USDA-ARS
U.S. Wheat and Barley Scab Initiative
FY19 Final Performance Progress Report
Due date: November 30, 2021

Cover Page

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Fiscal Year:	2019
USDA-ARS Agreement ID:	58-6070-9-019
USDA-ARS Agreement Title:	Management of Fusarium head blight of small grain crops in Kentucky
FY20 USDA-ARS Award Amount:	$ 36,803
Recipient Organization:	University of Kentucky Sponsored Projects Administration 500 S Limestone 109 Kinkead Hall Lexington, KY 40526-0001
DUNS Number:	939017877
EIN:	61-6033693
Recipient Identifying Number or Account Number:	3200002896
Project/Grant Reporting Period:	6/1/19 - 9/30/21
Reporting Period End Date:	9/30/2021

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
MGMT	Applied Management of Fusarium Head Blight in Kentucky	$ 25,550
MGMT	Educating Soft Winter Wheat Producers on MR Varieties as the Foundation of FHB Management	$ 11,253
	FY19 Total ARS Award Amount	**$ 36,803**

Carl A Bradley

11/28/2021

Principal Investigator Date

* MGMT – FHB Management
FST – Food Safety & Toxicology
R – Research
S – Service (DON Testing Lab)
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 research 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 newly-registered 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) evaluate multiple applications for FHB and DON management; 4) generate data to further quantify the economic benefit of FHB/DON management strategies; 5) develop more robust "best-management practices" for FHB and DON; and 6) generate data to validate and advance the development of FHB and DON risk prediction models.

2. What was accomplished under these goals or objectives? *(For each major goal/objective, address these three items below.)*

a) What were the major activities?

Two trials were conducted, which were an "integrated management trial" and a "uniform fungicide trial". These trials were conducted at the University of Kentucky Research & Education Center at Princeton, KY. Research trials were established, managed, sprayed with the fungicide treatments, rated for disease severity, and harvested for yield and for grain samples to be evaluated for DON. Since these projects are part of an overall coordinated project, the data were sent to Dr. Pierce Paul's research program (The Ohio State University), where the multi-state data were analyzed. Results from the research trials also were presented at scientific and extension meetings.

b) What were the significant results?

For the "integrated management trial", relatively low FHB pressure was present with means FHB index values ranging from 0.1 to 2.5. Although low, FHB index values generally were greatest in the susceptible (S) cultivar (AgriMaxx 446) compared to the moderately-susceptible (MS) cultivar (Pembroke 16) and the moderately-resistant (MR) cultivar (AgriMaxx 463). Within the S cultivar, FHB index was significantly ($P \leq 0.05$) lower than the non-treated control when sprayed with any of the fungicide treatments. Within the MS cultivar, FHB index was significantly lower than the non-treated control when sprayed with Prosaro at anthesis or Miravis Ace at anthesis. Within the MR cultivar, no differences were observed among fungicide treatments for FHB index due to overall low FHB levels in that cultivar. Grain yields were significantly improved with fungicide treatments in the S and MS cultivars, but not in the MR cultivar. Test weights were significantly improved with Miravis Ace treatments within all three cultivars. DON values ranged from 0.6 to 2.1 ppm. Compared to the non-

treated control of the S cultivar, all treatments, except the S cultivar treated with Miravis Ace at Feekes 10.3, had significantly lower DON values.

For the "uniform fungicide trial", FHB index was significantly reduced when any of the fungicide treatments were applied, compared to the non-treated control. The FHB index values ranged from 0.9 to 11.2. The fungicide treatments included Miravis Ace, a relatively new fungicide available for wheat farmers in the U.S. as well as an experimental product from BASF (BAS 840). No differences among treatments were observed for grain yield or test weight. DON values were relatively high, ranging from 2.9 to 6.9 ppm. All treatments except Miravis Ace applied at Feekes 10.3 and the combination treatment of Miravis Ace at Feekes 10.3 followed by Folicur 4 days after Feekes 10.51 had significantly lower DON values than the non-treated control.

c) List key outcomes or other achievements.

Much-needed information about how well the new fungicide Miravis Ace performs in managing FHB was obtained. Wheat farmers in Kentucky and the region, are eager to see unbiased research results with this new fungicide. In addition, it was also important to evaluate the experimental fungicide BAS 840, as it will be registered for use for the 2022 growing season. As observed in previous studies and confirmed in this research, the greatest reduction in FHB occurred when moderately resistant cultivars were planted and sprayed with an effective fungicide at the correct application timing.

3. Was this research impacted by the COVID-19 pandemic (i.e. university shutdowns and/or restrictions, reduced or lack of support personnel, etc.)? If yes, please explain how this research was impacted or is continuing to be impacted.

A reduction in summer seasonal technical help was applied at the University of Kentucky. In addition, restrictions on the number of people per university vehicle was applied. These changes resulted in longer hours (in some cases overtime being accrued) for support personnel as well as additional expenses on University of Kentucky motor pool vehicles.

