

**U.S. Wheat and Barley Scab Initiative
 FY01 Final Performance Report (approx. May 01 – April 02)
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Cover Page

PI:	Marcia McMullen
Institution:	North Dakota State University
Address:	Dept. of Plant Pathology Walster Hall, Rm 303 Fargo, ND 58105
Email:	mmcmulle@ndsuent.nodak.edu
Phone:	701-231-7627
Fax:	701-2131-7851
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Grant Title:	Fusarium Head Blight Research
FY01 ARS Award Amount:	\$ 44,076

Project

Program Area	Project Title	Requested Amount
Chem/Bio	Identification of Application Technologies that will Optimize Fungicide Efficacy against Fusarium Head Blight	\$ 32,229
Chem/Bio	Uniform fungicide trials to identify safe products that are effective against Fusarium head blight	\$ 12,049
	Total Amount Requested	\$ 44,278

Principal Investigator

Date

Project 1: Identification of Application Technologies that will Optimize Fungicide Efficacy against Fusarium Head Blight

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

Appropriate delivery of fungicides and/or biological agents to wheat and barley grain heads is crucial for effective control of Fusarium head blight (FHB). Fungicides available to protect small grains from FHB are locally systemic, meaning they move into the plant tissue at site of deposition, but only minimally translocate beyond the site of deposition. Biological agents do not translocate. The site of infection for this disease is the grain head, a plant structure with vertical architecture, a waxy surface, and often with long awns that interfere with spray deposition and retention. These characteristics, the architecture of the grain head and the non-translocation characteristics of the control products, have made it crucial to explore ways of spray application that will improve deposition and retention on the grain heads. In addition, infection in nature often occurs during multiple favorable environmental events instead of a single infection event at flowering. Thus, control with fungicides could theoretically be improved if multiple applications of fungicides were applied. We wanted to see if split applications at reduced rates of product would be viable for controlling FHB when multiple infection events occurred.

Our project has used greenhouse and field experiments to examine various parameters for improvement in spray application techniques. In previous experiments, we examined nozzle types and configurations, spray pressures, spray volumes, types and rates of adjuvants, and appropriate timings of applications and use of split rates of product. Two 2001 summer field experiments on Oxen spring wheat in Fargo, ND examined five adjuvants for their ability to improve control of FHB when added to two fungicides. During the winter of 2001-2002, 31 separate greenhouse trials on headed spring wheat, durum wheat, and barley were done to evaluate experimental and registered adjuvants and evaluate split timings of application and split rates of registered and experimental fungicides.

2. What were the most significant accomplishments?

Field experiments with adjuvants demonstrated that adjuvants provided improved control of FHB with Folicur and Tilt fungicides. Differences among adjuvants were not significant, but a non-ionic surfactant and an experimental consistently gave improved control. More extensive experiments in the greenhouse with adjuvants indicated that with Folicur fungicide, a non-ionic surfactant consistently provided the greatest reduction in FHB, while, with Tilt fungicide, a low rate (0.03% v/v) of a silicone-based adjuvant improved control. Experimental adjuvants from NDSU and Agrilience also enhanced performance of the fungicides. In timing of application studies, grain heads were inoculated with spores of *Fusarium graminearum* at 50% head emergence, early head emergence (barley) or flowering (wheat) and at kernel watery-ripe stage. Severe infections were achieved with infections at flowering or with multiple inoculations. A single application of a full rate of Folicur fungicide was as effective in controlling FHB as split applications of this fungicide applied at 2 + 2 fl oz or 1 + 2 + 2 fl oz, indicating that farmers may target their fungicide for a single application timing, early flowering in wheat.

Project 2: Uniform fungicide trials to identify safe products that are effective against Fusarium head blight

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

Fungicides and biological agents have been evaluated over several years for efficacy in controlling Fusarium head blight (FHB). These products, if effective, could provide an immediate tool for producers to use in reducing FHB severity, tombstone kernels and DON (vomitoxin). Information gathered from trials across North Dakota and through the regional and national uniform trials has led to special registrations for products that producers now have available to reduce this disease. In North Dakota, fungicide data has led to a Special Exemption (Section 18) for Folicur fungicide and a 24C (state label) registration for Tilt fungicide for heading application. ND producers have realized yield gains of approximately 20% when these fungicides were used to control the disease. The problem is that these fungicides still do not adequately reduce DON levels to that required by the malting and milling industry, and additional FHB reductions and yield increases are needed for improved economic return.

Further studies were established to resolve questions about fungicide and biocontrol agent efficacy. North Dakota participated in the national Uniform Fungicide and Biological Agent Trials across multiple environments and grain classes in 2001. Uniform trials were established at four locations in the state, across multiple environments and across two wheat classes and barley. Multiple environments increased the likelihood of a FHB infection at one or more test sites. The trial consisted of testing one special exemption fungicide (Folicur), two experimental fungicides (Bayer AMS 21619, BASF 505), and two biological agents (one from Cornell, one from USDA – Peoria). A uniform protocol for testing was used.

