

**USDA-ARS/  
U.S. Wheat and Barley Scab Initiative  
FY14 Final Performance Report  
July 15, 2015**

**Cover Page**

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<b>Fiscal Year:</b>	FY14
<b>USDA-ARS Agreement ID:</b>	59-0206-4-024
<b>USDA-ARS Agreement Title:</b>	Applied Management of Fusarium Head Blight in Illinois.
<b>FY14 USDA-ARS Award Amount:</b>	\$ 31,210

**USWBSI Individual Project(s)**

<b>USWBSI Research Category*</b>	<b>Project Title</b>	<b>ARS Award Amount</b>
MGMT	Integrated Management Strategies for Scab in Illinois.	\$ 19,680
MGMT	Uniform Fungicide Tests for Control of Fusarium Head Blight in Illinois.	\$ 6,666
MGMT	Management of Scab-Associated Mycotoxins in Wheat Straw.	\$ 4,864
	<b>FY14 Total ARS Award Amount</b>	<b>\$ 31,210</b>

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Principal Investigator

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Date

\* MGMT – FHB Management  
 FSTU – Food Safety, Toxicology, & Utilization of Mycotoxin-contaminated Grain  
 GDER – Gene Discovery & Engineering Resistance  
 PBG – Pathogen Biology & Genetics  
 EC-HQ – Executive Committee-Headquarters  
 BAR-CP – Barley Coordinated Project  
 DUR-CP – Durum Coordinated Project  
 HWW-CP – Hard Winter Wheat Coordinated Project  
 WES-CP – Western 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:** *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?**

Unfortunately, management of Fusarium head blight (FHB) and deoxynivalenol (DON) cannot be fully achieved with the application of a foliar fungicide alone. In addition, the best timing for fungicide application to achieve the greatest level of FHB and DON control is when plants begin to flower (Feekes growth stage 10.5.1), but this timing can be a very short duration in some years. This research project investigated management of FHB and DON using the combination of a foliar fungicide and moderately-resistant cultivars. In addition, foliar fungicides were applied at different stages past Feekes 10.5.1 to help determine how “wide” the window of opportunity is for applying fungicides for FHB and DON control. Results from this research have been used to show the importance of planting wheat varieties with the highest level of FHB resistance available, and that applying an effective fungicide to these cultivars will provide the greatest level of control of FHB and DON. In addition, this research has shown that the fungicide application window is a little wider than originally thought, in that fungicide applications made up to 6 days after Feekes growth stage 10.5.1 were also effective in reducing losses caused by 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 and Dixon Springs, IL to investigate FHB and DON control by combining a wheat cultivar with moderate resistance to FHB with foliar fungicide applications tested at different application timings. Results of this research indicated that combining a moderately-resistant cultivar with an efficacious foliar fungicide (Prosaro fungicide used in these particular trials) provided the best level of control of FHB and DON. In addition, Prosaro fungicide applied up to 6 days after Feekes growth stage 10.5.1 was effective in reducing FHB and DON, which indicates that the fungicide application window may be wider than realized.

**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 2:** *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; ii) evaluation of a biocontrol fungicide for FHB and DON; iii) evaluation of strobilurin fungicide risk of increasing DON; and iv) determination in any differences among different tebuconazole products for control of FHB and DON (since many “generic” tebuconazole products are now available in the marketplace).

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 are the best for FHB and DON management. 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. In addition, tebuconazole, once the “standard” for FHB and DON control, is now available as several commercial “generic” products in the marketplace. Although tebuconazole is no longer considered the best fungicide available for FHB and DON management, the price might make it attractive to some wheat producers (especially in years with reduced risk of FHB). Because of the number of tebuconazole products available, little is known if they are all equal in their efficacy in controlling 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 designed to evaluate their effect on FHB and DON were planted at four locations in Illinois (Brownstown, Dixon Springs, Monmouth, and Urbana), but only three locations were utilized due to severe winter kill occurring at the Monmouth location. FHB indices and DON values were high at all locations (FHB index range in non-treated controls = 29 – 61; DON value range in non-treated controls = 5.9 – 21.9). The fungicides that were the most consistent in reducing FHB and DON relative to a non-treated control were Prosaro and Caramba. Tebuconazole products, though not as efficacious as Prosaro or Caramba, appeared to be relatively equal to each other in regards to FHB and DON control. When added to Prosaro fungicide, the biocontrol treatment ‘Taegro’ did not significantly

decrease FHB or DON levels compared to Prosaro alone, but there were numerically lower levels of FHB and DON with the Prosaro + Taegro treatment at two of the three locations.

The strobilurin fungicide Aproach, and the strobilurin + triazole fungicide Aproach Prima numerically increased DON compared to the non-treated control at all three locations. At the time of testing, both Aproach and Aproach Prima included FHB on their fungicide labels. The results from this research will be used to discourage growers from using any products that contain a strobilurin active ingredient for FHB and DON management, since the risk of increasing DON levels appears to be real. 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.

### **Impact:**

This research identified Prosaro and Caramba fungicides as the most effective fungicide currently available in managing FHB and DON. In addition, Taegro biocontrol fungicide should be investigated in future studies, since the combination of Prosaro and Taegro resulted into numerically lower DON levels compared to Prosaro alone at two of the three locations. Although tebuconazole products were found to be generally less efficacious in controlling FHB and DON compared to Prosaro and Caramba, the tebuconazole products evaluated in our research did appear to reduce FHB and DON compared to the non-treated controls, and did appear to be generally equal no matter which specific tebuconazole product was applied. The strobilurin fungicide-containing products Aproach and Aproach Prima were found to numerically increase DON levels over the non-treated controls at all three locations. Despite FHB being on the labels of these products, this research will be used to discourage growers from applying these products for control of FHB due to their risk of increasing DON in harvested grain.

