

**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:	59-0790-4-114
FY04 ARS Agreement Title:	Studies of Fungicide Efficacy, and Ground and Aerial Fungicide Application Techniques for FHB Control in North Dakota.
FY04 ARS Award Amount:	\$ 67,974

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Adjusted Award Amount
CBC	Uniform Fungicide and Biocontrol Trials Across Multiple ND Sites and Grain Classes.	\$ 16,660
CBC	Refinement of Application Technologies that will Optimize Fungicide Efficacy Against FHB.	\$ 37,751
CBC	Integrated Project - Ground and Aerial Application of Fungicides for Improved FHB Control.	\$ 13,563
	Total ARS Award Amount	\$ 67,974

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 Fungicide and Biocontrol Trials Across Multiple ND Sites and Grain Classes.*

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

Wheat and barley producers need immediate solutions for controlling FHB in the absence of resistant cultivars. Although ND hard red spring producers have some improved resistant available to them in 'Alsen' wheat, this variety is not adapted to all areas of ND, and durum and barley producers must still plant fairly susceptible varieties. Producers are interested in using fungicides for FHB control, and previous research has shown the efficacy of available fungicides. In some years, ND producers have treated approximately 1 million acres of wheat with fungicides when FHB was a threat. Evaluations of registered and experimental fungicides, across grain classes and environments, provides much needed information on efficacy of products against FHB to reduce yield losses and deoxynivalenol content. In North Dakota we continue to look at available fungicides for improving FHB control over the existing products and practices. We tested six fungicide treatments in the summer of 2004 at four ND locations and across hard red spring wheat, durum wheat and barley. We determined the efficacy of experimental products vs the efficacy of a Section 18 product, Folicur, and a 24C State label product, Tilt.

2. What were the most significant accomplishments?

Fungicide testing was done in established uniform fungicide trial nurseries. Over the four locations, we determined that Folicur provides an improved control of the disease and a greater yield advantage over Tilt, and that experimental products tested were often better in improving disease control and increasing yield than Folicur or Tilt, the two effective products available to ND small grain producers.

This information was used to support the Section 18 request for Folicur for the 2005 season, and information on the experimental fungicides will be used to promote registration of these products for the future.

Project 2: Refinement of Application Technologies that will Optimize Fungicide Efficacy Against FHB.

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

Aerial application is used in about 50% of the fungicide treatments for Fusarium head blight(FHB) control in North Dakota, USA. Most sprays used in aerial application are applied in water volumes of 3 to 7 gallons per acre (gpa), depending on label requirements, while ground application water volumes generally range from 10 to 20 gpa. If fungicides could be applied at low water volumes and still be efficacious, this would allow more acres to be sprayed during one flight, thereby reducing aerial application costs. Preliminary dye coverage studies with varying water volumes on wheat heads indicated that 2 gpa resulted in less dye deposition than 5 or 10 gpa . Low spray volumes are achieved with several types of nozzles and nozzle placements. Many aerial applicators use the CP-type nozzle which has several sizes of orifices that disperse the spray solution to the direction of travel. Nozzle angle adjustments and changes in air speed also can affect droplet size. More research is needed on how to optimize aerial application of fungicides for FHB control. A cooperative study among NDSU, the Univ. of Minnesota, Crookston, and the USDA aerial application team of Texas A&M was formed to study the effect of water volume and droplet size on efficacy of fungicide application applied by air. Applications were made in July 2004 across three locations: at Hunter in east central ND, at St. Thomas in northeast ND, and at Crookston in northwest MN.

At each location, a commercial field of hard red spring wheat was treated with Folicur fungicide, with three treatments of water volume (3, 5, and 10 pga), and two treatments of droplet size (175 μ m and 350 μ m). Fungicide was applied in 50 ft swaths by the USDA/ARS aerial application team out of Texas A & M. Fungicides were applied at early-flowering stage (Feekes 10.51), using an Air Tractor AT- 402B equipped with CP-03 nozzles.

2. What were the most significant accomplishments?

FHB generally was decreased and yield increased with fungicide treatment, but few significant differences among treatments were observed. Overall, FHB severities were relatively low in the commercial fields. Location differences were significant ($P = 0.01$) across all parameters measured, except test weight. Test weights were significantly different ($P = 0.05$) by droplet size, with slightly lower test weight at the smaller droplet size. Location x water volume (gpa) interactions occurred for test weight. At the Hunter ND site, the lowest water volume did not give as good of control of FHB as the higher water volumes. Relatively low FHB field severities and significant variations across locations indicate that additional field testing will be necessary to determine FHB differences among aerial application methods.

