USDA-ARS | U.S. Wheat and Barley Scab Initiative

FY22 Performance Progress Report

Due date: July 26, 2023

Cover Page

USDA-ARS Agreement ID:	59-0206-2-098
USDA-ARS Agreement Title:	Fusarium Head Blight Management in Kentucky
Principle Investigator (PI):	Carl Bradley
Institution:	University of Kentucky
Institution UEI:	H1HYA8Z1NTM5
Fiscal Year:	2022
FY22 USDA-ARS Award Amount:	$37,949
PI Mailing Address:	University of Kentucky, Department of Plant Pathology 1205 Hopkinsville Street, Princeton, KY 42445
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Period of Performance:	May 1, 2022 – April 30, 2026
Reporting Period End Date:	April 30, 2023

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
MGMT IM-CP	Integrated Management of Fusarium Head Blight of Small Grain Crops in Kentucky	$37,949
	FY22 Total ARS Award Amount	$37,949

I am submitting this report as an: ☒ Annual Report

I certify to the best of my knowledge and belief that this report is correct and complete for performance of activities for the purposes set forth in the award documents.

Carl A Bradley _____ 7/24/2023 _____

Principal Investigator Signature Date Report Submitted

‡ BAR-CP – Barley Coordinated Project
DUR-CP – Durum Coordinated Project
EC-HQ – Executive Committee-Headquarters
FST-R – Food Safety & Toxicology (Research)
FST-S – Food Safety & Toxicology (Service)
GDER – Gene Discovery & Engineering Resistance
HWW-CP – Hard Winter Wheat Coordinated Project
MGMT – FHB Management
MGMT-IM – FHB Management – Integrated Management Coordinated Project
PBG – Pathogen Biology & Genetics
TSCI – Transformational Science
VDHR – Variety Development & Uniform Nurseries
NWW –Northern Soft Winter Wheat Region
SPR – Spring Wheat Region
SWW – Southern Soft Red Winter Wheat Region

Project 1: Integrated Management of Fusarium Head Blight of Small Grain Crops in Kentucky

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1. **What are the major goals and objectives of the research project?**
   The major objectives of the project are: i) evaluate integrated effects of fungicide treatment and genetic resistance on FHB and DON in wheat and barley; ii) compare efficacy of new fungicide products vs. existing "standards"; iii) generate data to quantify the economic benefit of FHB management programs; and iv) generate data to validate FHB 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 on both soft red winter wheat and winter barley. The trials included a non-irrigated "integrated management" trial and a mist irrigated "uniform fungicide trial". The trials were conducted at the University of Kentucky Research and Education Center in Princeton, KY. The integrated management trials evaluated different fungicides and fungicide application timings on different cultivars of soft red winter wheat and winter barley, and the uniform fungicide trials evaluated several fungicide and application timings on FHB-susceptible cultivars of soft red winter wheat and winter barley in mist-irrigated environments to encourage high FHB pressure.

   b) **What were the significant results?**
   Integrated management trial in soft red winter wheat: Overall, FHB index values were moderate (ranging from 1.8 to 15.8) and DON values were moderate to high (ranging from 0.7 to 5.6 ppm). FHB index and DON values were lowest in the moderately-resistant cultivar; however, some fungicide treatments (even in the moderately-resistant cultivar) still had DON values ≥2 ppm. In the susceptible and moderately-susceptible cultivars, fungicide treatments that resulted in DON levels less than 2 ppm were Prosaro, Prosaro Pro, or Sphaerex applied at Feekes 10.51. In the moderately-resistant cultivar, fungicide treatments that resulted in DON levels less than 2 ppm were Prosaro, Miravis Ace, Prosaro Pro, or Sphaerex applied at Feekes 10.51.

   Uniform fungicide trial in soft red winter wheat: Overall FHB index values were low (ranging from 0.9 to 3.2) and Don values were low (ranging from 0.1 to 2.0 ppm). All fungicide treatments, regardless of product or application timing, resulted in statistically significantly lower DON contamination compared to the non-treated control, and all fungicide treatments resulted in DON contamination values less than 2 ppm.

   Integrated management trial in winter barley: Overall FHB index values were low (ranging from 0.5 to 1.3), and DON values were relatively low (ranging from 0.4 to 1.5 ppm). This was the first year that 2-row winter barley cultivars were evaluated in a University of Kentucky FHB trial. Although disease levels were relatively low, it did appear that the cultivar 'Calypso' may have been more susceptible than the cultivar

'Violetta'. In 'Calypso', treatments that significantly reduced DON compared to the nontreated control were Miravis Ace, Prosaro Pro, or Sphaerex applied at Feekes 10.5 or Sphaerex applied 5 days after Feekes 10.5 (which provided the greatest DON reduction of all treatments). In 'Violetta', treatments that significantly reduced DON compared to the nontreated control were Prosaro, Miravis Ace, Prosaro Pro, or Sphaerex applied at Feekes 10.5 or Sphaerex applied 5 days after Feekes 10.5.

Uniform fungicide trial in winter barley: Overall, FHB index values were low (ranging from 0.2 to 0.8) and DON values were relatively low (ranging from 0.2 to 1.6 ppm). The treatments that had significantly lower DON values than the non-treated control were Prosaro, Caramba, Miravis Ace or Sphaerex applied at Feekes 10.5, and successive treatments of Miravis Ace applied at Feekes 10.5 followed by Prosaro Pro, Sphaerex, or Folicur 5 days later, Sphaerex applied at Feekes 10.5 followed by Folicur 5 days later, Prosaro Pro applied at Feekes 10.5 followed by Caramba 5 days later, and Prosaro Pro or Sphaerex applied 5 days after Feekes 10.5. Fungicide applications made at the boot stage (Feekes 10) did not result in DON levels lower than the non-treated control.

c) List key outcomes or other achievements.