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

Conducting this research allowed one undergraduate student (from Murray State University), a M.S. graduate student from the University of Kentucky, a postdoctoral scholar 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 disease cycle, impacts of this disease, and management options. In addition, the project has allowed the PI and a graduate student to attend the National Fusarium Head Blight Forum, which has promoted interaction with other scientists working on this disease. Results from this project

were presented to farmers, crop consultants, and others, which presents opportunities for their professional development and learning.

5. 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.

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 research 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 or objectives?** *(For each major goal/objective, address these three items below.)*

   a) **What were the 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). Although these webinars were presented live prior to this reporting period, the recorded webinars are still freely available on-line for CCAs and others to watch.

   b) **What were the significant results?**
   The two webinars were successful. Registration of attendees for the live webinars approached 1,000 people, and the recorded webinars available on-line continue to be viewed.

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

3. **Was this research impacted by the COVID-19 pandemic (i.e. university shutdowns and/or restrictions, reduced or lack of support personnel, etc.)? If yes, please explain how this research was impacted or is continuing to be impacted.**

   This project was not impacted by the COVID-19 pandemic.

4. **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.

5. 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

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY20 award period (6/1/19 - 9/30/21). 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 FY19 award period?**
   ☐Yes ☒No ☐ Not Applicable
   If yes, how many? Click to enter number here.

2. **Did any graduate students in your research program supported by funding from your USWBSI grant earn their Ph.D. degree during the FY19 award period?**
   ☐Yes ☒No ☐ Not Applicable
   If yes, how many? Click to enter number here.

3. **Have any post docs who worked for you during the FY19 award period and were supported by funding from your USWBSI grant taken faculty positions with universities?**
   ☐Yes ☒No ☐ Not Applicable
   If yes, how many? Click to enter number here.

4. **Have any post docs who worked for you during the FY19 award period and were supported by funding from your USWBSI grant gone on to take positions with private ag-related companies or federal agencies?**
   ☐Yes ☒No ☐ Not Applicable
   If yes, how many? Click to enter number here.

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 **FY19 award period (6/1/19 - 9/30/21)**. 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	FHB Rating (0-9)	Year Released
N/A	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year
Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year
Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year
Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year
Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year
Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year
Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year
Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year
Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year
Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year
Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year
Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year

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

Publications, Conference Papers, and Presentations

Instructions: Refer to the PR_Instructions for detailed more instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY20 grant award. Only citations for publications published (submitted or accepted) or presentations presented during the **award period (6/1/19 - 9/30/21**) should be included. If you did not publish/submit or present anything, state 'Nothing to Report' directly above the Journal publications section.

NOTE: Directly below each citation, you **must** indicate the Status (i.e. published, submitted, etc.) and whether acknowledgement of Federal support was indicated in the publication/ presentation. See example below for a poster presentation with an abstract:

Winn, Z.J., Acharya, R., Lyerly, J., Brown-Guedira, G., Cowger, C., Griffey, C., Fitzgerald, J., Mason R.E., and Murphy, J.P. (2020, Dec 7-11). Mapping of Fusarium Head Blight Resistance in NC13-20076 Soft Red Winter Wheat. p. 12. In: Canty, S., Hoffstetter, A. and Dill-Macky, R. (Eds.), *Proceedings of the 2020 National Fusarium Head Blight Forum*. https://scabusa.org/pdfs/NFHBF20_Proceedings.pdf.
Status: Abstract Published and Poster Presented
Acknowledgement of Federal Support: YES (Abstract and Poster)

Journal publications.

Anderson, N. R., A. N. Freije, G. C. Bergstrom, C. A. Bradley, C. Cowger, T. Faske, C. Hollier, N. Kleczewski, G. B. Padgett, P. Paul, T. Price, and K. A. Wise. 2020. Sensitivity of *Fusarium graminearum* to metconazole and tebuconazole fungicides before and after widespread use in wheat in the United States. Plant Health Progress 21:85-90.
Status: Published
Acknowledgement of Federal Support: YES

Cowger, C., C. A. Bradley, J. Ransom, and G. C. Bergstrom. 2020. Managing a destructive, episodic crop disease: a national survey of wheat and barley growers' experience with Fusarium head blight. Plant Disease 104:634-648.
Status: Published
Acknowledgement of Federal Support: YES

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

N/A

Other publications, conference papers and presentations.

Paul, P. A., S. J. Ng, G. Bergstrom, K. Bissonnette, K. Bowen, C. Bradley, E. Byamukama, M. Chilvers, A. Collins, C. Cowger, H. Darby, E. DeWolf, R. Dill Macky, P. Esker, A. Friskop, N. Kleczewski, A. Koehler, L. Madden, J. Marshall, H. Mehl, W. Moraes, M. Nagelkirk, N. Rawat, D. Smith, D. Telenko, S. Wegulo, H. Young-Kelly. 2019. "Fusarium head blight management coordinated project: integrated management trials 2018-2019". In: S. Canty, A. Hoffstetter, H. Campbell, and R. Dill-Macky (Eds.). *Proceedings of the 2019 National Fusarium Head Blight Forum*, Milwaukee, WI; December 8-10. University of Kentucky, Lexington, KY. pp. 20-24.
Status: Published
Acknowledgement of Federal Support: YES

