

USDA-ARS
U.S. Wheat and Barley Scab Initiative
FY18 Performance Report
Due date: September 23, 2019

Cover Page

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Fiscal Year:	2018
USDA-ARS Agreement ID:	59-0206-5-007
USDA-ARS Agreement Title:	Applied Management of Fusarium Head Blight in Kentucky.
FY18 USDA-ARS Award Amount:	\$ 38,452
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:	09/08/18 - 09/07/19
Reporting Period End Date:	09/07/19

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
MGMT	Applied Management of Fusarium Head Blight in Kentucky.	\$ 26,636
MGMT	Educating Soft Winter Wheat Producers on MR Varieties as the Foundation of FHB Management.	\$ 11,816
	FY18 Total ARS Award Amount	\$ 38,452



Principal Investigator

9/23/2019

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: *Applied Management of Fusarium Head Blight in Kentucky.*

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

The overall project goal is to improve management of FHB and DON. The specific objectives of the proposed study are: 1) evaluate the integrated effects of fungicide treatment and genetic resistance on FHB and DON in all major grain classes, with emphasis on a new fungicide, Miravis[®] Ace; 2) compare the efficacy of Miravis Ace when applied at heading or at anthesis to that of standard anthesis application of Prosaro or Caramba; 3) generate data to further quantify the economic benefit of FHB/DON management strategies; 4) develop more robust “best-management practices” for FHB and DON; and 5) generate data to validate and advance the development of FHB and DON risk prediction models.

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

1) major activities

The major activities including conducting an “integrated management trial” and a “uniform fungicide trial” at the UK-Research & Education Center at Princeton, KY. The collected data were then sent to Dr. Pierce Paul’s (Ohio State University) research program for multi-state data analyses. Results from the research trials also were presented at scientific and extension meetings.

2) specific objectives

The specific objectives were to: 1) evaluate the integrated effects of fungicide treatment and genetic resistance on FHB and DON in all major grain classes, with emphasis on a new fungicide, Miravis Ace; 2) compare the efficacy of Miravis Ace when applied at heading or at anthesis to that of standard anthesis application of Prosaro or Caramba; 3) generate data to further quantify the economic benefit of FHB/DON management strategies; 4) develop more robust “best-management practices” for FHB and DON; and 5) generate data to validate and advance the development of FHB and DON risk prediction models.

To meet these objectives, an integrated management trial (IMT) and a uniform fungicide trial (UFT) were conducted at the UK-Research & Education Center at Princeton, KY. The IMT trial investigated the effect of different fungicide products and different timings on three different soft red winter wheat cultivars that differed in FHB-susceptibility. The specific fungicide treatments were: a) Prosaro applied at Feekes 10.5.1; b) Miravis Ace applied at Feekes 10.5.1; c) Miravis Ace applied at Feekes 10.3; and d) a non-treated control. Plots with these treatments were inoculated with spores of *F. graminearum* at Feekes 10.5.1. In addition, a non-treated control and a Prosaro treatment at Feekes 10.5.1 were included that were on non-inoculated plots. Data collected and sent to Dr. Pierce Paul included FHB severity, FHB incidence, FHB index, FDK, test weight, DON, and yield.

The UFT trial investigated a total of 11 treatments, which were: 1) Non-treated control; 2) Prosaro at Feekes 10.5.1; 3) Caramba at Feekes 10.5.1; 4) Miravis Ace at Feekes 10.3; 5)

Miravis Ace at Feekes 10.5.1; 6) Miravis Ace at Feekes 10.5.1 + Prosaro 4 days later; 7) Miravis Ace at Feekes 10.5.1 + Caramba 4 days later; 8) Miravis Ace at Feekes 10.5.1 + Folicur 4 days later; 9) Headline at Feekes 10 + Miravis Ace at Feekes 10.5.1; 10) Headline at Feekes 10 + Miravis Ace at Feekes 10.5.1; and 11) Headline at Feekes 10. This trial was under mist-irrigation to help improve infection by *F. graminearum* and disease development. Data collected and sent to Dr. Pierce Paul included FHB severity, FHB incidence, FHB index, FDK, test weight, DON, and yield.