2. What were the most significant accomplishments?

FHB severity varied among locations, with test plots at Fargo having the lowest disease because of high temperatures during critical growth stages, while Carrington and Minot having severe infections, up to 42.1% field severity. All fungicide treatments significantly reduced FHB field severity, but the biological agents did not. The AMS experimental fungicide had the greatest impact on DON levels, averaging a 72% reduction in DON ppm. Yield increases with fungicides ranged from 25-30% with fungicides, but were non-significant with the biological agents. Test results showed that experimental fungicides have greater promise for FHB control and DON reduction than currently available fungicides. Test results also showed that improvements with biological agent applications need to be made before they can be viable alternatives for fungicides in standard disease control in wheat and barley production in the state.

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.

Halley, S., McMullen, M., Pedersen, and Moos, J. 2001. Fungicide application timing effects on field severity of Fusarium head blight in wheat and barley. *Phytopathology* 91:S177.

Jordahl, J., Meyer, S., and McMullen, M. 2001. Further studies on the effects of timing of application and of adjuvants on fungicide control of FHB. Page 65 in: *Proceedings of the 2001 National Fusarium Head Blight Forum, Cincinnati, Dec. 8-10, 2001*. U.S. Wheat and Barley Scab Initiative, Michigan State Univ., East Lansing, MI.

Krupinsky, J.M., Bailey, K.L., McMullen, M. P., Gossen, B.D., and Turkington, T. K. 2002. Managing plant disease risk in diversified cropping systems. *Agron. J.* 94: 198-209.

McMullen, M. 2002. Success factors in controlling FHB. Pages 20-22 in: *Prairie Grains* (Issue 46, June 2002). Minnesota Association of Wheat Growers, Red Lake Falls, MN 56750.

McMullen, M., Halley, S., and Jordahl, J. 2001. Evaluations of fungicides and a biological agent for control of Fusarium head blight, leaf rust and leaf spots in barley, 2000. *Fungicide and Nematicide Tests* 56: CF-1.

McMullen, M., Halley, S., and Jordahl, J. 2001. Evaluations of fungicides and a biological agent for control of Fusarium head blight, leaf rust and leaf spots in wheat, 2000. *Fungicide and Nematicide Tests* 56:CF-11.

McMullen, M., Jordahl, J., and Meyer, S. 2001. Adjuvants and efficacy of Folicur and Tilt fungicides for control of Fusarium head blight in small grains. *Phytopathology* 92 S. Poster presentation at NC APS division meeting, Manhattan, KS, June 20, 2001.

McMullen, M., Jordahl, J., Meyer, S., Lukach, J., and Gregoire, T. 2001. Updates on NDSU studies for optimizing fungicide application for scab control. Pages 4-5 in: *Prairie Grains* (Issue 38, June 2001). Minnesota Association of Wheat Growers, Red Lake Falls, MN 56750.

McMullen, M., Lukach, J., McKay, K., and Schatz, B. 2001. ND Uniform wheat fungicide trials, 2001. Page 476 in: *Crop Production Guide 2002, Crop Production Guide No. 12*, NDSU Extension Service, Fargo, ND 58105.

McMullen, M., Lukach, J., Jordahl, J., and Meyer, S. 2001. Uniform barley fungicide trials in North Dakota, 2001. Page 66 in: *Proceedings of the 2001 National Fusarium Head Blight Forum, Cincinnati, Dec. 8-10, 2001*. U.S. Wheat and Barley Scab Initiative, Michigan State Univ., East Lansing, MI.

McMullen, M., Lukach, J., McKay, K., and Schatz, B. 2001. ND Uniform wheat fungicide and biocontrol trials, 2001. Pages 67-69 in: Proceedings of the 2001 National Fusarium Head Blight Forum, Cincinnati, Dec. 8-10, 2001. U.S. Wheat and Barley Scab Initiative, Michigan State Univ., East Lansing, MI.

McMullen, M., Lukach, J., McKay, K., and Schatz, B. 2002. Efficacy of foliar fungicides and a biological for control of Fusarium head blight across spring wheat cultivars, 2001. Fungicide and Nematicide Tests 57:CF05.

McMullen, M., Jordahl, J., and Meyer, S. 2002. Evaluation of foliar fungicides and biologicals for control of Fusarium head blight and leaf diseases in spring wheat, 2001. Fungicide and Nematicide Tests 57:CF19.

Milus, E. A., Hershman, D., and McMullen, M. 2001. Analysis of the 2001 uniform wheat fungicide and biocontrol trials across locations. Pages 75-79 in: Proceedings of the 2001 National Fusarium Head Blight Forum, Cincinnati, Dec. 8-10, 2001. U.S. Wheat and Barley Scab Initiative, Michigan State Univ., East Lansing, MI.

Panigrahi, S., Kubiak, A., McMullen, M., and Jordahl, J. 2001. Evaluation of UV spectrum for controlling Fusarium head blight. Paper 011122 in: Proceedings of American Society of Agricultural Engineers (ASAE) 94th Annual International Meeting, Sacramento, CA, July 29-Aug. 1, 2001.

Pederson, J.D., Horsley, R.D., and McMullen, M. P. 2001. Efficacy of fungicides in controlling Fusarium head blight on barley genotypes with partial resistance. Pages 82-86 in: Proceedings of the 2001 National Fusarium Head Blight Forum, Cincinnati, Dec. 8-10, 2001. U.S. Wheat and Barley Scab Initiative, Michigan State Univ., East Lansing, MI.