

USDA-ARS
U.S. Wheat and Barley Scab Initiative
FY17 Final Performance Report
Due date: October 2, 2018

Cover Page

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Fiscal Year:	2017
USDA-ARS Agreement ID:	59-0206-5-007
USDA-ARS Agreement Title:	Applied Management of Fusarium Head Blight in Kentucky.
FY17 USDA-ARS Award Amount:	\$ 20,289
Recipient Organization:	University of Kentucky Research Foundation University Station Lexington, KY 40506-0057
DUNS Number:	939017877
EIN:	61-6033693
Recipient Identifying Number or Account Number:	3200000233
Project/Grant Reporting Period:	9/08/17 - 9/7/18
Reporting Period End Date:	09/07/18

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
MGMT	Integrated Management of Fusarium Head Blight in Kentucky.	\$ 20,289
	FY17 Total ARS Award Amount	\$ 20,289

Principal Investigator

Date

* MGMT – FHB Management
FST – Food Safety & Toxicology
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
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 of Fusarium Head Blight in Kentucky.*

1. What are the major goals and objectives of the project?

The major goals/objectives of the project were: 1) demonstrate that integrated management is the most effective and economical means of reducing losses to Fusarium head blight / DON; and 2) increase grower adoption of integrated strategies to control Fusarium head blight.

2. What was accomplished under these goals? *Address items 1-4) below for each goal or objective.*

1) major activities

The major activities included conducting field research trials at Princeton, KY and Marion, IL, sending collected data to Dr. Pierce Paul's (Ohio State University) research program for multi-state data analyses, and presenting research results at scientific and extension meetings.

2) specific objectives

The specific objectives were to investigate management of FHB and DON contamination in wheat grain in an integrated management trial (IMT) conducted at two locations (Princeton, KY and Marion, IL) and in a mist-irrigated uniform fungicide trial (UFT) conducted at one location (Princeton, KY).

The IMT investigated "standard" fungicides Prosaro and Caramba applied at the recommended timing (Feekes 10.5.1) and a new fungicide product, Miravis Ace, applied at either Feekes 10.5 or Feekes 10.5.1 on soft red winter wheat cultivars that differed in their susceptibility to Fusarium head blight (three cultivars at Princeton, KY and two cultivars at Marion, IL).

The UFT investigated standard treatments (Caramba and Prosaro) applied at Feekes 10.5.1, a new fungicide (Miravis Ace) applied at different application timings, and sequential applications of fungicide products on a soft red winter wheat cultivar susceptible to Fusarium head blight under mist-irrigation.

3) significant results

For the IMT at Princeton, KY, mean FHB index values ranged from 0.7 to 19.4, and mean DON values ranged from 0.1 ppm to 1.9 ppm. Overall, the FHB index values and DON values were greater in the cultivar that was most susceptible to FHB (FHB index values of 6.2 vs. 7.4 vs. 19.4 and DON values of 0.2 ppm vs. 0.6 ppm vs. 1.3 ppm for the non-treated controls of the MR vs. MS vs. S cultivars, respectively). For the S cultivar, all fungicide treatments significantly ($P \leq 0.05$) reduced FHB index values relative to the non-treated control. For the MS cultivar, all fungicides except Miravis Ace significantly reduced FHB index values relative to the non-treated control. For the MR cultivar, all fungicides except Prosaro reduced FHB index values relative to the non-treated control. For the S cultivar, all fungicides significantly reduced DON contamination relative to the

non-treated control. For the MS cultivar, all fungicides except Miravis Ace significantly reduced DON contamination relative to the non-treated control. For the MR cultivar, no significant differences were observed between the non-treated control and fungicide treatments for DON contamination (DON values were ≤ 0.2 ppm for the MR cultivar).

For the IMT at Marion, IL, mean FHB index values ranged from 1.3 to 46.4, and mean DON values ranged from 1.3 ppm to 6.8 ppm. Overall, the FHB index values and DON values were greater in the FHB-susceptible cultivar compared to the cultivar with moderate resistance to FHB (FHB index values of 18.5 vs. 46.4 and DON values of 3.0 ppm vs. 5.7 ppm for the non-treated controls of the MR vs. S cultivars, respectively). All fungicide treatments significantly ($P \leq 0.05$) reduced FHB index and DON within each cultivar relative to the corresponding cultivar's non-treated control. The greatest reduction in FHB index value and DON value occurred when the MR cultivar was sprayed with a fungicide at the Feekes 10.5.1 growth stage.

For the UFT at Princeton, KY, mean FHB index values ranged from 0.6 to 21.1, and mean DON values ranged from 0.5 ppm to 3.6 ppm. All treatments except the QoI fungicide, Headline, applied at Feekes 10 significantly ($P \leq 0.05$) reduced FHB index values compared to the nontreated control. All treatments reduced DON contamination in the grain relative to the non-treated control except Headline applied at Feekes 10, a sequential treatment of Headline (Feekes 10) and Miravis Ace (Feekes 10.3), Miravis Ace applied at a below standard rate at Feekes 10.3, and Miravis Ace applied at the standard rate at 6 days after Feekes 10.5.1.

