USDA-ARS / USWBSI
FY03 Final Performance Report (approx. May 03 – April 04)
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Cover Page

PI:	**Marcia McMullen**
Institution:	**North Dakota State University**
Address:	**Department of Plant Pathology** **Walster Hall, Rm 303** **Fargo, ND 58105**
E-mail:	**Marcia.McMullen@ndsu.nodak.edu**
Phone:	**701-231-7627**
Fax:	**701-231-7851**
Year:	**FY2003 (approx. May 03 – April 04)**
FY03 ARS Agreement ID:	**59-0790-9-053**
FY03 ARS Agreement Title:	**Evaluation of fungicides and biological agents and ground and aerial application techniques for improved FHB control in ND.**
FY03 ARS Award Amount:	**$ 61,138**

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Adjusted Award Amount
CBC	Uniform trials to identify safe fungicides and biological agents effective against Fusarium head blight across four locations and multiple wheat classes and barley in ND.	$ 16,612
CBC	Comparison of aerial application to ground application of Folicur fungicide for control of FHB in durum wheat.	$ 8,285
CBC	Identification of application technologies that will optimize fungicide efficacy against Fusarium head blight.	$ 36241
	Total Amount Recommended	**$ 61,138**

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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 trials to identify safe fungicides and biological agents effective against Fusarium head blight across four locations and multiple wheat classes and barley in ND.***

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

Wheat and barley producers need immediate solutions for reducing Fusarium head blight. In addition to cultural and genetic management tools that may be available, fungicides have been evaluated for their ability to reduce the severity of Fusarium head blight and DON levels. Registered fungicides have reduced the disease, on average, about 50%. Greater reductions are needed. New fungicide chemistries and biological agents have been evaluated for their ability to improve control of this disease over the standard fungicide treatments available. The evaluation of the efficacy of the newer products and the appropriate rates of these products provides information on whether better products are available and, if so, the data then is used to help get registration of these products. A uniform set of fungicide treatments were evaluated across four ND locations and across spring wheat, durum wheat and barley cultivars. This multiple location, multiple class of small grains evaluations provides increased chances of determining efficacy of products across multiple conditions.

2. **What were the most significant accomplishments?** Six fungicide treatments were evaluated across four ND locations and 2 wheat classes and on spring barley. Two experimental fungicides, JAU6476 from Bayer CropScience and V-10116 from Valent, were evaluated at various rates and compared to the current standard for FHB control, Folicur fungicide. The JAU6476 at 5.7 fl oz/A provided the greatest reduction in FHB severity, a 76.7% reduction and a combination of JAU6476 + Folicur provided the greatest reduction in DON levels, a 74% reduction in wheat. Fungicide treatments provided significant improvements in disease control and yield and test weight. The Jau6476 + Folicur treatment also provided the highest yield, with a 13.1 bushel yield advantage over the untreated check and 3.1 bushel yield advantage over the best available fungicide treatment. The results indicated that experimental products are providing better control of FHB than the best available treatment.

Project 2: ***Comparison of aerial application to ground application of Folicur fungicide for control of FHB in durum wheat.***

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

Fusarium head blight has caused severe economic losses in durum wheat in ND in recent years, with millions of dollars lost to producers because of this disease. Currently grown cultivars are very susceptible to FHB, so effective fungicides and efficient means of application are essential to control the disease. Currently in ND, about half of the fungicides applied to small grains are applied by aerial application, the other half by ground application. Ground application has been thought to have the advantage because of the ability to get closer to the canopy and to provide more water as a carrier. However, when conditions are favorable for FHB development, often fields are too wet for ground application equipment, and aerial applicators play an important role in getting the fungicide to the crop. Studies on the efficacy of aerial application vs ground application are needed to determine if aerial application can be as efficient as ground application in deposition of the fungicide product, and to determine if improvements in application by air are needed. A study was conducted to examine air vs ground application of Folicur fungicide to durum wheat in an area that grows a considerable amount of the crop and has had a history of severe FHB.