Project 3: *Integrated Project - Ground and Aerial Application of Fungicides for Improved FHB Control.*

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

Improvements in application techniques for fungicidal control of FHB are necessary for consistent and positive response to fungicides. Information on nozzle angle, gallonage, pressure, and timing of application for anthesis infection has been researched and information on the best practices recognized from these studies has been provided to producers and adopted by many for their conventional ground sprayers. Our goal is to further identify optimum application procedures that are easily and economically adapted and adopted by producers.

Experiments were designed to evaluate further timings of application in relationship to inoculum events, environmental conditions, and use of split rates and timings, using one to several applications of fungicide and multiple infection events. Much of this work is done in a greenhouse environment with controlled conditions. The greenhouse studies concentrated on barley and durum, two grain classes in ND that have more susceptibility to FHB than the commonly grown hard red spring wheat cultivars. The study further confirmed that multiple infection events in barley could not be controlled with a single application of Folicur fungicide at early heading, but that split applications would help reduce FHB severity. However, a single application of Folicur fungicide in durum was almost equal to multiple applications of fungicide for FHB control (data table provided after project description). This work substantiated findings from the previous year. The 2004 project also continued work in evaluating adjuvants for enhancing control of FHB with two fungicides, Folicur, and the experimental JAU6476 from Bayer. Results of multiple testing trials across multiple grain classes indicated that across all grain classes, Preference or an experimental product from Agrilliance provided slightly better reductions in FHB with Folicur than did the standard Induce surfactant (data provided in table following project description). For the experimental fungicide JAU6476, a different Agrilliance experimental adjuvant and also Preference provided better reduction in FHB field severity than other products tested.

2. What were the most significant accomplishments?

Barley and durum producers have been provided with the most accurate information available on expected results of fungicide applications to their crops to control FHB, and have been provided information on the correct timing of application.

Producers have been provided information on the need for appropriate adjuvants with their fungicide application to control FHB. Many commercial firms are trying to sell their own adjuvants with fungicides for FHB control, and some are not satisfactory in performance. This information must be provided to producers so that they are not reducing their disease control by using ineffective adjuvants with their fungicide application. As new fungicides become available, appropriate adjuvants also must be identified for different chemistries.

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 your grant. Please reference each item using an accepted journal format. If you need more space, continue the list on the next page.

McMullen, M., Halley, S., Hollingsworth, C., Hofman, V., Fritz, B.K., Kirk, I.W., Hoffmann, W.C., and Martin, D.E. 2004. Integrated study of aerial application parameters to improve control of HFB with fungicides. Pages 350-351 in: Proceedings of the 2nd International Symposium on Fusarium Head Blight. Dec. 11-15, 2004, Orlando, Florida. U. S. Wheat and Barley Scab Initiative, Michigan State Univ., East Lansing, MI.

McMullen, M., Jordahl, J., and Meyer, S. 2004. Efficacy of triazole fungicides for FHB control with various adjuvants and split timings of application. Pages 346-349 in: Proceedings of the 2nd International Symposium on Fusarium Head Blight. Dec. 11-15, 2004, Orlando, Florida. U. S. Wheat and Barley Scab Initiative, Michigan State Univ., East Lansing, MI.

McMullen, M., Jordahl, J., and Meyer, S. 2005. Evaluation of fungicides for control of Fusarium head blight and net blotch in barely, 2004. Fungic. Nemat. Tests Report No. 60:CF009.

McMullen, M., Jordahl, J., and Meyer, S. 2005. Evaluation of fungicides for control of Fusarium head blight and leaf diseases in wheat, 2004. Fungic. Nemat. Tests Report No. 60:CF010.

McMullen, M., Lukach, J., McKay, K., and Schatz, B. 2004. Wheat uniform fungicide trials, ND 2004. Pages 353-354 in: Proceedings of the 2nd International Symposium on Fusarium Head Blight. Dec. 11-15, 2004, Orlando, Florida. U. S. Wheat and Barley Scab Initiative, Michigan State Univ., East Lansing, MI.

McMullen, M., Lukach, J., McKay, K., Schatz, B. 2004. Uniform fungicide trials, wheat, ND, 2004. Pages 477-478 in: 2005 North Dakota Crop Production Guide. NDSU Extension Crop Production Guide No. 15. 490 pp.

Key Presentations:

“Fungicides and fungicide application techniques for FHB control”. Jan. 5, 2005. Lake Region Roundup, Devils Lake, ND.

“Management of FHB”. Jan. 10, 2005. ND Grain Growers and US Durum Growers Forum, Bismarck, ND.

“Integrated Management of Fusarium head blight”. Jan. 18, 2005. International Fusarium Symposium sponsored by Bayer CropScience, Monheim, Germany.