

**USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY08 Final Performance Report (approx. May 08 – April 09)
July 15, 2009**

Cover Page

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Fiscal Year:	2008
USDA-ARS Agreement ID:	59-0790-4-133
USDA-ARS Agreement Title:	Uniform Fungicide Trial For Scab on Wheat in Illinois.
FY08 USDA-ARS Award Amount:	\$ 36,814

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Adjusted Award Amount
MGMT	Uniform Fungicide Trial for Scab on Winter Wheat in Illinois.	\$12,594
MGMT	Evaluation of Integrated Management Strategies for Scab in Illinois.	\$ 19,376
VDHR-NWW	Fungicide x Variety Interaction Experiment.	\$ 4,844
	Total Award Amount	\$ 36,814

Principal Investigator

Date

* MGMT – FHB Management
 FSTU – Food Safety, Toxicology, & Utilization of Mycotoxin-contaminated Grain
 GDER – Gene Discovery & Engineering Resistance
 PBG – Pathogen Biology & Genetics
 BAR-CP – Barley Coordinated Project
 HWW-CP – Hard Winter Wheat Coordinated Project
 VDHR – Variety Development & Uniform Nurseries – Sub categories are below:
 SPR – Spring Wheat Region
 NWW – Northern Winter Wheat Region
 SWW – Southern Sinter Wheat Region

Project 1: *Uniform Fungicide Trial for Scab on Winter Wheat in Illinois.*

1. What major problem or issue is being resolved relevant to Fusarium head blight (scab) and how are you resolving it?

Growers now have multiple fungicide products to choose from for management of FHB, and information on which products are the very best in reducing FHB severity and DON contamination in the grain is needed. Fungicide application timing is considered a critical component of achieving the best efficacy; however, due to adverse weather conditions or difficulties in scheduling a custom applicator, timely application is not always possible for a grower. Information is needed on how wide the window of application is for the most efficacious fungicides. Although strobilurin fungicides are very good at controlling foliar diseases, they have been shown to increase DON levels in grain when applied at later growth stages. Information is needed on how late in the growing season these products can be applied without increasing DON levels. Uniform fungicide trials were conducted at five locations in Illinois to address these questions. To ensure high levels of disease pressure, two of the sites were mist-irrigated to provide conditions conducive for FHB.

2. List the most important accomplishment and its impact (i.e. how is it being used) to minimize the threat of Fusarium head blight or to reduce mycotoxins. Complete both sections (repeat sections for each major accomplishment):

Accomplishment: Uniform fungicide trials were conducted at five locations in Illinois (Monmouth, Urbana, Brownstown, Carbondale, and Dixon Springs). At all of the locations, multiple fungicide products were evaluated for their efficacy in reducing FHB and DON levels when applied at the recommended timing of Feekes 10.5.1 (early anthesis). At two of the locations (Urbana and Carbondale), Proline fungicide (the only fully-registered FHB fungicide at the time the study was conducted) was applied at Feekes 10.5 (head emergence), Feekes 10.5.1, or at five days following the Feekes 10.5.1 application in order to determine how wide the window of application can be for this product to still be able to reduce FHB and DON. At two locations (Urbana and Carbondale), the strobilurin fungicide, pyraclostrobin, was applied at three different growth stages (flag leaf, boot, or heading) to determine its impact on DON contamination in the grain.

Disease pressure (FHB and foliar diseases) ranged from low to high across the five different locations. At most locations, the fungicide products Folicur, Proline, Prosaro, and Caramba significantly reduced FHB severity compared to the untreated control. In general, all four of these products tended to be statistically similar in their ability to reduce FHB severity; however, at some locations, Proline, Prosaro, and Caramba were statistically better at reducing DON levels in the harvested grain compared to Folicur.

