

**USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY16 Final Performance Report
Due date: July 28, 2017**

Cover Page

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Fiscal Year:	2016
USDA-ARS Agreement ID:	59-0206-6-014
USDA-ARS Agreement Title:	Integrated Management and Prediction of Fusarium Head Blight and DON in Winter Wheat.
FY16 USDA-ARS Award Amount:	\$ 13,835
Recipient Organization:	University of Nebraska Sponsored Programs 312 N 14th, Alexander West Lincoln, NE 68588-0430
DUNS Number:	55-545-6995
EIN:	47-0049123
Recipient Identifying Number or Account Number:	25-6235-0270-001
Project/Grant Reporting Period:	6/13/16 - 6/12/17
Reporting Period End Date:	06/12/17

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
MGMT	Integrating Strategies to Mitigate Fusarium Head Blight and DON in Winter Wheat.	\$ 13,835
	FY16 Total ARS Award Amount	\$ 13,835



Principal Investigator

July 28, 2017

Date

* MGMT – FHB Management
 FST – Food Safety & Toxicology
 GDER – Gene Discovery & Engineering Resistance
 PBG – Pathogen Biology & Genetics
 EC-HQ – Executive Committee-Headquarters
 BAR-CP – Barley Coordinated Project
 DUR-CP – Durum Coordinated Project
 HWW-CP – Hard Winter Wheat Coordinated Project
 VDHR – Variety Development & Uniform Nurseries – Sub categories are below:
 SPR – Spring Wheat Region
 NWW – Northern Soft Winter Wheat Region
 SWW – Southern Soft Red Winter Wheat Region

Project 1: *Integrating Strategies to Mitigate Fusarium Head Blight and DON in Winter Wheat.*

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

The goals the project is addressing are:

Goal # 1) Develop integrated management strategies for FHB and mycotoxins that are robust to conditions experienced in production fields.

Goal # 2) Help develop and validate the next generation of management tools for FHB/DON control.

2. What was accomplished under these goals? Address items 1-4) below for each goal or objective.

1) Major activities

Four locally adapted winter wheat cultivars differing in levels of FHB and DON resistance were planted in the fall of 2015 at the Agricultural Research and Development Center (ARDC) near Mead, NE. The cultivars were Overley (susceptible), McGill (moderately susceptible), Overland (moderately resistant) and Millennium (moderately resistant). Each cultivar was subjected to the following treatments: 1) Non-fungicide treated, spray-inoculated with spores of *F. graminearum* at anthesis, 2) sprayed with the fungicide Prosaro at anthesis, spray-inoculated with spores of *F. graminearum* 24 hours later; 3) sprayed with Prosaro at anthesis, spray-inoculated with spores of *F. graminearum* 24 hours later, and sprayed with the fungicide Caramba 4 days after anthesis; 4) sprayed with Caramba at anthesis, spray-inoculated with spores of *F. graminearum* 24 hours later, and sprayed with the fungicide Folicur 4 days after anthesis; 5) sprayed with the fungicide Proline at anthesis, spray-inoculated with spores of *F. graminearum* 24 hours later, and sprayed with Folicur 4 days after anthesis; and 6) non-sprayed, non-inoculated check. Treatments were arranged in a split plot design in randomized complete blocks with four replications. Cultivars were the main plots and fungicide spray treatments were the subplots. Experimental units were 4 ft x 15 ft plots. Weather at the plot site was monitored with a WatchDog 2000 Series weather station (Spectrum Technologies, Paxinos, PA).

2) Specific objectives

The specific objectives of this project were to 1) Evaluate the integrated effects of fungicide and genetic resistance on FHB and DON, 2) Generate data for a quantitative synthesis of the integrated effects of fungicide and resistance on FHB/DON and the influence of region-specific factors on the overall efficacy of this integrated approach, 3) Develop best-management-practices for FHB and DON, and 4) Generate data to advance the FHB and DON risk prediction effort.