Although FHB and DON levels were relative low in these trials, significant differences among treatments were observed. Data from the wheat trials were sent to Dr. Pierce Paul's program (Ohio State University) for meta-analysis using data from multiple locations across several states and wheat grain classes. Having such a large set of data can help lead to national outcomes. Both results from local Kentucky trials and the results of the national meta-analyses are used to show stakeholders the importance of choosing the correct fungicide and application timing for FHB and DON management, and even more importantly that the best control of FHB and DON occurs when integrated management is used by planting the most resistant cultivars and applying the best fungicides at the best application timing.

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

This research provided training for 2 graduate students, 2 undergraduate summer interns, and 1 post-doctoral scholar in my research program.

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

Results have been disseminated to local stakeholders through winter meeting presentations and field day presentations. In addition, results were summarized in USWBSI National FHB Forum Proceedings articles.

Publications, Conference Papers, and Presentations

Please include a listing of all your publications/presentations about your FHB work that were a result of funding from your FY22 grant award. Only citations for publications published (submitted or accepted) or presentations presented during the **award period** should be included.

Did you publish/submit or present anything during this award period May 1, 2022 – April 30, 2023?

X Yes, I've included the citation reference in listing(s) below.

☐ No, I have nothing to report.

Journal publications as a result of FY22 award

List peer-reviewed articles or papers appearing in scientific, technical, or professional journals. Include any peer-reviewed publication in the periodically published proceedings of a scientific society, a conference, or the like.

Identify for each publication: Author(s); title; journal; volume: year; page numbers; status of publication (published [include DOI#]; accepted, awaiting publication; submitted, under review; other); acknowledgement of federal support (yes/no).

Books or other non-periodical, one-time publications as a result of FY22 award

Report any book, monograph, dissertation, abstract, or the like published as or in a separate publication, rather than a periodical or series. Include any significant publication in the proceedings of a one-time conference or in the report of a one-time study, commission, or the like.

Identify for each one-time publication: Author(s); title; editor; title of collection, if applicable; bibliographic information; year; type of publication (book, thesis, or dissertation, other); status of publication (published; accepted, awaiting publication; submitted, under review; other); acknowledgement of federal support (yes/no).

Other publications, conference papers and presentations as a result of FY22 award

Identify any other publications, conference papers and/or presentations not reported above. Specify the status of the publication.

Moraes, W. B., Bergstrom, G., Bissonnette, K., Bowen, K., Bradley, C., Byamukama, E., Chilvers, M., Collins, A., Cowger, C., Darby, H., DeWolf, E., Dill Macky, R., Esker, P., Friskop, A., Kleczewski, N., Koehler, A., Langston, D., Madden, L., Marshall, J., Mehl, H., Negelkirk, M., Rawat, N., Smith, D., Telenko, D., Wegulo, S., Young-Kelly, H., and Paul, P. (2022). Fusarium head blight management coordinated project: integrated management trials 2022. Proceedings of the 2022 National Fusarium Head Blight Forum; Tampa, FL. December 4-6, 2022. Retrieved from: https://scabusa.org/forum/2022/2022NFHBForumProceedings.pdf. Acknowledgement of federal support: yes

Moraes, W. B., Bergstrom, G., Bissonnette, K., Bowen, K., Bradley, C., Byamukama, E., Chilvers, M., Collins, A., Cowger, C., Darby, H., DeWolf, E., Dill Macky, R., Esker, P., Friskop, A., Kleczewski, N., Koehler, A., Langston, D., Madden, L., Marshall, J., Mehl, H., Negelkirk, M., Rawat, N., Smith, D., Telenko, D., Wegulo, S., Young-Kelly, H., and Paul, P. 2022. Fusarium head blight management coordinated project: uniform fungicide trials. Proceedings of the 2022 National Fusarium Head Blight Forum Tampa, FL. December 4-6, 2022. Retrieved from: https://scabusa.org/forum/2022/2022NFHBForumProceedings.pdf. Acknowledgement of federal support: yes

Bradley, C. 2022. Management of soybean and wheat diseases. Presentation at the Southern Illinois Fertilizer and Pesticide Conference, November 22, 2023, Mt. Vernon, IL.
Acknowledgement of federal support: yes

Bradley, C. 2023. Managing important wheat diseases. Presentation at the University of Kentucky Winter Wheat Meeting, January 5, 2023, Hopkinsville, KY.
Acknowledgement of federal support: yes

Bradley, C. 2023. Management of soybean and wheat diseases. Presentation at the Illinois Fertilizer and Chemical Association Conference, January 17, 2023, Peoria, IL.
Acknowledgement of federal support: yes

Bradley, C. 2023. Wheat disease management. Presentation at the Illinois Crop Management Conference Webinar (recorded January 2023).
Acknowledgement of federal support: yes

Bradley, C. 2023. Soybean and wheat disease update. Presentation at the University of Kentucky Graves County Extension Grain Day, February 10, 2023, Mayfield, KY.

Bradley, C. 2023. Soybean and wheat disease update. Presentation at the Agribusiness Association of Kentucky Virtual Pest Management Meeting, March 9, 2023.
Acknowledgement of federal support: yes

Bradley, C. 2023. Management of Fusarium head blight. Presentation at the University of Kentucky Wheat Field Day, May 9, 2023, Princeton, KY.
Acknowledgement of federal support: yes