Data from this research was 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. These results were used in meetings with wheat growers, crop consultants, and industry representatives in Illinois to provide information about the most efficacious fungicides currently available for FHB and DON management.

**Project 3:** *Management of Scab-Associated 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:**

From a field trial in Urbana, IL, straw samples were collected twelve different wheat cultivars that differed in their susceptibility to FHB to determine if susceptibility to FHB had an impact on the DON levels in the straw. Although nivalenol and zearalenone were detected in wheat straw, DON was found the most often and at the highest concentrations. Differences occurred among cultivars for the level of DON found in the straw, and this appeared to be related to the cultivar's level of resistance to FHB.

**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, it does appear that wheat cultivars with improved resistance to FHB may have lower levels of DON in straw. Overall, growers that plant cultivars with the greatest FHB resistance levels available will likely have fewer issues with high levels of DON in wheat straw.

### **Training of Next Generation Scientists**

**Instructions:** Please answer the following questions as it pertains to the FY14 award period. The term “support” below includes any level of benefit to the student, ranging from full stipend plus tuition to the situation where the student’s stipend was paid from other funds, but who learned how to rate scab in a misted nursery paid for by the USWBSI, and anything in between.

- 1. Did any graduate students in your research program supported by funding from your USWBSI grant earn their MS degree during the FY14 award period?**

**If yes, how many?** No.

- 2. Did any graduate students in your research program supported by funding from your USWBSI grant earn their Ph.D. degree during the FY14 award period?**

**If yes, how many?** No.

- 3. Have any post docs who worked for you during the FY14 award period and were supported by funding from your USWBSI grant taken faculty positions with universities?**

**If yes, how many?** None

- 4. Have any post docs who worked for you during the FY14 award period and were supported by funding from your USWBSI grant gone on to take positions with private ag-related companies or federal agencies?**

**If yes, how many?** None

**Include below a list of all germplasm or cultivars released with full or partial support of the USWBSI during the FY14 award period. List the release notice or publication. Briefly describe the level of FHB resistance. If not applicable because your grant did NOT include any VDHR-related projects, enter N/A below.**

N/A.

**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 FY14 grant. Please reference each item using an accepted journal format. If you need more space, continue the list on the next page.**

**Publications:**

Bissonnette, K. M., Ames, K. A., Dong, Y., Kolb, F. L., and Bradley, C. A. 2014 Effect of cultivar and fungicide on *Fusarium* mycotoxins in wheat straw. *Phytopathology* 104:S3.15.

Bissonnette, K. M., Ames, K. A., Dong, Y., Kolb, F. L., and Bradley, C. A. 2014. Accumulation of *Fusarium graminearum* mycotoxins in wheat straw at various intervals after anthesis for wheat cultivars ranging in susceptibility to Fusarium head blight. Proceedings of the 2014 National Fusarium Head Blight Forum, St. Louis, MO, pp. 4-5.

Bradley, C. A. 2014. Wheat scab rearing its ugly “head” again in 2014. University of Illinois Bulletin Newsletter (online at: <http://bulletin.ipm.illinois.edu/?p=2242>).

D’Angelo, D. L., Bradley, C. A., Ames, K. A., Willyerd, K. T., Madden, L. V., and Paul, P. A. 2014. Efficacy of post-anthesis fungicide applications against Fusarium head blight and deoxynivalenol in soft red winter wheat. *Plant Disease* 98:1387-1397.

Madden, L. V., Bradley, C. A., Dalla Lana da Silva, F., and Paul, P. A. 2014. Meta-analysis of 19 years of fungicide trials for the control of Fusarium head blight of wheat. Proceedings of the 2014 National Fusarium Head Blight Forum, St. Louis, MO, pp. 17-18.

Salgado, J. D., Ames, K., Bergstrom, G., Bradley, C., Byamukama, E., Cummings, J., Dill-Macky, R., Friskop, A., Gautam, P., Kleczewski, N., Madden, L., Milus, E., Nagelkirk, M., Ransom, J., Ruden, K., Wegulo, S., Wise, K., and Paul, P. A. 2014. Best FHB management practices: a 2014 multi-state project update. Proceedings of the 2014 National Fusarium Head Blight Forum, pp. 31-36.

Smith, M. J., Wiersma, J., Friskop, A., Schatz, B., Gautam, P., Bergstrom, G. C., Cummings, J. A., Byamukama, E., Ruden, K., Bleakley, B., Murthy, N., Bradley, C. A., Ames, K., Pike, J., Bellm, R., and Milus, G. 2014. Uniform fungicide trial results for management of FHB and DON, 2014. Proceedings of the 2014 National Fusarium Head Blight Forum, St. Louis, MO, p. 43.

FY14 (approx. May 14 – May 15)

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PI: Bradley, Carl

USDA-ARS Agreement #: 59-0206-4-024

**Presentations:**

Bradley, C. A. 2014. Management of wheat diseases in Illinois. Illinois Wheat Association Forum, Mt. Vernon, IL (Feb. 18, 2014).

Bradley, C. A. 2014. Management of Fusarium head blight of wheat. Univ. IL Field Day at Ewing Field, Ewing, IL (Sep. 11, 2014).