3) significant results

For the IMT, mean FHB index values ranged from 0.1 to 12.5, and mean DON values ranged from 0.2 to 4.6 ppm. Overall, the FHB index values and DON values were greatest in the cultivar that was most susceptible to FHB (FHB index values of 12.5 vs. 8.3 vs. 1.4, and DON values of 4.6 ppm vs. 1.5 ppm vs. 0.7 ppm for the non-treated controls of the MR vs MS vs S cultivars, respectively). For the S and MS cultivars, all fungicide treatments significantly ($P \leq 0.05$) reduced FHB index values relative to the non-treated controls. For the MR cultivar, FHB index values were too low to observe any significant differences among treatments. For the S cultivar, all fungicide treatments significantly reduced DON values relative to the non-treated control. For the MS cultivar, all fungicide treatments except Miravis Ace applied at Feekes 10.3, reduced DON values relative to the non-treated control. For the MR cultivar, no differences among treatments for DON values were observed due to the low DON values in all treatments (DON values were ≤ 0.7 ppm for the MR cultivar).

For the UFT, mean FHB index values ranged from 0.2 to 8.3, and DON values ranged from 2.1 to 7 ppm. All treatments, except Headline at Feekes 10, significantly reduced FHB index relative to the non-treated control. The only treatments that significantly reduced DON values relative to the non-treated control were treatments with Miravis Ace at Feekes 10.5.1 that were followed with either Prosaro, Caramba, or Folicur 4 days later. Headline applied at Feekes 10 significantly increased DON relative to the non-treated control.

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 (one from the University of Tennessee-Martin and one from Southern Illinois University), a post doc from the University of Kentucky, a research analyst from the University of Kentucky, and an extension associate from the University of Kentucky to gain hands-on learning about the Fusarium head blight

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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.

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

Results of the Coordinated Management Trials have been disseminated to the scientific community through journal articles and through 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.

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Project 2: *Educating Soft Winter Wheat Producers on MR Varieties as the Foundation of FHB Management.*

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

This project was aimed at strengthening the message and enhancing adoption of variety resistance, particularly in soft winter wheat. The objectives included: developing a national webinar focused on certified crop advisors (CCAs), seeking opportunities to address and inform millers, elevator operators, and other grain purchasers at their meetings and via their information networks, and coordinating with state extension specialists to ensure state commodity groups are receiving and disseminating research-based results.

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

1) major activities

The major activity that occurred was the development of a 2-part webinar series titled, “Management of Fusarium head blight (scab) of wheat”. The two webinars in the series were titled, “Understanding the basics of Fusarium head blight” and “Management of Fusarium head blight (scab) of wheat with fungicides”, and were presented live on February 11th and 18th, 2019, respectively. These webinars were presented as part of the Agronomy Society of America’s on-line training program that is focused on allowing CCAs to get continuing education units (CEUs).

2) specific objectives

The specific objective for this activity was to educate CCAs on the biology and management of FHB, with a heavy focus on the importance of utilizing moderately resistant varieties as part of a FHB management program.

3) significant results

A total of 929 and 912 people registered for the first and second webinar, respectively. Most of the registrants were from the U.S. (81%) and Canada (17%), with a handful from other countries. Each webinar provided 2 CEUs as part of the CCA training program. A post-webinar survey was available for attendees to fill out. Based on this survey, 64% found the program “very valuable” and 31% found it “somewhat valuable”.

4) key outcomes or other achievements

In total, nearly 1,000 people attended both webinars. In addition, the recorded webinars are available on-line and can be accessed at any time. We can continue to utilize these webinars to help educate stakeholders about the importance of utilizing moderately-resistant varieties for managing FHB and DON.

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

These webinars provided an opportunity for many CCAs across the U.S. to learn more about FHB and how to utilize moderately-resistant varieties as part of an overall FHB management program.

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

The webinar is available on-line at: <https://www.agronomy.org/education/classroom/classes>. Information about the webinar was disseminated through e-mail list-servs, through press releases, and through on-line newsletters distributed by commodity groups and university extension specialists.

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Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY18 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 FY18 award period?** Yes

If yes, how many? 1

2. **Did any graduate students in your research program supported by funding from your USWBSI grant earn their Ph.D. degree during the FY18 award period?** No

If yes, how many?

