U.S. Wheat and Barley Scab Initiative
FY05 Final Performance Report (approx. May 05 – April 06)
July 14, 2006

Cover Page

PI:	**Marcia McMullen**
Institution:	**North Dakota State University**
Address:	**Department of Plant Pathology** **Walster Hall, Rm 303** **Fargo, ND 58105**
E-mail:	**mmcmulle@ndsuext.nodak.edu**
Phone:	**701-231-7627**
Fax:	**701-231-7851**
Fiscal Year:	**2005**
FY05 ARS Agreement ID:	**59-0790-4-114**
Agreement Title:	**Collaborative Studies of Fungicides and Application Techniques for Improved Control of Fusarium Head Blight.**
FY05 ARS Award Amount:	**$ 73,485**

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Adjusted Award Amount
CBC	Evaluation of Fungicide Application Technologies to Optimize FHB Control.	$ 36,746
CBC	Integrated Project-Aerial Application of Fungicides for Improved FHB Control.	$ 18,178
CBC	ND Uniform Fungicide Trials Across Multiple Sites and Grain Classes.	$ 17,561
	Total Award Amount	**$ 73,485**

_____

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: *Evaluation of Fungicide Application Technologies to Optimize FHB Control.*

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

Fungicides are valuable tools in reducing FHB severity and DON levels. However, current fungicide chemistries and application techniques reduce FHB severity and DON levels on average by about 50%, with improvements needed in application techniques that will get more fungicide to the target site of infection. Improvements in application techniques for fungicidal control of FHB include finding the optimum nozzle angle and nozzle type for fungicide deposition, and for finding adjuvants that may improve distribution and retention of the fungicide. We are continuing to refine application parameters to maximize fungicide efficacy for FHB control, while assuring these techniques are easily and economically adopted by producers.

2. List the most important accomplishment and its impact (how is it being used?). Complete all three sections (repeat sections for each major accomplishment):

Accomplishment: Greenhouse experiments confirmed that a non-ionic surfactant added to triazole fungicides improved fungicide efficacy. New adjuvants that encapsulate the fungicide, in combination with a spreader-sticker adjuvant, optimized FHB control.
Impact: This work verifies the necessity of adding adjuvants to fungicides for effective FHB control and provides data on the activity of new adjuvants that are being sold by distributors.
As a result of that accomplishment, what does your particular clientele, the scientific community, and agriculture as a whole have now that they didn't have before?:
The agriculture community has a body of research information that tells what adjuvants are effective in conjunction with available fungicides for FHB control, and provides information about adjuvants that either are non-effective or are inhibitory to fungicide efficacy.

Accomplishment: The investigator collaborated with the Langdon Exp. Station and Agricultural Engineers in reviewing and providing data on nozzle configuration for fungicide control when using ground sprayers traveling at 10 mph or greater and applying less than 15 gpa.

Impact: Data provided confirms that a single nozzle, angled 30-45 degrees from the horizontal, provides similar control of FHB as the double swivel body nozzles.

As a result of that accomplishment, what does your particular clientele, the scientific community, and agriculture as a whole have now that they didn't have before?:
Growers who have not already invested in the double swivel body nozzle configuration for their ground sprayers now have information that indicates that they may equip their sprayers with a single, angled flat fan nozzle, and get similar control as the two nozzle configuration, when traveling at normal tractor speeds and using 10 gpa.

Project 2: *Integrated Project-Aerial Application of Fungicides for Improved FHB Control.*

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

Approximately 50% of fungicides applied to small grains in ND for FHB control are applied by air. It is uncertain as to what aerial application practices deposit the greatest levels of active ingredient on wheat heads for maximum FHB control. An integrated project was established across two ND locations and one NW MN location to evaluate the effect of water volume and droplet size on spray deposition and FHB control. An integrated approach was taken, where one spray plane and similar procedures were used across different wheat varieties and environments. This project cooperated on a spring wheat field near Hunter in east central ND.

2. List the most important accomplishment and its impact (how is it being used?). Complete all three sections (repeat sections for each major accomplishment):

Accomplishment: A successful aerial trial was accomplished, with good cooperation among scientists from several states, the applicator, and the producers. Data was collected on FHB incidence and head severity as impacted by three water volumes, 3, 5 or 7gpa, and three droplet sizes, 200, 275, and 350 microns. Disease levels were substantial at the Hunter, ND site, and significant differences were observed among treatments.

Impact: The industry standard treatment, of 275 micron droplet size, and 5 gpa, were shown to provide the best control of FHB, and the results established that aerial application of fungicide on spring wheat was of benefit for yield and quality of the crop.

As a result of that accomplishment, what does your particular clientele, the scientific community, and agriculture as a whole have now that they didn't have before?:
The results show that a reduction in water volume to 3 gpa is not sufficient for maximum FHB control, and that an increase of water volume to 7 gpa does not provide a significant improvement in FHB control over the 5 gpa, indicating that money can be saved by not increasing water volume, but that disease control and yield and quality results will be lost if water volume is dropped too low.