At Urbana, IL, Proline applied at Feekes 10.5.1 or applied five days after Feekes 10.5.1 reduced FHB severity and DON levels in grain compared to the untreated control; however, Proline applied at Feekes 10.5 did not significantly reduce FHB severity or DON compared to the untreated control. At Dixon Springs, IL, Proline applied at any of the three timings significantly reduced FHB severity and DON compared to the untreated control.

At Carbondale, IL, pyraclostrobin fungicide applied at flag leaf or heading stage significantly increased DON contamination in harvested grain compared to the untreated control (1.9, 2.7, and 3.6 ppm for untreated, flag leaf timing, and heading timing, respectively). Pyraclostrobin applied at boot stage increased DON (2.5 ppm) compared to the untreated control, but not enough to be considered statistically different than the untreated control. At Urbana, IL, pyraclostrobin fungicide applied at flag leaf, boot, or heading stage did not significantly increase or reduce DON levels in harvested grain compared to the untreated control.

Impact: Results from Illinois FHB uniform fungicide trials indicate that Proline, Prosaro, and Caramba are the best products evaluated in reducing both FHB severity and DON levels. Additionally, results from Illinois indicate that Proline applied at five days following Feekes 10.5.1 gave similar protection against FHB and DON compared to application at Feekes 10.5.1 under severe FHB pressure. Additional years of testing are needed to confirm this, but this may provide information to growers on how late an application can be made and still achieve high levels of protection. Pyraclostrobin was shown to increase DON levels compared to an untreated control when applied as early as flag leaf emergence. This information is alarming, and warrants further investigation. Further research is needed, so that growers can have accurate information on when they can apply strobilurin fungicides to their wheat crop without increasing DON levels. Data from Illinois uniform fungicide trials were compiled with uniform fungicide trial data received from other states. These multi-state results were used to prepare a proceedings paper for the 2008 National Fusarium Head Blight Forum. Additionally, results from the Illinois FHB uniform fungicide trials were used to prepare a poster presented at the 2008 National Fusarium Head Blight Forum. Information gleaned from this research project has been used to help prepare a multi-state fungicide efficacy table (compiled by members of NCERA 184 Small Grain Diseases Committee) that Extension personnel, crop consultants, industry personnel, and growers can use to help make FHB management decisions. Additionally, information from this research project has been used to prepare multiple Extension newsletter articles and presentations.

Project 2: *Evaluation of Integrated Management Strategies for Scab in Illinois.*

1. What major problem or issue is being resolved relevant to Fusarium head blight (scab) and how are you resolving it?

Under severe FHB pressure, using only one control tactic is not effective enough to prevent losses. The use of integrated management tactics is needed to provide the highest levels of FHB and DON control. Research studies were initiated to evaluate the combination effects of crop rotation, moderately-resistant cultivars, and foliar fungicides on FHB severity and DON contamination.

2. List the most important accomplishment and its impact (i.e. how is it being used) to minimize the threat of Fusarium head blight or to reduce mycotoxins. Complete both sections (repeat sections for each major accomplishment):

Accomplishment: Research trials were conducted at Urbana, IL and Dixon Springs, IL that evaluated the effects of cultivars ranging in FHB susceptibility level and fungicide (Prosaro fungicide or non-treated) in two adjacent blocks (one in soybean residue and the other in corn residue). At both Urbana and Dixon Springs, FHB severity was lowest and yields were highest when cultivars with moderate resistance to FHB were sprayed with a foliar fungicide and planted into soybean stubble when compared to non-treated, susceptible cultivars planted into corn stubble.

Additionally, strips of corn and soybean were established in 2008, so that the effect of crop rotation could be statistically evaluated with cultivar and fungicide effects for studies to be conducted in the 2008-09 winter wheat season. These strips were established at four locations in the state (Monmouth, Urbana, Carbondale, and Dixon Springs).

Impact: Results indicated that using the best FHB management practices in combination with each other provided the lowest FHB severity values and the highest yields. Information from these results have been used to prepare Extension newsletter articles and presentations. Results from the Illinois FHB integrated management research trials will be used in combination with other states' research results to populate the new ScabSmart web page.