4) key outcomes or other achievements

Much-needed information about how well the new fungicide Miravis Ace performs in managing FHB and DON was obtained. Wheat farmers in Kentucky and the region, are eager to see unbiased research results with this new fungicide. As observed in previous studies and confirmed in this research, the greatest reduction in FHB and DON occurs when moderately resistant cultivars are planted and sprayed with an effective fungicide at the correct application timing.

3. What opportunities for training and professional development has the project provided?

Conducting this research allowed two undergraduate students from the University of Tennessee-Martin, a post doc from the University of Kentucky, a research specialist from the University of Kentucky, and an extension specialist from the University of Kentucky to gain hands-on learning about the Fusarium head blight disease cycle, impacts of this disease, and management options. In addition, the project has allowed the PI to attend the National Fusarium Head Blight Forum, which has promoted interaction with other scientists working on this disease. Results from this project are presented to farmers, crop consultants, and others, which presents opportunities for their professional development and learning.

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4. How have the results been disseminated to communities of interest?

Results of the Integrated Management Project throughout the years have been disseminated to the scientific community thru journal articles and thru posters presented at the National Fusarium Head Blight Forum and the American Phytopathological Society Annual Meeting. Results also have been disseminated to stakeholders (i.e. farmers, Extension personnel, crop consultants, industry representatives, and commodity representatives) through presentations at Extension meetings, field days, and articles written in on-line Extension newsletters and blogs.

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY17 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 FY17 award period?** No

If yes, how many?

2. **Did any graduate students in your research program supported by funding from your USWBSI grant earn their Ph.D. degree during the FY17 award period?** No

If yes, how many?

- 3.
4. **Have any post docs who worked for you during the FY17 award period and were supported by funding from your USWBSI grant taken faculty positions with universities?** No

If yes, how many?

5. **Have any post docs who worked for you during the FY17 award period and were supported by funding from your USWBSI grant gone on to take positions with private ag-related companies or federal agencies?** No

If yes, how many?

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Release of Germplasm/Cultivars

Instructions: In the table below, list all germplasm and/or cultivars released with full or partial support through the USWBSI during the FY17 award period. All columns must be completed for each listed germplasm/cultivar. Use the key below the table for Grain Class abbreviations. *Leave blank if you have nothing to report or if your grant did NOT include any VDHR-related projects.*

Name of Germplasm/Cultivar	Grain Class	FHB Resistance (S, MS, MR, R, where R represents your most resistant check)	FHB Rating (0-9)	Year Released

Add rows if needed.

NOTE: List the associated release notice or publication under the appropriate sub-section in the ‘Publications’ section of the FPR.

Abbreviations for Grain Classes

- Barley - BAR
- Durum - DUR
- Hard Red Winter - HRW
- Hard White Winter - HWW
- Hard Red Spring - HRS
- Soft Red Winter - SRW
- Soft White Winter - SWW

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Publications, Conference Papers, and Presentations

Instructions: Refer to the FY17-FPR_Instructions for detailed instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY17 grant. Only include citations for publications submitted or presentations given during your award period (9/08/17 - 9/7/18). If you did not have any publications or presentations, state 'Nothing to Report' directly above the Journal publications section.

NOTE: Directly below each reference/citation, you must indicate the Status (i.e. published, submitted, etc.) and whether acknowledgement of Federal support was indicated in publication/presentation.

Journal publications.

Paul, P.A., J.D. Salgado, G. Bergstrom, C.A. Bradley, E. Byamukama, A.M. Byrne, V. Chapara, J.A. Cummings, M.I. Chilvers, R. Dill-Macky, A. Friskop, N. Kleczewski, L.V. Madden, M. Nagelkirk, J. Stevens, M. Smith, S.N. Wegulo, K. Wise, and D. Yabwalo. 2018. Integrated effects of genetic resistance and prothioconazole + tebuconazole application timing on Fusarium head blight in wheat. *Plant Disease* <https://doi.org/10.1094/PDIS-04-18-0565-RE>.

Status: Accepted, awaiting publication.

Acknowledgement of Federal Support: Yes

Paul, P.A., C.A. Bradley, L.V. Madden, F. Dalla Lana, G.C. Bergstrom, R. Dill-Macky, K.A. Wise, P.D. Esker, M.P. McMullen, A. Grybauskas, W.W. Kirk, E.A. Milus, and K. Ruden. 2018. Effects of pre- and post-anthesis applications of demethylation inhibitor fungicides on Fusarium head blight and deoxynivalenol in spring and winter wheat. *Plant Disease*. <https://doi.org/10.1094/PDIS-03-18-0466-RE>.

