USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY06 Final Performance Report (approx. May 06 – April 07)
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Cover Page

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Fiscal Year:	2006
USDA-ARS Agreement ID:	59-0790-4-114
USDA-ARS Agreement Title:	Collaborative Studies of Fungicides and Application Techniques for Improved Control of Fusarium Head Blight.
FY06 ARS Award Amount:	$ 58,805

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Award Amount
CBCC	Evaluation of Application Technologies That May Impact Fungicidal Control of FHB.	$ 41,251
CBCC	ND Uniform Fungicide Trials Across Multiple Sites and Grain Classes.	$ 17,554
	Total Award Amount	**$ 58,805**

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Principal Investigator Date

* CBCC – Chemical, Biological & Cultural Control
EEDF – Etiology, Epidemiology & Disease Forecasting
FSTU – Food Safety, Toxicology, & Utilization of Mycotoxin-contaminated Grain
GET – Genetic Engineering & Transformation
HGR – Host Genetics Resources
HGG – Host Genetics & Genomics
PGG – Pathogen Genetics & Genomics
VDUN – Variety Development & Uniform Nurseries

Project 1: *Evaluation of Application Technologies That May Impact Fungicidal Control of FHB.*

1. What major problem or issue is being resolved and how are you resolving it?
Fungicides are one management tool for reducing yield and quality losses due to FHB and DON. Producers in ND apply fungicides to wheat and barley both by aircraft and by ground sprayers. Producers need to know the optimum application techniques for both of these application methods. Application methods include aspects of sprayer nozzle types, orientation, and droplet size. In addition, information is needed on the optimum timing for application to reduce not only the FHB head severity but also the DON levels in the harvested grain. The experiments in 2006 compiled and finalized application studies on optimum nozzle orientation, spray pressures and droplet size. In addition, further studies on specific fungicide application timing for optimum DON reduction in harvested grain were conducted in the greenhouse under controlled environmental conditions.

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: The author collaborated with other researchers in the region and contributed to two NDSU Extension publications that were published and distributed, publications that provided updated information on appropriate methods for both ground and aerial application of fungicides to wheat and barley for FHB control.

Greenhouse studies on spring wheat, durum wheat and barley indicated that fungicide applications that significantly reduced FHB severity also were highly correlated with similar reductions in DON levels in harvested grain. Initial DON results from the greenhouse indicated that two inoculations of *Fusarium graminearum* resulted in the highest levels of DON in all three crops; up to 150 ppm DON was recorded in twice inoculated barley from small samples of harvested grain. However, Prosaro fungicide applied at watery ripe stage in barley reduced these high DON levels down to 2-3 ppm , and from 20-60 ppm in spring wheat, down to undetectable levels when applied at flowering.

Impact: Application technology information for producers has been updated and new guidelines for ground application suggest producers use a single, angled nozzle toward the grain head, rather than the forward/backward configuration previously recommended, providing some cost savings to producers. Timing of fungicide application studies in the greenhouse clarify timing of treatment information for optimum DON reduction. Final DON data from greenhouse studies have only recently been received from the NDSU Toxicology lab, so complete analyses of this data are yet to be finalized.

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?
New tools for fungicide application spray technology have been provided and additional information on how FHB reduction affects DON levels in grain has been determined.

Project 2: *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?

One of the management strategies to reduce yield and quality losses due to FHB infection is the use of appropriate fungicides. Wheat and barley producers need the most efficacious fungicides available to reduce FHB severity and DON levels. Uniform tests of fungicides across multiple grain classes and environments provides information on how registered or experimental fungicides perform on these grain classes common in North Dakota, and multiple testing sites help assure that at least one or more sites may have disease development. Tests were done on spring wheat, durum wheat, and barley, across four sites in ND representing different climatic and soil environments. Data from these trials has been instrumental in providing management information to producers and in getting new fungicides registered.

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: The weather in North Dakota was hot and dry in July 2006, which limited disease development at all locations of the test, even at sites with mist irrigation; several days of 100+ degrees in July retarded FHB development. However, information on fungicide effects on FHB severity, DON, and/or % tombstones was gathered at 3 of 4 test sites, and yield differences were obtained at all sites. Two fungicide treatments, Prosaro (prothioconazole + tebuconazole) and BAS555 (metconazole) were identified to consistently be the best in reducing FHB, DON, and % tombstones. For example, Prosaro treatment resulted in a 62% reduction in DON in wheat and 50% reduction in DON in barley at the Fargo location. Some additional experimental products, of different modes of action in the test, also showed promise for the future.

Impact: The data shows that Prosaro and BAS555 are better than Folicur for reducing DON and FHB severity. The data was used to help get a component of Prosaro, prothioconazole or Proline, registered for the 2007 growing season, and a section 18 request for Folicur was also granted by EPA. A combination of Folicur + Proline (roughly equivalent to Prosaro) was then available for ND producers in 2007. The data will be used to support registration of the BAS555 product in the future.

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?
An additional and better fungicide combination for application to wheat and barley was available to help reduce the disease and DON levels.

Include below a list of the publications, presentations, peer-reviewed articles, and non-peer reviewed articles written about Projects 1 and 2:

Project 1:

Hofman, V., Halley, S., VanEe, G., Hollingsworth, C., McMullen, M., and Ruden, B. 2007. Aerial application of fungicide for the suppression of Fusarium head blight in small grains. NDSU Circular AE-1327. 4p.

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 Ext. Circular AE-1314. 4 p.

Jordahl, J., Meyer, S., and McMullen, M. 2006. Adjuvant effects on performance of Folicur and Prosaro fungicides for FHB control in durum wheat and barley. Page 13 in: Proc. 2006 National Fusarium head blight Forum. Research Triangle Park, North Carolina. Michigan State Univ., East Lansing, MI.

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. Applied Engineering in Agriculture 22(3):357-364.

McMullen, M. 2006. 3-ADON and 15-ADON associations with DON grain concentrations, Fusarium head blight (FHB) susceptibility, and fungicide treatment, ND 2005. Phytopathology 96:S174.

Project 2:

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.

McMullen, M., Jordahl, J., and Meyer, S. 2007. Evaluation of fungicides for reduction of Fusarium head blight and DON in wheat, 2006. Online: Plant Dis. Management Rpts 1:CF011.

McMullen, M., Meyer, S., and Jordahl, J. 2007. Evaluation of fungicides for reduction of Fusarium head blight and DON in barley, 2006. Online: Plant Dis. Management Rpts 1:CF010.

Meyer, S., Jordahl, J., and McMullen, M. 2006. Uniform fungicide trial results on HRS wheat and barley, Fargo, ND 2006. Page 14 in: Proc. Proc. of 2006 National Fusarium head blight Forum. Research Triangle Park, North Carolina. Michigan State Univ., East Lansing, MI.

Cont.

McMullen, M., Meyer, S., and Jordahl, J. 2006. Uniform fungicide trail results on HRS Wheat and Barley, Fargo, ND 2006. Page 497 in: 2007 ND Crop Production Guide, No. 17, NDSU Ext. Service., Fargo, ND.

Paul, P.A., Lipps, P.E., Hershman, D.E., McMullen, M.P., Draper, M.A., and Madden, L.V. 2007. A quantitative review of tebuconazole effect on Fusarium head blight and deoxynivalenol content in wheat. Phytopathology 97:211-220.

Invited Presentation: "Fusarium head blight management", at Illinois Crop Protection Conference, University of Illinois, January 2007