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

FY22 Performance Progress Report

Due date: July 26, 2023

Cover Page

USDA-ARS Agreement ID:	59-0206-2-158
USDA-ARS Agreement Title:	Management of Fusarium Head Blight (FHB) and DON in Wheat and Barley
Principle Investigator (PI):	Stephen Wegulo
Institution:	University of Nebraska
Institution UEI:	HTQ6K6NJFHA6
Fiscal Year:	2022
FY22 USDA-ARS Award Amount:	$20,001
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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	Integrating Strategies to Mitigate Fusarium Head Blight and DON in Winter Wheat	$20,001
	FY22 Total ARS Award Amount	$20,001

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.

July 20, 2023

Principal Investigator Signature | Date Report Submitted

ǂ 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 is to integrate cultivar resistance with fungicide application to effectively manage FHB and DON in winter wheat. The specific objectives are:

1) Evaluate the integrated effects of fungicide treatment and genetic resistance on FHB and DON in winter wheat, with emphasis on new combination fungicides, Prosaro Pro and Sphaerex.
2) Compare the efficacy of Prosaro Pro and Sphaerex to that of Prosaro, Caramba, and Miravis Ace.
3) Generate data to further quantify the economic benefit of FHB and DON management programs.
4) Generate data to validate and advance the development of 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?

In 2022, 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), Siege (susceptible), and Wesley (susceptible). The fungicide x inoculation treatments were 1) untreated, non-inoculated check; 2) untreated, inoculated check, 3) Prosaro (6.5 fl. oz.) at anthesis, inoculated; 4) Miravis Ace (13.7 fl. oz.) at anthesis, inoculated; 5) Prosaro Pro (10.3 fl. oz.) at anthesis, inoculated; and 6) Sphaerex (7.3 fl oz) at anthesis, inoculated. 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 2 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. The experiment was repeated in 2023 and grain samples are currently being analyzed for FDK and being prepared for submission to a DON testing lab. Data analysis will be performed and data will be submitted to Dr. Pierce Paul later in 2023.

b) What were the significant results?

Very low levels of FHB (< 2%) and DON (< 0.5 ppm) developed due to unusually dry weather conditions. Because of the very low disease and DON levels, results from statistical analysis are not meaningful.

c) List key outcomes or other achievements.

Although there were no significant results due to the drought-like conditions which limited disease development, 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 2022 National FHB Forum as part of their professional development. Graduate student Mahnoor Asif learned how to assess FHB in field plots. 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.

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?

☒ 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.

Frels, K., Wang, F., Wegulo, S., Cai, X., Baenziger, P. S., and Belamkar, V. (2022). Selecting for *Fusarium* resistance in the Great Plains. Proceedings of the 2022 National Fusarium Head Blight Forum; Tampa, FL. December 4-6, 2022. Retrieved from: https://scabusa.org/forum/2022/2022NFHBForumProceedings.pdf.

Singla, S., Palmer, N., Bernhardson, L., O'Neill, P., Gries, T., Duray, Z., Dill-Macky, R., Sattler, S., Wegulo, S., and Funnell-Harris, D. (2022). Constitutive expression of *SbCCoAOMT* in the phenylpropanoid pathway can improve resistance to Fusarium head blight of wheat. Proceedings of the 2022 National Fusarium Head Blight Forum; Tampa, FL. December 4-6, 2022. Retrieved from: https://scabusa.org/forum/2022/2022NFHBForumProceedings.pdf.

Wang, F., Charif, A., Danilova, T., Zhang, W., Zhang, M., Ren, S., Zhu, X., Zhong, S., Fiedler, J., Xu, S., Frels, K., Wegulo, S., Boehm Jr., J., and Cai, X. (2022). Molecular marker-assisted *Fhb7* introgression in common and durum wheat. Proceedings of the 2022 National Fusarium Head Blight Forum; Tampa, FL. December 4-6, 2022. Retrieved from: https://scabusa.org/forum/2022/2022NFHBForumProceedings.pdf.