johnston, A. L and Mills, D. R. 2004. Evaluation of foliar fungicides for control of Fusarium head blight on winter wheat in Ohio, 2003. Fungicide and Nematicide Tests (online.) Report 59:CF005. DOI: 10.1094/FN59. The American Phytopathological Society, St. Paul, MN.

Lipps, P. E., Johnston, A. L and Mills, D. R. 2005. Evaluation of foliar fungicides for control of Fusarium head blight on winter wheat in Ohio, 2004. Fungicide and Nematicide Tests (online.) Report 60:CF007. DOI: 10.1094/FN60. The American Phytopathological Society, St. Paul, MN.

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

Paul, P. A., Lipps, P. E. and Madden, L. V. 2004. Influence of drop size, fall height, and target type on splash dispersal of *Gibberella zeae* and the amount of water splashed. Phytopathology 94:S82.

Paul, P. A., Lipps, P. E. and Madden, L. V. 2004. Relationship between the environment and the amount of *Gibberella zeae* inoculum recovered from wheat heads in Ohio.. Phytopathology 94: S82.

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.

De Wolf, E. D., Lipps, P. E., Miller, D., Knight, P., Molineros, J., Francl, L. and Madden, L. V. 2004. Evaluation of prediction models for Wheat Fusarium head blight in the US, 2004. Pages 439 in: Proceedings 2nd International Symposium on Fusarium Head Blight, Orlando, FL. Dec. 11-15, 2004.

Molineros, J. E., Madden, L. V., Lipps, P. E., Shaner, G., Osborne, L., Shaukat, A., Francl, L. and De Wolf, E. D. 2004. Comparison of methods for developing Fusarium head blight forecasting models. Page 475 in: Proceedings 2nd International Symposium on Fusarium Head Blight, Orlando, FL. Dec. 11-15, 2004.

Madden, L. V., Lipps, P. E. and De Wolf, E. 2004. Developing forecasting systems for Fusarium head blight. Page 471 in: Proceedings 2nd International Symposium on Fusarium Head Blight, Orlando, FL. Dec. 11-15, 2004.

Paul, P. A., Lipps, P. E. and Madden, L. V. 2004. Inoculum gradient of *Gibberella zea* from small area sources within wheat canopies in Ohio. Page 483 in: Proceedings 2nd International Symposium on Fusarium Head Blight, Orlando, FL. Dec. 11-15, 2004.

Paul, P. A., El-Allaf, S. M., Lipps, P. E. and Madden, L. V. 2004. Relationship between the environment and the number of *Gibberella zea* propagules recovered from wheat spikes. Page 484 in: Proceedings 2nd International Symposium on Fusarium Head Blight, Orlando, FL. Dec. 11-15, 2004.

Schaafsma, A. W., Hooker, D. C., Lipps, P. E., Gilbert, J., Fernandez, M., De Wolf, E. D., Chandelier, A. Detrizhe, P. and Dill-Macky, R. 2004. Approaches to using epidemiological knowledge for the management of Fusarium head blight of wheat. Pages 506-509 in: Proceedings 2nd International Symposium on Fusarium Head Blight, Orlando, FL. Dec. 11-15, 2004.

Schisler, D. A., Zhang, S., Boehm, M. J. and Lipps, P. E. 2004. USDA-ARS, Ohio State University cooperative research on biological control of Fusarium head blight 1: Use of diatomaceous earth as a carrier form formulations of the antagonist *Cryptococcus nodaensis* OH 182.9. Pages 369-373 in: Proceedings 2nd International Symposium on Fusarium Head Blight, Orlando, FL. Dec. 11-15, 2004.

Sneller, C., Lipps, P., Herald, L. and Johnston, A. 2004. FHB resistance in soft red winter wheat adapted to the eastern US. Page 165 in: Proceedings 2nd International Symposium on Fusarium Head Blight, Orlando, FL. Dec. 11-15, 2004.

Sneller, C., Garcia, G., Nolan, R., Gupta, A., Lipps, P., Herald, L. and Johnston, A. 2004. Genetics of FHB resistance in the soft red winter wheat cultivar 'Freedom'. Pages 166 in: Proceedings 2nd International Symposium on Fusarium Head Blight, Orlando, FL. Dec. 11-15, 2004.

Sneller, C., Lipps, P., Herald, L. and Johnston, A. 2004. Report on the 2003-04 Northern Uniform Winter Wheat Scab Nursery (NUWWSN). Pages 167-170 in: Proceedings 2nd International Symposium on Fusarium Head Blight, Orlando, FL. Dec. 11-15, 2004.

Lipps, P. E., Mills, D. R. and Madden, L. 2004 Forecasting Fusarium Head Scab of Wheat in Ohio in 2004 and Summary of Disease Levels, 2002-2004. Ohio Agricultural Research and Development Center, Plant Pathology Department Series 125. August 2004. 15 pages.

Beuerlein, J., Lipps, P., and Minyo, Jr., R. 2004. Ohio Wheat Performance Trials, 2004. Ohio Agricultural Research and Development Center, Horticulture and Crop Science Series 228. July 2004. 13 pages.

Sneller, C. H., Lipps, P. E. and Herald, L. 2004. Northern uniform winter wheat scab nursery report on 2003-2004 nursery. Ohio Agricultural Research and Development Center, Horticulture and Crop Science Series 690. 24 pages.

De Wolf, E., Madden, L., Lipps, P., Knight, P. and Miller, D. 2004. Wheat Fusarium Head Blight Prediction Center. <http://www.oardc.ohio-state.edu/ohiofieldcropdisease> or <http://www.wheatscab.psu.edu/>.

Lipps, P. and Mills, D. 2004 "Wheat heading in southern Ohio; What is th risk of head scab" Crop Observation and Recommendation Network (C.O.R.N.) 2004-13 May 11-18, 2004. <http://agcrops.osu.edu/>

Lipps, P. and Mills, D. 2004. "Current risk of head scab in Ohio" Crop Observation and Recommendation Network (C.O.R.N.) 2004-14, May 18- 2004. <http://agcrops.osu.edu/>

Lipps, P. and Mills, D. 2004. "Fungicide applications on wheat" Crop Observation and Recommendation Network (C.O.R.N.). 2004-15, May 25-June 2, 2004. <http://agcrops.osu.edu/>

Lipps, P. and Mills, D. 2004. "Wheat scab risk high in north central Ohio". Crop Observation and Recommendation Network (C.O.R.N.). 2004-15, May 25-June 2, 2004. <http://agcrops.osu.edu/>

Lipps, P. and Mills, D. 2004. "Wheat head scab showing up in southern Ohio". Crop Observation and Recommendation Network (C.O.R.N.). 2004-16, June 1-8, 2004. <http://agcrops.osu.edu/>

Lipps, P. and Mills, D. 2004. "Update on wheat head scab development". Crop Observation and Recommendation Network (C.O.R.N.). 2004-17, June 8-15, 2004. <http://agcrops.osu.edu/>