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

FY21 FINAL Performance Progress Report

Due date: July 26, 2023

Cover Page

USDA-ARS Agreement ID:	59-0206-0-183
USDA-ARS Agreement Title:	Integrated management of Fusarium head blight of small grain crops in Kentucky
Principle Investigator (PI):	Carl Bradley
Institution:	University of Kentucky
Institution UEI:	H1HYA8Z1NTM5
Fiscal Year:	2021
FY21 USDA-ARS Award Amount:	$47,428
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Period of Performance:	5/15/21 - 5/14/23
Reporting Period End Date:	5/14/2023

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
MGMT-IM	Integrated Management of Fusarium Head Blight of Small Grain Crops in Kentucky	$47,428
	FY21 Total ARS Award Amount	$47,428

I am submitting this report as a: ☒ FINAL 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 goals and objectives were: i) to evaluate the integrated effects of fungicide treatment and genetic resistance on FHB and DON in soft red winter wheat and winter barley, with emphasis on Miravis Ace fungicide; and ii) to compare the efficacy of Miravis Ace fungicide when applied at early heading or anthesis (heading in barley) to that of standard anthesis (heading in barley) application of Prosaro or Caramba fungicides.

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 relatively low (averaging between 0.03 to 1.58, 0.04 to 1.21, and 0.02 to 0.34 in the susceptible, moderately-susceptible, and moderately-resistant cultivars, respectively). However, DON values in the non-treated checks were greater than 2 ppm in the susceptible and moderately-susceptible cultivars. Overall, all fungicide treatments except Miravis Ace applied at Feekes 10.51 reduced DON contamination to below 2 ppm in the susceptible cultivar, and all fungicide treatments in both the moderately-susceptible and moderately-resistant cultivars resulted in DON contamination less than 2 ppm.

   Uniform fungicide trial in soft red winter wheat: Overall, FHB index values were relative low (averaging between 0.02 to 1.07, but DON contamination values ranged from 1.1 to 4.6 ppm. Single application fungicide treatments that reduced DON contamination to below 2 ppm were Prosaro applied at Feekes 10.51, and Miravis Ace applied at 5 days after Feekes 10.51. Several treatments that evaluated 2 successive fungicide applications were evaluated. Those that reduced DON contamination below 2 ppm were Miravis Ace applied at Feekes 10.51 followed by Prosaro applied 5 days later, Miravis Ace applied at Feekes 10.51 followed by Caramba applied 5 days later, and Miravis Ace applied at Feekes 10.3 followed by Caramba applied 5 days after Feekes 10.51.

Integrated management trial in winter barley: Overall, both FHB index values and DON contamination were low in this trial (FHB index range = 0.03 to 0.23; DON contamination range = 0.2 to 1.3 ppm). Very little information is available regarding susceptibility of 6-row winter barley cultivars to FHB and DON. This trial did help show that 'Thoroughbred' may be less susceptible to FHB and DON than 'Secretariat', as all DON values from 'Thoroughbred' were ≤0.5 ppm, whereas the DON value in the untreated control for 'Secretariat' was 1.3 ppm.

Uniform fungicide trial in winter barley: Overall, both FHB index values and DON contamination were relatively low in this trial (FHB index range = 0 to 2.6; DON contamination range = 0.2 to 0.9 ppm). Statistically significant differences in DON were present, where the following treatments had statistically significant lower DON values compared to the non-treated control: Caramba, Miravis Ace, Sphaerex, or Prosaro applied at Feekes 10.5, Miravis Ace applied at Feekes 10.3 or 3-7 days after heading, and Miravis Ace applied at Feekes 10.51 followed by Prosaro, Caramba, or Folicur 5 days later.

c) List key outcomes or other achievements.

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 webinars, winter meeting presentations, field day presentations, and online newsletter 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 FY21 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?

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

☐ No, I have nothing to report.

Journal publications as a result of FY21 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 FY21 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 FY21 award

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

Bradley, C. 2022. Management of Fusarium head blight (scab) of wheat with fungicides. Kentucky Pest News, April 19, 2022 issue. https://kentuckypestnews.wordpress.com/2022/04/19/management-of-fusarium-head-blight-scab-of-wheat-with-fungicides/
Acknowledgement of federal support: yes

Bradley, C. 2021. Putting it all together: integrated managed of head scab in wheat. Presentation at the University of Kentucky Winter Wheat Virtual Meeting. January 8, 2021.
Acknowledgement of federal support: yes

Bradley, C. 2021. Foliar fungicides for disease control in field crops. Presentation at the University of Tennessee Virtual Grain Conference. February 4, 2021.
Acknowledgement of federal support: yes

Bradley, C. 2021. Foliar fungicides for field crops. Presentation at the University of Kentucky Virtual County Extension Grain Crops Conference for Carlisle and Fulton Counties, March 1, 2021.
Acknowledgement of federal support: yes

Bradley, C. 2022. Blights and spots: wheat and soybean disease management. Presentation at the University of Illinois Crop Management Conference, Mt. Vernon, IL, January 19, 2022.
Acknowledgement of federal support: yes

Bradley, C. 2022. Blights and blotches: wheat disease management update. Presentation at the University of Kentucky Winter Wheat Meeting, Hopkinsville, KY, February 8, 2022.
Acknowledgement of federal support: yes

Bradley, C. 2022. Soybean and wheat disease update. Presentation at the BASF North Delta Consultant Meeting, Nashville, TN, February 10, 2022.
Acknowledgement of federal support: yes

Bradley, C. 2022. Wheat and soybean disease update. Presentation at the University of Kentucky – University of Tennessee Annual Grain Day, Russellville, KY, February 23, 2022.
Acknowledgement of federal support: yes

Bradley, C. 2022. Panel member of the 2022 USWBSI Scabinar. Held as a live webinar on March 15, 2022 and recording available at https://scabusa.org/scabinar.
Acknowledgement of federal support: yes