Status: Accepted, awaiting publication.

Acknowledgement of Federal Support: Yes

Paul, P.A., C.A. Bradley, L.V. Madden, F. Dalla Lana, G.C. Bergstrom, R. Dill-Macky, P.D. Esker, K.A. Wise, M. McMullen, A. Grybauskas, W.W. Kirk, E. Milus, and K. Ruden. 2018. Meta-analysis of the effects of QoI and DMI fungicide combinations on Fusarium head blight and deoxynivalenol in wheat. *Plant Disease*. <https://doi.org/10.1094/PDIS-02-18-0211-RE>.

Status: Accepted, awaiting publication.

Acknowledgement of Federal Support: Yes

Bissonnette, K.M., F.L. Kolb, K.A. Ames, and C.A. Bradley. 2018. Effect of wheat cultivar on the concentration of *Fusarium* mycotoxins in wheat stems. *Plant Disease*. <https://doi.org/10.1094/PDIS-12-17-2034-RE>.

Status: Accepted, awaiting publication.

Acknowledgement of Federal Support: Yes

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Bissonnette, K.M., F.L. Kolb, K.A. Ames, and C.A. Bradley. 2018. Effect of Fusarium head blight management practices on mycotoxin contamination of wheat straw. *Plant Disease* 102:1141-1147.

Status: Published.

Acknowledgement of Federal Support: Yes

Books or other non-periodical, one-time publications.

Nothing to Report

Other publications, conference papers and presentations.

Bradley, C.A., L.V. Madden, and P.A. Paul 2017. "Multi-state research on the effect of quinone outside inhibitor fungicides on DON contamination in wheat grain." In: S. Canty, B. Wiermer and D. Van Sanford (Eds.), *Proceedings of the 2017 National Fusarium Head Blight Forum* (p. 6). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative

Status: Abstract Published and Presentation Given.

Acknowledgement of Federal Support: YES (presentation), Yes (abstract)

Salgado, J.D., G. Bergstrom, C. Bradley, K. Bowen, E. Byamukama, A. Byrne, A. Collins, C. Cowger, J. Cummings, V. Chapara, M.I. Chilvers, R. Dill-Macky, H.M. Darby, A. Friskop, N. Kleczewski, L.V. Madden, J. Marshall, H. Mehl, M. Nagelkirk, J. Stevens, D. Smith, M. Smith, S. Wegulo, K. Wise, D. Yabwalo, H.M. Young-Kelly, and P.A. Paul. 2017. "Efficacy of two-treatment fungicide programs for FHB management: a multi-state coordinated project." In: S. Canty, B. Wiermer and D. Van Sanford (Eds.), *Proceedings of the 2017 National Fusarium Head Blight Forum* (pp. 20-25). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative

Status: Published.

Acknowledgement of Federal Support: Yes

Salgado, J.D., K. Ames, G. Bergstrom, C. Bradley, E. Byamukama, J. Cummings, V. Chapara, M.I. Chilvers, R. Dill-Macky, A. Friskop, P. Gautam, N. Kleczewski, L.V. Madden, E. Milus, M. Nagelkirk, J. Ransom, K. Ruden, J. Stevens, S. Wegulo, K. Wise, D. Yabwalo, and P.A. Paul. 2017. "Robust management programs to minimize losses due to Fusarium head blight and deoxynivalenol in wheat". In: S. Canty, B. Wiermer and D. Van Sanford (Eds.), *Proceedings of the 2017 National Fusarium Head Blight Forum* (pp. 26-27). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative

Status: Abstract Published and Presentation Given.

Acknowledgement of Federal Support: YES (presentation), Yes (abstract)

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Bradley, C.A. 2018. "Management of Wheat Diseases". Presentation at University of Kentucky Wheat Field Day, Princeton, KY, May 8, 2018.

Status: Presented

Acknowledgement of Federal Support: Yes

Bradley, C.A. and T. Stombaugh. 2018. "Fungicide Application Considerations for Wheat and Soybean." Presentation at University of Kentucky Spray Clinic, Princeton, KY, July 17, 2018.

Status: Presented

Acknowledgement of Federal Support: Yes

Bradley, C.A. and T. Stombaugh. 2018. "Fungicide and Sprayer Technology." Presentation at University of Kentucky Wheat Field School, Princeton, KY, April 26, 2018.

Status: Presented

Acknowledgement of Federal Support: Yes

Bradley, C.A. 2018. "Fungicide Management of Fusarium Head Blight: Do's and Don'ts." Presentation at University of Kentucky Winter Wheat Meeting, Hopkinsville, KY, January 4, 2018.

Status: Presented

Acknowledgement of Federal Support: Yes

Bradley, C.A. 2018. "Update on wheat and soybean disease research." Presentation at Kentucky Commodity Conference, Bowling Green, KY, January 18, 2018.

Status: Presented

Acknowledgement of Federal Support: Yes