Project 3: *ND Uniform Fungicide Trials Across Multiple Sites and Grain Classes.*

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

ND producers of hard wheat, durum wheat, and barley need immediate solutions for controlling FHB in the absence of resistant cultivars. Spring wheat producers now have several tolerant varieties available, but these are not grown on all acres. Spring barley and durum producers do not yet have resistance available. Producers are using fungicides for FHB control, based on previous research showing the efficacy of available fungicides. However, these available fungicides often only reduce FHB and DON by 50-60%, and greater control is desired, especially for DON reduction. We continue to evaluate registered and experimental fungicides across grain classes and environments in ND, to provide much needed information on efficacy of products against FHB to further registration of the best products. As part of the Uniform fungicide trials across several states, we identified the most efficacious products in the presence of the severe FHB epidemic in ND in 2005.

2. List the most important accomplishment and its impact (how is it being used?). Complete all three sections (repeat sections for each major accomplishment):

Accomplishment: We successfully evaluated fungicide treatments in three of four ND locations which had extensive FHB in wheat, durum, and/or barley. We determined that all treatments significantly reduced FHB field severity and FDK over the untreated check. Two experimental products, BAS555 and Prosaro, provided the greatest reduction of DON. The data indicated that all triazole fungicides are not created equal, as two of the five tested were not satisfactory in controlling FHB.

Impact: The data support that some fungicide chemistries have better activity against FHB and reduce DON levels significantly better than registered products or other experimental fungicides. The data has important impact in providing justification for registration of these improved products.

As a result of that accomplishment, what does your particular clientele, the scientific community, and agriculture as a whole have now that they didn't have before?:
The results provide verifiable data on the efficacy of products and help support data packages presented to EPA to assist in registration of products that will truly benefit the producer by reducing DON levels.

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.

Refereed

Fritz, B.K., Kirk, I.W., Hoffman, W.C., Martin, D.E., Hofman, V., Hollinsgworth, C.R., **McMullen, M.**, and Halley, S. 2006. Aerial application methods for increasing spray deposition on wheat heads. Accepted by Applied Engineering in Agriculture Journal.

Horsley, R.D., Pederson, J.D., Schwarz, P.B., McKay, K., Hochhalter, M.R., and **McMullen, M. P.** 2006. Integrated use of tebuconazole and Fusarium head blight resistant barley genotypes in controlling Fusarium head blight and deoxynivalenol accumulation. Agron. J. 98:194-197.

Abstract

McMullen, M. 2005. An update on the impact of Fusarium head blight on North American agriculture. Phytopatholgoy 95:S123.

Proceedings

Hollingsworth, C., **McMullen, M.,** Halley, S., Hofman, V., Mottegerg, C., and Meyer, S. 2005. Cooperative study for improved management of Fusarium head blight using aerial application of fungicide. 2005. Pages 205-208 in: Proceedings of the 2005 National Fusarium head blight Forum. Dec. 11-13, Milwuakee, WI. U.S. Wheat and Barley Scab Initiative, Michigan State Univ., East Lansing, MI.

McMullen, M., Jordahl, J., and Meyer, S. 2005. Effect of adjuvants on efficacy of Folicur fungicide for FHB control. Page 215 in: Proceedings of the 2005 National Fusarium head blight Forum. Dec. 11-13, Milwuakee, WI. U.S. Wheat and Barley Scab Initiative, Michigan State Univ., East Lansing, MI.

McMullen, M., and Lukach, J. 2005. Results of the unfiorm fungicide trial on barley, North Dakota, 2005. Page 217 in: Proceedings of the 2005 National Fusarium head blight Forum. Dec. 11-13, Milwuakee, WI. U.S. Wheat and Barley Scab Initiative, Michigan State Univ., East Lansing, MI.

McMullen, M., Lukach, J., McKay, K., and Schatz, B. 2005. Wheat uniform fungicide trials, ND, 2005. Pages 218-220 in: Proceedings of the 2005 National Fusarium head blight Forum. Dec. 11-13, Milwuakee, WI. U.S. Wheat and Barley Scab Initiative, Michigan State Univ., East Lansing, MI.

Scientific Reports

McMullen, M., Jordahl, J., Meyer, S. 2005. Evaluation of fungicides for control of Fusarium head blight and net blotch in barley, 2004. Fungic. Nematicide Tests 60:CF009.

McMullen, M., Jordahl, J., and Meyer, S. 2005. Evaluation of fungicides for control of Fusarium head lbight and leaf diseases in wheat, 2004. Fungic. Nematicide Tests 60:CF010.

Extension Circulars

Aakre,D., Flaskerud, G., Hellevang, K., Lardy, G., **McMullen, M.,** Ransom, J., Sorenson, B., and Swenson, A. 2005. DON (Vomitoxin) in wheat. NDSU Extension Circular PP-1302. 4 p.

Hofman, V., Halley, S., VanEe, G., Draper, M**., McMullen, M**., and Hollingsworth, C. 2006. Ground Application of Fungicide for the Suppression of Fusarium Head Blight in Small Grains. NDSU Extension Circular AE-1314. 4 p.