

**USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY13 Final Performance Report
July 15, 2014**

Cover Page

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Fiscal Year:	FY13
USDA-ARS Agreement ID:	59-0206-9-076
USDA-ARS Agreement Title:	Applied Management of Fusarium Head Blight in Illinois.
FY13 USDA-ARS Award Amount:	\$ 41,038

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
MGMT	Uniform Fungicide Tests for Control of Fusarium Head Blight in Illinois.	\$ 16,079
MGMT	Integrated Management Strategies for Scab in Illinois.	\$ 21,032
MGMT	Influence of FHB Management Practices on Mycotoxins in Wheat Straw.	\$ 3,927
	FY13 Total ARS Award Amount	\$ 41,038

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
 DUR-CP – Durum Coordinated Project
 HWW-CP – Hard Winter Wheat Coordinated Project
 VDHR – Variety Development & Uniform Nurseries – Sub categories are below:
 SPR – Spring Wheat Region
 NWW – Northern Soft Winter Wheat Region
 SWW – Southern Soft Red Winter Wheat Region

Project 1: *Uniform Fungicide Tests for Control of Fusarium Head Blight in Illinois.*

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

The major points being addressed by this project are: i) determination of the best fungicide for FHB and DON management that is currently registered on wheat, and evaluation of these products when applied a few days later than the typical recommendation of the Feekes 10.5.1 growth stage (early anthesis); ii) evaluation of experimental fungicides for FHB and DON control that are not currently registered on wheat; iii) determination of the risk of an increase of DON with the application of fungicide products that contain a strobilurin active ingredient applied at Feekes 9.0 growth stage (flag leaf emergence).

Fungicides are a critical component of a FHB and DON management plan. Wheat growers in Illinois need data from local fungicide research trials, so they can better understand which fungicides and application timings are the best for FHB and DON management. Risks are associated with an increased level of DON when fungicides that contain strobilurin active ingredients are applied. Although strobilurin fungicides are excellent for control of foliar diseases of wheat, their use could be detrimental in DON management when conditions are favorable for FHB. Because only fungicides in the triazole chemical class are registered for control of FHB, a risk of fungicide resistance is present. Thus, it is important to continue to evaluate fungicides from new and different chemistry classes for their efficacy in managing FHB and DON. The data from the Illinois uniform fungicide testing project are submitted to the leader of the national uniform fungicide testing project, so that a large dataset from multiple states and small grain classes can be analyzed to determine the best fungicide management solutions for FHB and DON.

2. List the most important accomplishments and their impact (i.e. how are they being used) to minimize the threat of Fusarium Head Blight or to reduce mycotoxins. Complete both sections; repeat sections for each major accomplishment:

Accomplishment:

Fungicide research trials were conducted at four locations in Illinois (Brownstown, Dixon Springs, Monmouth, and Urbana) to evaluate the effect of fungicides on FHB and DON. FHB indices and DON values were high at all locations (FHB index range in non-treated controls = 30 – 40; DON value range in non-treated controls = 5.6 – 10.3). The fungicides that were the most consistent in reducing FHB and DON relative to a non-treated control were Caramba and Prosaro fungicides. These fungicides were most effective when applied at Feekes growth stage 10.5.1 (early anthesis), but in some cases when applied 5 days after Feekes 10.5.1, they still reduced FHB and DON relative to the untreated control.

An experimental fungicide, known as thymol, was evaluated for FHB and DON control in a mixture with tebuconazole. A tebuconazole alone treatment also was included so that comparisons between thymol + tebuconazole and tebuconazole could be made.

Unfortunately, the addition of thymol to tebuconazole did not provide any added control of FHB or DON when compared to a tebuconazole alone treatment.

Three strobilurin + triazole fungicide mixture products (Stratego YLD, Quilt Xcel, and TwinLine) and one strobilurin + SDHI fungicide mixture product (Priaxor) were evaluated for their effects on DON since previous research has indicated a risk of increased DON levels relative to non-treated controls when strobilurin products have been applied. These products were all applied at the Feekes 9 growth stage in our trials. At the Monmouth location, both Stratego YLD and TwinLine fungicides significantly increased DON compared to the untreated control (DON values for Stratego YLD and TwinLine = 17.7 and 16.5, respective; DON value for untreated control = 10.3). At the Dixon Springs location, both TwinLine and Priaxor fungicides significantly increased DON relative to the untreated control (DON values for TwinLine and Priaxor = 8.8 and 8.7, respectively; DON value for untreated control = 5.6).

Impact:

This research identified that Caramba and Prosaro fungicides are the most effective fungicides currently available in managing FHB and DON. These fungicides should be utilized by wheat growers in Illinois as part of an integrated management plan for FHB and DON management.

This research did not identify any experimental fungicides that were superior to any currently registered products in reducing FHB and DON. However, it is important to continue evaluating fungicides from different and new chemistry classes, since there currently is an over-reliance on only one chemistry class for FHB and DON management in wheat (triazole fungicides).

This research identified that fungicides that contain strobilurin active ingredients are a risk in increasing DON levels relative to a non-treated control. Wheat growers will need to factor these findings into their decision-making process when deciding on applying foliar fungicides for leaf disease control, and may need to make a second application of either Caramba or Prosaro to minimize any adverse effects on DON caused by strobilurin fungicides.