2. What were the most significant accomplishments?

During the 2003 growing season, a trial was conducted comparing a conventional ground sprayer and an aerial sprayer, both in cooperation with a commercial applicator service and a durum grower, near Kenmare, ND. Fungicide application was with Folicur fungicide at early flowering, and FHB field severity was evaluated at soft dough stage of kernel development. The area of the state suffered moderate drought conditions during the latter half of the growing season, and FHB development was very low. Differences among treatments on FHB development could not be determined because of the arid conditions, but both the ground application and the aerial application treatments were similar in increasing yields by 2 to 4 bushels/acre, primarily due to some control of leaf diseases. A repeat of the experiment is necessary under more favorable conditions for FHB development.

Project 3: ***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?

Wheat is most vulnerable to infection by *Fusarium graminearum* during anthesis, while spring barley becomes vulnerable to infection at early head emergence. If prolonged periods of favorable weather for infection before or after these growth stages, multiple infections may occur, resulting in lower yield and quality than if a single infection event occurred. Wheat and barley producers need to know the optimum timing of fungicide application to get maximum control of FHB under a variety of weather events. Few producers, if any, can afford to take the time or spend the money to apply multiple applications of fungicides, unless research data can demonstrate the need and economic response. Research trials were established to evaluate the effects of multiple infection events and multiple or single fungicide applications on the severity of FHB in spring wheat, durum wheat, and spring barley. Greenhouse trials under controlled conditions allowed tests with fungicides and inoculations to be applied at various growth stages of these crops. Applications of F. graminearum spores were made at Feekes 10.3, Feekes 10.51, or Feekes 10.54. Multiple or single applications of Folicur or JAU6476 fungicide were applied at these various growth stages, as well.

2. What were the most significant accomplishments?

High levels of FHB infection were observed in the 2002-2003 greenhouse trials. FHB field severities of 77% were observed in untreated checks, and the high level of infection allowed for good separation of treatment effects. For hard red spring and durum wheat, a single, full rate application of either fungicide at anthesis resulted in significant and similar control of FHB, no matter the timing or number of inoculations. However, in barley, a single fungicide application at early full head emergence could not control the disease if multiple infection events occurred. Thus, multiple infection events in barley may have to be controlled with split applications of fungicide at multiple timings, if DON levels are to be effectively reduced.

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.

Jordahl, J., **McMullen, M.,** and Meyer, S. 2003. Differential response of barley, hard red spring wheat, and durum wheat to multiple FHB infections and fungicide treatments. Page 87 in: Proceedings of the 2003 National Fusarium Head Blight Forum, Minneapolis, MN, Dec. 13-15, 2003. U.S. Wheat and Barley Scab Initiative, Michigan State Univ., East Lansing, MI.

McKay, J., Hofman, V., **McMullen, M**., and Michels, K. 2003. Comparison of aerial application with ground application of Folicur fungicide for the control of Fusarium head lbight (FHB) in durum wheat. Page 94 in: Proceedings of the 2003 National Fusarium Head Blight Forum, Minneapolis, MN, Dec. 13-15, 2003. U.S. Wheat and Barley Scab Initiative, Michigan State Univ., East Lansing, MI.

McMullen, M., Jordahl, J., and Meyer, S. 2004. Evaluation of fungicides for Fusarium head blight and leaf disease control in wheat, 2003. Fungicide and Nematicide Tests 59:CF002.

McMullen, M., Jordahl, J., and Meyer, S. 2004. Evaluation of fungicides for Fusarium head blight control in barley, 2003. Fungicide and Nematicide Tests 59:CF003.

McMullen, M., Lukach, J., McKay, K., and Schatz, B. 2003. Wheat uniform fungicide trials, ND, 2003. Pages 95-96 in: Proceedings of the 2003 National Fusarium Head Blight Forum, Minneapolis, MN, Dec. 13-15, 2003. U.S. Wheat and Barley Scab Initiative, Michigan State Univ., East Lansing, MI.

McMullen, M., Lukach, J., McKay, K., Schatz, B. 2003. Wheat uniform fungicide trials, ND, 2003. Pages 477-478 in: Crop Production Guide 2004. NDSU Ext. Service Crop Production Guide No. 14. Fargo, ND.