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:	59-0206-0-191
USDA-ARS Agreement Title:	Integrated Management of Fusarium Head Blight and DON in Winter Wheat and Barley
Principle Investigator (PI):	Stephen Wegulo
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Institution UEI:	HTQ6K6NJFHA6
Fiscal Year:	2021
FY21 USDA-ARS Award Amount:	$16,950
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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	Integrating Strategies to Mitigate Fusarium Head Blight and DON in Winter Wheat	$16,950
	FY21 Total ARS Award Amount	$16,950

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.

Principal Investigator Signature

July 20, 2023
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: Integrating Strategies to Mitigate Fusarium Head Blight and DON in Winter Wheat

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

The overall goal of this research was to integrate cultivar resistance with fungicide application to effectively manage FHB and DON in winter wheat. The specific objectives were:

1) Evaluate the integrated effects of fungicide treatment and genetic resistance on FHB and DON in winter wheat with emphasis on a new fungicide, Miravis Ace
2) Enhance communication and end user education/outreach on integrated management of FHB and DON

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?

In 2021, a field experiment was conducted to investigate the effects of cultivar resistance and fungicide application on FHB and DON in winter wheat. The experiment was located at the University of Nebraska Havelock Research Farm near Lincoln, Nebraska. The experimental design was a split plot in randomized complete blocks with four replications, with cultivars as main plots and fungicide x inoculation treatments as sub-plots. Four cultivars adapted to Nebraska were used: Overland (moderately resistant), Zenda (moderately resistant), Roubidoux (susceptible), and Wesley (susceptible). The fungicide x inoculation treatments were 1) untreated, inoculated check; 2) Prosaro (6.5 fl. oz.) at anthesis, inoculated; 3) Miravis Ace (13.7 fl. oz.) at anthesis, inoculated; 4) Miravis Ace at Feekes 10.3, inoculated; 5) Miravis Ace (13.7 fl. oz.) at anthesis followed by Tebuconazole (4.0 fl oz/A 4-6 days later, inoculated; 6) BAS8400F at anthesis, inoculated; and 7) untreated, non-inoculated check. Fungicides were applied with a CO_2-powered backpack sprayer set at 35 psi, equipped with four Teejet 800-1 VS nozzles, and calibrated to deliver 20 gallons of fungicide-water mixture per acre. In treatments 1 to 6, plots were spray-inoculated with spores of *Fusarium graminearum* (1 x 10^5 spores/mL) 24 hours after fungicide application at anthesis. To enhance inoculum buildup in the plots as well as disease development, corn kernel inoculum was spread weekly on the soil surface starting at three weeks before anthesis. FHB intensity was assessed at the soft dough growth stage. At and following harvest, yield, *Fusarium*-damaged kernels (FDK), and DON concentration were determined. A weather station at the experiment site recorded weather data starting in mid-April through harvest.

b) What were the significant results?

Low levels of FHB developed due to unfavorable weather conditions. The susceptible cultivars Robidoux and Wesley had significantly higher (P = 0.05) FHB index (6.2% and

3.0%, respectively) than the moderately resistant Zenda and Overland (1.0% and 0.4%, respectively). FDK results were similar, with the susceptible Robidoux having the highest FDK (20.5%) and the moderately resistant Overland having the lowest FDK (5.8%). Index in fungicide treated plots ranged from 1.1% (Miravis Ace at anthesis followed by Folicur 4-6 days later) to 2.5% (Prosaro at anthesis) and was significantly lower than index in the non-treated, inoculated check (5.1%) and the non-treated, non-inoculated check (3.9%). Similarly, FDK was significantly lower in fungicide treated plots (10-13%) than in the two checks (18%). DON was negligible at <0.20-0.23 ppm in all treatments.

c) List key outcomes or other achievements.

Although disease levels were low, results showed that the combination of moderate cultivar resistance and application of the fungicides Prosaro, Miravis Ace, and BAS8400F (Sphaerex) at anthesis most effectively reduced FHB index and FDK. Weather data were collected and provided to the FHB forecasting team.

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

Research technologist Julie Stevens and graduate student Mahnoor Asif attended the 2021 National FHB Forum as part of their professional development. Undergraduate student workers gained research training and experience working on the project.

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

Results and FHB management information have been disseminated through Nebraska Extension programs (field days) and the CropWatch newsletter. The PI made a presentation on FHB, including results from this project, at a Nebraska Extension Alfalfa and Wheat Expo on September 2, 2021.

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?

☒ 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.

Asif, M., Wegulo, S., Stevens, J., Frels, K., Hallen-Adams, H. and Eskridge, K. (2022). Effects of fungicides and cultivar resistance on Fusarium head blight of wheat. Page 6 in: Proceedings of the 2022 National Fusarium Head Blight Forum; Tampa, FL. December 4-6, 2022. Retrieved from: https://scabusa.org/forum/202X/202XNFHBForumProceedings.pdf.

Moraes, W. B., et al. (2022a). Fusarium head blight management coordinated project: integrated management trials 2022. Pages 20-21 in: Proceedings of the 2022 National Fusarium Head Blight Forum; Tampa, FL. December 4-6, 2022. Retrieved from: https://scabusa.org/forum/202X/202XNFHBForumProceedings.pdf.

Moraes, W. B., et al. (2022b). Fusarium head blight management coordinated project: uniform fungicide trials 2022. Pages 22-23 in: Proceedings of the 2022 National Fusarium Head Blight Forum; Tampa, FL. December 4-6, 2022. Retrieved from: https://scabusa.org/forum/202X/202XNFHBForumProceedings.pdf.