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

FY22 Performance Progress Report

Due date: July 26, 2023

Cover Page

USDA-ARS Agreement ID:	59-0206-2-090
USDA-ARS Agreement Title:	Fusarium Head Blight (FHB) Management in Wheat in South Dakota
Principle Investigator (PI):	Madalyn Shires
Institution:	South Dakota State University
Institution UEI:	DNZNC466DGR7
Fiscal Year:	2022
FY22 USDA-ARS Award Amount:	$37,300
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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	Fungicide and variety evaluation for FHB management in wheat in South Dakota	$37,300
	FY22 Total ARS Award Amount	$37,300

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.

Madalyn Shires — Principal Investigator Signature

07/24/23 — 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: Fungicide and variety evaluation for FHB management in wheat in South Dakota

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

This project is part of the FHB Integrated Management Coordinated Project (MGMT_CP) with the overall goal to determine the efficacy of Prosaro Pro and Sphaerex applied at flowering to winter and spring wheat varieties with varying levels of FHB resistance or susceptibility. The specific objectives of the proposed study are to:

1. Determine the integrated effects of Prosaro Pro and Sphaerex fungicide treatments and genetic resistance on FHB and DON in winter and spring wheat,
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?

Obj 1: The standard protocol stipulated application of fungicides to varieties with varying genetic reactions to FHB including susceptible (S), moderately susceptible (MS) and moderately resistant (MR) varieties. Field trials were conducted at two locations in South Dakota namely, Volga Research Farm (VRF) and Northeast Research Farm (NERF), near South Shore, SD. Three hard red winter wheat (HRWW) varieties namely Oahe (FHB-moderately susceptible), Draper (FHB-susceptible) and Thompson (FHB-susceptible) were used. Four hard red spring wheat (HRSW) varieties namely, Boost (FHB-moderately resistant), Brick (FHB-resistant), Samson (FHB-susceptible), and CP3099A (FHB-susceptible) were used for this objective. The field plots were set up as a randomized complete block design with a split-plot arrangement, where the variety was the main plot and fungicide the sub-plot. Treatments evaluated include (1) inoculated – untreated, (2) non-inoculated untreated check, (3) Prosaro 6.5 fl oz/ac, (4) Miravis Ace @ 13.7 fl oz/ac, (5) Prosaro Pro @ 10.3 fl oz/ac and (6) Sphaerex @ 7.3 fl oz/ac. All treatments were applied at early anthesis.

Obj 2: Ideal and Samson, HRWW and HRSW FHB susceptible varieties, respectively, were planted at VRF and NERF. The trial was laid out as a randomized complete block design. Field plots were subjected to the following treatments: (1) Untreated Check, (2) Prosaro 6.5 fl oz/ac at early anthesis, (3) Caramba 13.5 fl oz/ac at early anthesis, (4) Miravis Ace 13.7 fl oz/ac at early anthesis, (5) Prosaro Pro 10.3 fl oz/ac at early anthesis, (6) Sphaerex 7.3 fl oz/ac at anthesis, (7) Miravis Ace 13.7 fl oz/ac at early anthesis followed by Prosaro Pro 10.3 fl oz/ac 4-6 days after early anthesis, (8) Miravis Ace 13.7 fl oz/ac at early anthesis followed by Sphaerex 7.3 fl oz/ac 4-6 days after early anthesis, and (9) Miravis Ace 13.7 fl oz/ac at early anthesis followed by Tebuconazole 4 fl oz/ac 4-6 days after early anthesis.

Treatments in both trials (Obj. 1 & 2) were replicated four times and plots trimmed to 5 ft x 15 ft. Product applications were conducted using a CO2-pressurized backpack sprayer (40 psi) with three Twin Jet TJ- 60 8002 nozzles spaced at 15 inches apart on a boom. Plots in field trials at VRF were inoculated with *Fusarium graminearum* infected corn spawn at 3.33 g per square foot. An automated misting system was installed to increase FHB pressure. FHB incidence, severity and indexes were assessed in mid-to-late June for HRWW and in late July for HRSW in 2022. For both obj. 1 & 2, all fungicide products were mixed with a nonionic surfactant at 0.125 v/v.

b) What were the significant results?

Obj. 1: All fungicide treated plots generated significantly lower FHB index than the untreated check. Untreated non-inoculated plots also had lower FHB indexes than the untreated-inoculated plots. Miravis Ace at 13.7 fl oz/ac had the lowest FHB-index and DON in MR/R varieties in both HRWW and HRSW. However, differences between fungicides, in terms of FHB index and DON, were not significantly different in statistical terms at $p \leq 0.05$. With high FHB indexes in inoculated and misted plots the efficacy of the fungicides is reduced and stability in fungicide performance is lost.

Obj. 2: All plots treated with a fungicide had significantly lower mean FHB indexes and DON accumulation than the untreated check. Application of Miravis Ace at early anthesis followed by Prosaro Pro or Sphaerex or Tebuconazole at 4 to 6 days after early anthesis application generated the lowest FHB indexes and DON content in both HRWW and HRSW.

c) List key outcomes or other achievements.

Obj. 1: Prosaro Pro and Sphaerex applied alone had better efficacy for FHB index than Prosaro and Caramba. However, the initial results suggest Miravis Ace performance is superior. Lowest FHB index and DON levels were observed when fungicides were applied to a variety with inherent genetic resistance, MR/R compared to a susceptible variety.

Obj. 2: Sequential application of fungicides provided the greatest efficacy against both FHB index and DON.

Obj. 3 & 4: Data were collected and submitted to the national coordinator for economic benefit assessment of FHB and DON management programs and FHB risk prediction model generation**.**

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

Undergraduate and graduate students who participated in these projects had practical experience to identify FHB and conduct disease assessment for scab in the field.

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

Results were presented at the 2022 National Fusarium Head Blight Forum, electronic newsletter articles and extension talks at trade shows, research farm field days, and fungicide applicators trainings.

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.

Conference Poster: Yabwalo, D., et al. 2022. (2022). Management of Fusarium Head Blight with Demethylation Inhibitors and Succinate Dehydrogenase Inhibitors Combinations Under High Disease Pressure in Spring Wheat. Proceedings of the 2022 National Fusairum Head Blight Forum; Tampa, FL. December 4-6, 2022. Retrieved from: https://scabusa.org/forum/2022/2022NFHBForumProceedings.pdf

Conference Poster: Mahecha, E., et al. (2022). Efficacy of Essential Oils in the Management of Fusarium Head Blight in Spring Wheat. Proceedings of the 2022 National Fusairum Head Blight Forum; Tampa, FL. December 4-6, 2022. Retrieved from: https://scabusa.org/forum/2022/2022NFHBForumProceedings.pdf