

**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:	59-0790-9-053
Grant Title:	Fusarium Head Blight Research
FY02 ARS Award Amount:	\$ 48,697

Project

Program Area	Project Title	USWBSI Recommended Amount
CBC	Uniform trials to identify safe fungicides and biological agents effective against Fusarium Head Blight, ND.	\$15,378
CBC	Identification of Application Technologies that will Optimize Fungicide Efficacy against Fusarium Head Blight.	\$34,536
	Total Amount Recommended	\$49,914

Principal Investigator

Date

Project 1: Uniform trials to identify safe fungicides and biological agents effective against Fusarium Head Blight, ND.

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

Fungicides and biological agents could provide an immediate tool for producers to use in reducing FHB severity, tombstone kernels and DON (vomitoxin). Disease resistance is still limited in various wheat classes and barley, and producers need additional management options. Fungicides and biological agents have been evaluated over several years for efficacy in controlling Fusarium head blight (FHB). 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 FHB reductions on average of 50% and 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.

A uniform trial, consisting of four fungicide and three biological agent treatment trials, was established in hard red spring wheat, spring barley, and durum wheat in North Dakota at four locations - Fargo, Minot, Carrington and Langdon. Experimental and special use products for FHB control were included. The uniform trials were part of a cooperative effort among multiple states in spring grain regions and in winter wheat regions of the United States. The establishment of a core set of uniform treatments across a number of states allows evaluation of products and methods for consistency in performance over a wide number of environments and across grain types affected by Fusarium head blight (FHB). Also, because FHB does not occur every year in every location, regardless of attempts to ensure infection through added inoculum or misting systems, having the trials across multiple environments increases the chance of favorable disease levels for evaluation of new materials across sites.

2. What were the most significant accomplishments?

Fungicide treatments reduced FHB field severity by 47-59% in wheat and by 67-75% in barley, and reduced DON levels by up to 69% in durum wheat. The experiments showed that two experimental fungicides had greater efficacy than the Section 18 Folicur product, which is a standard. This data indicates further testing is needed for these two experimental products to gain efficacy information for the registration progress. Biological agents did not provide as much control of FHB as did fungicides tested. Tests with a combination of a fungicide + a biological indicated that the biological control can be enhanced with a fungicide combination.

Project 2: 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?

Fungicides available to protect small grains from FHB act either as protectants or are locally systemic. Because they don't translocate widely in the plant, it is crucial to deliver the fungicides to the grain spike, the site of infection. But grain spikes are difficult targets for application - they have a vertical architecture, are often waxy, and generally have awns that interfere with fungicide deposition and retention. Methods to improve ways of getting the fungicides to the target site began in North Dakota in the summer of 1998 and have continued with field and greenhouse studies. Funds from an initial USDA scab initiative grant built a semi-permanent greenhouse which is home to an experimental track sprayer used for fungicide application studies. Optimum spray pressures for various nozzles and optimum gallons/acre for each crop were studied. Summer field tests helped validate greenhouse results and further examined spray pressures and nozzles, and compared an experimental air assist (Spray Air) sprayer to other sprayer types. Forward and backward nozzles angled toward the grain head consistently provided the best head coverage in trials and this information was provided to producers who subsequently adapted their sprayers.

More recent field and greenhouse studies have shown that some types of adjuvants perform better with certain fungicide chemistries and that rate of adjuvant also is important. The most promising adjuvants are experimentals; further validation of their performance was done in the greenhouse to provide data that would lead to commercialization and availability to producers.

Information also was needed on the optimum timing of fungicide application to spring wheat, durum, and barley under circumstances of multiple infection events. Cost of spray applications and time restraints often prohibit producers from using multiple applications; however, in nature, multiple infection events often occur. Experiments were designed to evaluate whether multiple, split rate, applications of fungicide would provide significantly greater control of FHB under multiple infection events than a single application at the optimum timing.

2. What were the most significant accomplishments?

Several experimental adjuvants provided by Agrilience Co. resulted in significantly improved FHB control over the use of a standard non-ionic surfactant, when tested with Folicur fungicide. These adjuvants were tested in the greenhouse and will be tested in the field during the summer of 2003. Continued success with these adjuvants will aid development and commercialization.

In the multiple infection, multiple fungicide application studies on wheat, durum, and barley, multiple infection events resulted in higher FHB field severities than did a single inoculation event. However, split applications of reduced rates of Folicur across multiple growth stages generally did not significantly improve disease control over a single treatment of the full label rate at the most susceptible growth stage, Feekes 10.5 in barley and Feekes 10.51 in wheat. The data also showed that the least satisfactory control was with a single application at Feekes 10.54, when kernels were in the watery ripe stage. These results have important implications for producers using fungicides.

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.