Project 2: *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?

Regardless of the availability of foliar fungicides with efficacy against *Fusarium graminearum*, there is more to managing Fusarium head blight (FHB) and deoxynivalenol (DON) than just applying fungicides. On highly susceptible cultivars, the reduction in DON with a foliar fungicide may not be enough to allow the grower to sell the grain (DON may still be above 2 ppm even though a fungicide was applied). This research project investigated management of FHB and DON using the combination of a foliar fungicide and moderately-resistant cultivars. Results from this research have been used to show the importance of integrating more than one management practice to achieve the largest reduction in FHB and DON.

2. List the most important accomplishments and their impact (i.e. how are they being used) to minimize the threat of Fusarium Head Blight or to reduce mycotoxins. Complete both sections; repeat sections for each major accomplishment:

Accomplishment:

Field research trials were conducted at Urbana, Monmouth, and Dixon Springs, IL to investigate the impact of combining a foliar fungicide application and moderately-resistant wheat cultivars on FHB and DON reduction. Results of this research indicated that utilizing the combination of moderately-resistant cultivars with a properly-timed fungicide application (Prosaro fungicide applied at Feekes 10.5.1) provided the largest reduction in FHB and DON.

Impact:

The results of this research have been used in Scab Forum and grower presentations and newsletter articles to show the importance of utilizing more than one strategy for FHB and DON management. Wheat growers, crop consultants, and industry representatives in Illinois have utilized this information to be better prepared to manage FHB and DON.

Project 3: *Influence of FHB Management Practices on Mycotoxins in Wheat Straw.*

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

Wheat straw is used for livestock bedding, but livestock still eat some of the bedding (i.e. swine sows eat 2-4 kg of straw bedding per day). If the straw contains high levels of mycotoxins, such as deoxynivalenol (DON), zearalenone (ZEA), or nivalenol (NIV), then the livestock can become very sick and non-productive. Little is known about the presence of mycotoxins in straw, nor if typical Fusarium head blight management practices also reduce mycotoxins in the straw.

2. List the most important accomplishments and their impact (i.e. how are they being used) to minimize the threat of Fusarium Head Blight or to reduce mycotoxins. Complete both sections; repeat sections for each major accomplishment:

Accomplishment:

Straw samples (wheat stem) were collected from FHB management trials located in Urbana, Monmouth, Brownstown, and Dixon Springs, IL and assayed for mycotoxins. Mycotoxins detected in the wheat straw were DON, 3-ADON, 15-ADON, NIV, and ZEA. In several cases, the DON levels found in straw exceeded the DON levels found in grain from the same plot. Preliminary results indicate that management practices such as planting moderately-resistant cultivars and applying a triazole fungicide at Feekes growth stage 10.5.1 provided inconsistent reduction of mycotoxins in the straw; however, cultivar appeared to have the largest effect in decreasing DON levels in the straw.

Impact:

Results from this research have been presented at the Scab Forum. More research is needed to better understand the impact of finding these mycotoxins in wheat straw and the etiology of how these mycotoxins accumulate; however, this research is the first to evaluate the effects of management practices on the mycotoxins in the straw.

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 FY13 grant. Please reference each item using an accepted journal format. If you need more space, continue the list on the next page.

Bradley, C. A. 2013. Conditions favorable for *Fusarium* head blight (scab) in southern Illinois. University of Illinois Pest Management and Crop Development Bulletin (www.bulletin.ipm.illinois.edu) (May 9, 2013).

Bradley, C. A. 2013. Wheat scab rearing its ugly “head”. University of Illinois Pest Management and Crop Development Bulletin (www.bulletin.ipm.illinois.edu) (June 10, 2013).

Bissonnette, K. M., Ames, K. A., Kolb, F. L., and Bradley C. A. 2013. “Effect of cultivar and fungicide on *Fusarium* mycotoxins in wheat straw.” In: S. Canty, A. Clark, Y. Salat, and D. Van Sanford (Eds.), *Proceedings of the 2013 National Fusarium Head Blight Forum*. East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative. p. 95.

Paul, P. A., Bergstrom, G., Bradley, C. Byamukama, E., Cummings, J. A., Grybauskas, A., Madden, L, Milus, G., Ruden, K., Salgado, J. D., Sweets, L., Wegulo, and Wise, K. 2013. “FHB integrated management: a 2013 update.” In: S. Canty, A. Clark, Y. Salat, and D. Van Sanford (Eds.), *Proceedings of the 2013 National Fusarium Head Blight Forum*. East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative. p. 110.

Paul, P. A., Andersen, K. F., Bradley, C. A., D’Angelo, D. L., and Madden, L. V. 2013. “Implications of rainfall at anthesis for scab management with fungicides.” In: S. Canty, A. Clark, Y. Salat, and D. Van Sanford (Eds.), *Proceedings of the 2013 National Fusarium Head Blight Forum*. East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative. p. 112.

Bradley, C. A. 2014. Considerations for fungicide management of *Fusarium* head blight of wheat. University of Illinois Pest Management and Crop Development Bulletin (www.bulletin.ipm.illinois.edu) (May 9, 2014).