3. **Have any post docs who worked for you during the FY18 award period and were supported by funding from your USWBSI grant taken faculty positions with universities?** No

If yes, how many?

4. **Have any post docs who worked for you during the FY18 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 FY18 award period. All columns must be completed for each listed germplasm/cultivar. Use the key below the table for Grain Class abbreviations.

NOTE: 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 FY18-FPR_Instructions for detailed instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY18 grant. Only include citations for publications submitted or presentations given during your award period (09/08/18 - 09/07/19). 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. See example below for a poster presentation with an abstract:

Conley, E.J., and J.A. Anderson. 2018. Accuracy of Genome-Wide Prediction for Fusarium Head Blight Associated Traits in a Spring Wheat Breeding Program. In: Proceedings of the XXIV International Plant & Animal Genome Conference, San Diego, CA.

Status: Abstract Published and Poster Presented

Acknowledgement of Federal Support: YES (poster), NO (abstract)

Journal publications.

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* 102:2500-2510.

Status: Published

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* 102:2539-2544.

Status: Published

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* 102:2602-2615.

Status: Published

Acknowledgement of Federal Support: YES

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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. 2019. Integrated effects of genetic resistance and prothioconazole + tebuconazole application timing on Fusarium head blight in wheat. *Plant Disease* 103:223-227.

Status: Published

Acknowledgement of Federal Support: YES

Cowger, C., C.A. Bradley, J. Ransom, and G.C. Bergstrom. 2019. Managing a destructive, episodic crop disease: a national survey of wheat and barley grower's experience with Fusarium head blight. *Plant Disease* (In press).

Status: In press

Acknowledgement of Federal Support: YES

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

Nothing to report

Other publications, conference papers and presentations.

Salgado, J.D., G. Bergstrom, C. Bradley, K. Bowen, E. Byamukama, A. Byrne, A. Collins, C. Cowger, J. Cummings, V. Chapara, M.I. Chilvers, E. De Wolf, R. Dill-Macky, H.M. Darby, P.D. Esker, A. Friskop, J. Halvorson, N. Kleczewski, L.V. Madden, J. Marshall, H. Mehl, M. Nagelkirk, J. Starr, J. Stevens, D. Smith, M. Smith, S. Wegulo, K. Wise, D. Yabwalo, H.M. Young-Kelly, and P.A. Paul. 2018. Efficacy of Miravis Ace for FHB and DON management across environments and grain market classes: a progress report. In: Canty, S., A. Hoffstetter, B. Wiermer, and R. Dill-Macky (Eds.), *Proceedings of the 2018 National Fusarium Head Blight Forum* (pp. 40-44). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative.

Status: Published

Acknowledgement of Federal Support: YES

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. 2018. Efficacy of two-treatment fungicide programs for FHB management: a multi-state coordinated project. In: Canty, S., A. Hoffstetter, B. Wiermer, and R. Dill-Macky (Eds.), *Proceedings of the 2018 National Fusarium Head Blight Forum* (pp. 45-46). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative.

Status: Abstract published and poster presented

Acknowledgement of Federal Support: YES (poster), YES (abstract)

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Bradley, C., and Paul, P. 2019. Management of Fusarium head blight (scab) of wheat with fungicides. On-line webinar presented February 18, 2019. Recorded version available at: <https://www.agronomy.org/education/classroom/classes>.

Status: Presented and available on-line

Acknowledgement of Federal Support: YES

Bradley, C. 2019. Which and when? Fungicide management of Fusarium head blight. Presentation given at the 2019 University of Kentucky Winter Wheat Meeting in Hopkinsville, KY on January 8, 2019.

Status: Presented

Acknowledgement of Federal Support: YES

Bradley, C. 2019. Wheat and soybean disease update. Presentation at the 2019 Kentucky-Tennessee Ag Day in Russellville, KY on February 8, 2019.

Status: Presented

Acknowledgement of Federal Support: YES

Bradley, C. 2019. Fungicide management of Fusarium head blight of wheat. Presentation at the 2019 University of Kentucky Wheat Field Day in Princeton, KY on May 14, 2019.

Status: Presented

Acknowledgement of Federal Support: YES