Publications and Presentations

Jordahl, J., Meyer, S., and McMullen, M. 2002. Multiple infection events and split timing of Folicur fungicide applications for control of FHB in hard red spring wheat, durum wheat, and spring barley, 2002. Page 91 in: Proceedings of the 2002 National Fusarium Head Blight Forum Proceedings, Erlanger, KY, Dec. 7-9, 2002. 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. 2003. Impacts of FHB on the North American Agriculture Community - the Power of One Disease to Catapult Change. Pages 484-503 in: B. Bushnell and K. Leonard, eds. *Fusarium Head blight of Wheat and Barley*. APS Press, St. Paul, MN.

McMullen, M., Jordahl, J., and Meyer, S. 2003. Evaluation of fungicides and biological agents for Fusarium head blight and leaf disease control in wheat, 2002. *Fungicide and Nematicide Tests* 58:CF011.

McMullen, M., Lukach, J., McKay, K., and Schatz, B. 2002. Fungicide and biological agent effects on Fusarium head blight across two wheat classes. *Journal of Applied Genetics* 43A: 223-226.

McMullen, M., Lukach, J., McKay, K., and Schatz, B. 2002. ND uniform wheat fungicide and biological agent trials, 2002. Pages 97-99 in: Proceedings of the 2002 National Fusarium Head Blight Forum Proceedings, Erlanger, KY, Dec. 7-9, 2002. U. S. Wheat and Barley Scab Initiative, Michigan State Univ., East Lansing, MI.

McMullen, M., Lukach, J., McKay, K., and Schatz, B. 2002. Uniform what fungicide and biological agent trials, ND, 2002. 2003 Crop Production Guide # 13: 458-459. NDSU Extension Service, Fargo, ND.

McMullen, M., Meyer, S., and Jordahl, J. 2003. Evaluation of fungicides and biological agents for Fusarium head blight control in barley, 2002. *Fungicide and Nematicide Tests* 58:CF012.

McMullen, M., Meyer, S., and Jordahl, J. 2002. Uniform barley fungicide and biological agent trials, Fargo, ND, 2002. 2003 Crop Production Guide # 13: 460. NDSU Extension Service, Fargo, ND.

McMullen, M. and Milus, E. 2002. History and accomplishments of the USWBSI uniform fungicide and biological control trials, 1998-2002. Page 96 in: Proceedings of the 2002 National Fusarium Head Blight Forum Proceedings, Erlanger, KY, Dec. 7-9, 2002. U. S. Wheat and Barley Scab Initiative, Michigan State Univ., East Lansing, MI.

McMullen, M. and Sayler, T. 2002. Success factors in controlling FHB. Pages 20-22 in: *Prairie Grains*, Issue 46. Published by Minnesota Assn. of Wheat Growers.

McMullen, M. and Sayler, T. 2003. Another Section 18 season for Folicur. Page 35 in: *Prairie Grains*, Issue 53. Published by Minnesota Assn. of Wheat Growers.

McMullen, M. and Sayler, T. 2003. Controlling wheat leaf diseases, FHB: fungicides can make a difference. Pages 19-20 in: *Prairie Grains*, Issue 54. Published by Minnesota Assn. of Wheat Growers.

Meyer, S., Jordahl, J., and McMullen, M. 2002. Uniform barley fungicide and biological agent trials, Fargo, ND, 2002. Pages 104-105 in: Proceedings of the 2002 National Fusarium Head Blight Forum Proceedings, Erlanger, KY, Dec. 7-9, 2002. U. S. Wheat and Barley Scab Initiative, Michigan State Univ., East Lansing, MI.

Pedersen, J. D., Horsley, R.D., McMullen, M., and McKay, K. 2002. Efficacy of fungicides in controlling barley Fusarium head blight in lines with partial resistance. Page 10 in: Proceedings of the 2002 National Fusarium Head Blight Forum Proceedings, Erlanger, KY, Dec. 7-9, 2002. U. S. Wheat and Barley Scab Initiative, Michigan State Univ., East Lansing, MI.

Scherer, T. F., Kirkpatrick, D. and McMullen, M. P. 2002. Automated control of a watering system for Fusarium head blight (scab) research. Amer. Soc. Agric. Eng. MBSK02-305.

Presentations related to FHB, fungicides, and application technology during FY02:

July, 2002	Field Days at five separate research extension centers in North Dakota
Oct. 4, 2002	Canadian Western Plant Pathologists Meeting, Winnipeg, Manitoba
Dec. 3, 2002	N.D. Ag. Association Trade Show, Fargo, ND
Jan. 7, 2003	Lake Region Roundup, Devils Lake, ND
Jan. 28, 2003	Fungicide and FHB training for Agriliance Co., Fargo
Jan. 29, 2003	Manitoba-ND Zero Till Assoc. meeting, Brandon, Manitoba
Feb. 25, 2003	Grand Forks County Improvement meeting, Grand Forks, ND
Mar. 4, 2003	Eastern Crop Scout School, Fargo, ND
Mar. 29, 2003	Four State Cropping Systems Conference, Sidney, NE
April 9, 2003	Agent Update at Extension Spring Conference, Fargo, ND