Project 3: *Fungicide x Variety Interaction Experiment.*

1. What major problem or issue is being resolved relevant to Fusarium head blight (scab) and how are you resolving it?

Suppression of FHB under heavy disease pressure frequently requires more than a single method of control. In this experiment we studied the control of FHB under heavy disease pressure using resistant and susceptible varieties in combination with and without fungicide application. Our hypothesis was that the best suppression of FHB will occur by growing a FHB resistant variety and applying a fungicide at flowering.

2. List the most important accomplishment and its impact (i.e. how is it being used) to minimize the threat of Fusarium head blight or to reduce mycotoxins. Complete both sections (repeat sections for each major accomplishment):

Accomplishment: Six FHB susceptible and six FHB resistant breeding lines and varieties were grown and three treatments (no fungicide, Folicur[®] and Prosaro[®]) were applied to each variety. A split plot design with three replications and fungicide treatment as the main plots was used. The plots were grown in a mist-irrigated, inoculated nursery to enhance disease pressure. Data were collected on FHB incidence, severity, % Fusarium damaged kernels, deoxynivalenol content (ppm), grain yield and test weight. The experiment was conducted in the 2008 season and is being repeated in the 2009 season. Useful data were obtained from the 2008 trial and the 2009 trial data are still being collected. The following results are based on the 2008 trial.

- Both fungicide and cultivar had a significant effect on all variables.
- Averaged over all cultivars both Folicur[®] and Prosaro[®] significantly increased yield and test weight, and significantly reduced incidence, severity, FHB index, FDK, ISK index, and DON.
- Folicur[®] increased yield by an average of 9.5 bu/A and decreased FDK by 36% and DON by 44%, while Prosaro[®] increased yield by 13.8 bu/A and decreased FDK by 55% and DON by 67%. Prosaro[®] treated plots significantly outperformed Folicur[®] treated plots in yield, test weight, incidence, FHB index, FDK, and ISK index.
- The FHB-resistant cultivars significantly ($P < 0.001$) outperformed the FHB-susceptible cultivars, regardless of the treatment, for all parameters. Averaged over cultivars yield increased 20%, FDK decreased 78%, and DON decreased 68%, when FHB-resistant cultivars were grown.
- Averaged over cultivars, Prosaro[®] plus host resistance increased yield by 34%, test weight by 12%, and decreased disease symptoms (FHB index) by 88%, FDK by 91%, and DON by 93% compared to the average of six susceptible cultivars.

Impact: Based on the 2008 results we clearly demonstrated that best management practices for suppression of FHB under heavy disease pressure include combining a resistant variety with fungicide application. The results from the 2008 trial were presented in a poster at the

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2008 Scab Forum, and the results of this experiment have been used extensively locally in Illinois in a number of presentations at field-days and grower meetings and published in Extension newsletter articles to provide producers with important information on best management practices to use.

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.

Abstracts, Edited Scientific Reports, and Proceedings:

Bradley, C. A., Adey, E., Ebelhar, S., and Young, B. 2008. Fungicide control of Fusarium head blight on soft red winter wheat in Illinois. Proceedings of the National Fusarium Head Blight Forum, December 2-4, 2008, Indianapolis, IN, page 11.

Bradley, C. A., Adey, E., Ebelhar, S., Young, B., Burrows, M., McMullen, M., Lukach, J., Osborne, L., Ruden, K., Sweets, L., and Wise, K. 2008. Multi-state uniform fungicide trials to control Fusarium head blight and deoxynivalenol. Proceedings of the National Fusarium Head Blight Forum, December 2-4, 2008, Indianapolis, IN, pages 13-16.

Bradley, C. A., and McMullen, M. P. 2008. Fungicides for FHB management: past, present, and future. Proceedings of the National Fusarium Head Blight Forum, December 2-4, 2008, Indianapolis, IN, page 12.