Paul, P. A., S. J. Ng, G. Bergstom, K. Bissonnette, K. Bowen, C. Bradley, E. Byamukama, M. Chilvers, A. Collins, C. Cowger, H. Darby, E. DeWolf, R. Dill Macky, P. Esker, A. Friskop, N. Kleczewski, A. Koehler, L. Madden, J. Marshall, H. Mehl, W. Moraes, M. Nagelkirk, N. Rawat, D. Smith, D. Telenko, S. Wegulo, and H. Young-Kelly. 2019. "Fusarium head blight management coordinated project: uniform fungicide trials 2018-2019". In: S. Canty, A. Hoffstetter, H. Campbell, and R. Dill-Macky (Eds.). *Proceedings of the 2019 National Fusarium Head Blight Forum*, Milwaukee, WI; December 8-10. University of Kentucky, Lexington, KY. pp. 25-29.
Status: Published
Acknowledgement of Federal Support: YES

Bradley, C. A. 2020. "Results of fungicide trials focusing on Fusarium head blight management". Presentation at the 2020 University of Kentucky Winter Wheat Conference, Princeton, KY, January 7, 2020.
Status: Presented
Acknowledgement of Federal Support: YES

Bradley, C. A. 2020. "Soybean and wheat disease update". Presentation at the 2020 Kentucky-Tennessee Grain Day Conference, Russellville, KY, February 7, 2020.
Status: Presented
Acknowledgement of Federal Support: YES

Bradley, C. A. 2020. "Wheat disease management considerations". Presentation at the 2020 University of Kentucky Virtual Wheat Field Day, Princeton, KY, May 12, 2020.
Status: Presented
Acknowledgement of Federal Support: YES

J.M. Luis, S.J. Ng, G. Bergstrom, K. Bissonnette, K. Bowen, C. Bradley, E. Byamukama, M. Chilvers, A. Collins, C. Cowger, H. Darby, E. DeWolf, R. Dill-Macky, P. Esker, A. Friskop, N. Kleczewski, A. Koehler, D.B. Langston, L. Madden, J. Marshall, H. Mehl, W. Moraes,

M. Nagelkirk, N. Rawat, D. Smith, D. Telenko, S. Wegulo, H. Young-Kelly, and P.A. Paul. 2020. "Fusarium head blight management coordinated project: integrated management trials 2018-2020." In: S. Canty, A. Hoffstetter, and R. Dill-Macky (Eds.), *Proceedings of the 2020 National Fusarium Head Blight Forum* (p. 38-43), Virtual; December 7-11. Online: https://scabusa.org/pdfs/NFHBF20_Proceedings.pdf.

Status: Published
Acknowledgement of Federal Support: YES

J.M. Luis, S.J. Ng, G. Bergstrom, K. Bissonnette, K. Bowen, C. Bradley, E. Byamukama, M. Chilvers, A. Collins, C. Cowger, H. Darby, E. DeWolf, R. Dill Macky, P. Esker, A. Friskop, N. Kleczewski, A. Koehler, D.B. Langston, L. Madden, J. Marshall, H. Mehl, W. Moraes, M. Nagelkirk, N. Rawat, D. Smith, D. Telenko, S. Wegulo, H. Young-Kelly, and P.A. Paul. 2020. "Fusarium head blight management coordinated project: uniform fungicide trials 2018-2020." In: S. Canty, A. Hoffstetter, and R. Dill-Macky (Eds.), *Proceedings of the 2020 National Fusarium Head Blight Forum* (p. 44-48), Virtual; December 7-11. Online: https://scabusa.org/pdfs/NFHBF20_Proceedings.pdf.

Status: Published
Acknowledgement of Federal Support: YES

C. Bradley. 2021. "Putting it all together: integrated management of head scab in wheat." Presentation at the 2021 University of Kentucky Winter Wheat Meeting; Virtual; January 5, 2021. Online: https://wheatscience.ca.uky.edu/videos.

Status: Published
Acknowledgement of Federal Support: YES

C. Bradley. 2021. "Foliar fungicides for disease control in field crops." Presentation at the 2021 Tennessee Grain & Soybean Producers Conference; Virtual; January 2021. Online: https://conference.utcrops.com/foliar-fungicides-for-disease-control-in-field-crops/.

Status: Published
Acknowledgement of Federal Support: YES

C. Bradley. 2021. "Foliar fungicides for disease control in wheat and soybean". Presentation at the Virtual Grain Conference for Carlisle and Fulton Counties, KY; Virtual; March 1, 2021.

Status: Presented
Acknowledgement of Federal Support: YES

C. Bradley. 2021. "Management of Fusarium head blight". Presentation at the 2021 University of Kentucky Wheat Webinar; Virtual; May 11, 2021. Online: https://www.youtube.com/watch?v=WpV1XsQ9pXk.

Status: Presented
Acknowledgement of Federal Support: YES