Brucker, E.A. , N.H. Karplus, C.A. Bradley and F.L. Kolb. 2008. Evaluation of host plant resistance and fungicide treatment for suppression of Fusarium head blight and deoxynivalenol. Proceedings of the 2008 National Fusarium Head Blight Forum, December 2-4, 2008, Indianapolis, IN, page 150.

Bradley, C. A. and Ames, K. A. 2009. Evaluation of foliar fungicides on soft red winter wheat in Urbana, IL, 2008. Plant Disease Management Reports 3:CF020.

Extension Articles and Publications:

Illinois Pest Management and Crop Development Bulletin Newsletter Articles (online at <http://ipm.illinois.edu/bulletin/>):

- Bradley, C. A. 2008. Early foliar fungicide applications for wheat. Issue 1, March 21, 2008.
- Bradley, C. A. 2008. Managing Fusarium head blight (scab) of wheat. Issue 3, April 11, 2008.
- Bradley, C. A. 2008. A plethora of wheat diseases in the final stretch. Issue 13, June 20, 2008.
- Bradley, C. A. 2009. Applying foliar fungicides to early-stage wheat. Issue 3, April 10, 2009.

- Bradley, C. A. 2009. Management of Fusarium head blight (scab) of wheat. Issue 5, April 24, 2009.
- Bradley, C. A. 2009. Wheat scab alert and results of 2008 Illinois wheat fungicide trials. Issue 7, May 8, 2009.
- Bradley, C. A. 2009. Wheat disease update. Issue 9, May 22, 2009.
- Bradley, C. A. 2009. Update on a wheat disease survey in Illinois. Issue 11, June 5, 2009.

NCERA 184 Management of Small Grain Diseases Committee. 2009. Fungicide Efficacy Table for Control of Wheat Diseases (available online at multiple websites including: http://ipm.illinois.edu/bulletin/pdf/ncera_wheat_fungicide_chart_2009.pdf)

Presentations:

Bradley, C. A., and McMullen, M. P. 2008. Fungicides for FHB management: past, present, and future. National Fusarium Head Blight Forum, December 2, 2008, Indianapolis, IN.

Bradley, C. A. 2008. Management of wheat diseases. University of Illinois Brownstown Agronomy Research Center Field Day, July 2008, Brownstown, IL.

Bradley, C. A. 2008. Management of wheat diseases. University of Illinois Dixon Springs Agricultural Center Field Day, August 2008, Dixon Springs, IL.

Bradley, C. A. and Kolb, F. L.. 2008. Management of Fusarium head blight of wheat. University of Illinois Crop Sciences Research and Education Center Agronomy Day. August 2008, Urbana, IL.

Bradley, C. A., and McMullen, M. P. 2008. Fungicides for FHB management: past, present, and future. National Fusarium Head Blight Forum, December 2, 2008, Indianapolis, IN.

Bradley, C. A. 2009. Management of corn, soybean, and wheat diseases with fungicides. Southern Illinois Crop Management Conference, January 2009, Whittington, IL.

Bradley, C. A. 2009. Management of corn, soybean, and wheat diseases with fungicides. Northern Illinois Crop Management Conference, February 2009, Malta, IL.

Bradley, C. A. 2009. Management of wheat diseases with fungicides. Ag Issues Forum, February 2009, Grapevine, TX.

Bradley, C. A. 2009. Management of wheat diseases. University of Illinois Small Grains Field Tour, June 2009, DeKalb, IL.

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If your FY08 USDA-ARS Grant contained a VDHR-related project, include below a list all germplasm or cultivars released with full or partial support of the USWBSI. List the release notice or publication. Briefly describe the level of FHB resistance. If this is not applicable (i.e. no VDHR-related project) to your FY08 grant, please insert ‘Not Applicable’ below.

Not Applicable.