3) Significant results

FHB index was low due to unfavorable environmental conditions for disease development (low levels of rainfall before and during flowering). Cultivars differed significantly in FHB index ($P < 0.05$) with the susceptible Overlay having the highest index (7.7%) followed by the moderately susceptible McGill (4.5%), the moderately resistant Overland (1.2%), and the moderately resistant Millennium (0.8%). Fungicide treatments did not differ ($P > 0.05$) in FHB index (range: 3.2% - 3.8%). Cultivars significantly differed in yield with Overland yielding the highest (61 bu/A) followed by Millennium and Overlay ((56 bu/A) and McGill (43 bu/A). Significant differences in Fusarium-damaged kernels (FDK) were also observed among cultivars, with the susceptible Overlay having higher FDK (5.5% than the other three cultivars (3.0-3.5%). DON levels also differed among cultivars with the highest DON concentration in Overlay (2.8 ppm) followed by McGill (1.0 ppm), Millennium (0.7 ppm) and Overland (0.5 ppm). Weather data collected were furnished to the FHB and DON forecasting team in the U.S. Wheat and Barley Scab Initiative (USBSI) and will be used to improve the accuracy of FHB and DON forecasting models.

4) Key outcomes or other achievements

The key outcomes of this research were that (i) the moderately resistant cultivars Overland and Millennium had significantly lower FHB index and DON than the moderately susceptible McGill and the susceptible Overlay; hence, growers can make informed decisions when choosing the cultivars to plant, (ii) due to unfavorable conditions for disease development, significant difference among fungicide treatments were not observed; hence, growers will be informed that in a season with unfavorable weather conditions for FHB development, it is not necessary to apply a fungicide at anthesis, which will save them time and money, and (iii) weather data collected will be used to improve the accuracy of FHB and DON forecasting models which will in turn reduce losses and increase grower profits. The overall outcome will be improved economic and social livelihoods for wheat growers and consumers.

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

Mrs. Julie Stevens, a research technologist in the PI's lab, worked on the project. She was assisted by Mr. Carlos Bolanos Cariel, a graduate student in the PI's lab. The PI and Mr. Bolanos Cariel attended the 2016 FHB Forum in St. Louis, MO in December 2016.

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

Results have been disseminated through presentations at Extension meetings in Nebraska and poster presentations and discussions with attendees at the 2016 FHB Forum.

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Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY16 award period. The term “support” below includes any level of benefit to the student, ranging from full stipend plus tuition to the situation where the student’s stipend was paid from other funds, but who learned how to rate scab in a misted nursery paid for by the USWBSI, and anything in between.

1. **Did any graduate students in your research program supported by funding from your USWBSI grant earn their MS degree during the FY16 award period?**

No

If yes, how many?

2. **Did any graduate students in your research program supported by funding from your USWBSI grant earn their Ph.D. degree during the FY16 award period?**

No

If yes, how many?

3. **Have any post docs who worked for you during the FY16 award period and were supported by funding from your USWBSI grant taken faculty positions with universities?**

N/A

If yes, how many?

4. **Have any post docs who worked for you during the FY16 award period and were supported by funding from your USWBSI grant gone on to take positions with private ag-related companies or federal agencies?**

N/A

If yes, how many?

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Release of Germplasm/Cultivars

N/A

Instructions: In the table below, list all germplasm and/or cultivars released with full or partial support through the USWBSI during the FY16 award period. All columns must be completed for each listed germplasm/cultivar. Use the key below the table for Grain Class abbreviations. *Leave blank if you have nothing to report or if your grant did NOT include any VDHR-related projects.*

Name of Germplasm/Cultivar	Grain Class	FHB Resistance (S, MS, MR, R, where R represents your most resistant check)	FHB Rating (0-9)	Year Released

Add rows if needed.

NOTE: List the associated release notice or publication under the appropriate sub-section in the ‘Publications’ section of the FPR.

Abbreviations for Grain Classes

- Barley - BAR
- Durum - DUR
- Hard Red Winter - HRW
- Hard White Winter - HWW
- Hard Red Spring - HRS
- Soft Red Winter - SRW
- Soft White Winter - SWW

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Publications, Conference Papers, and Presentations

Instructions: Refer to the FY16-FPR_Instructions for detailed instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY16 grant. Only include citations for publications submitted or presentations given during your award period (6/13/16 - 6/12/17). If you did not have any publications or presentations, state ‘Nothing to Report’ directly above the Journal publications section.

Journal publications.

Nothing to report

Books or other non-periodical, one-time publications.

Nothing to report

Other publications, conference papers and presentations.

Bolanos-Carriel, C., Wegulo, S.N., Hallen-Adams, H., Baenziger, P.S., Eskridge, K.M., and Funnell-Harris, D. 2016. “Effects of cultivar resistance, fungicide application timing, and fungicide chemical class on FHB and DON in winter wheat.” Pages 9-10 in: *Proceedings of the 2016 National Fusarium Head Blight Forum*. S. Canty, K. Wolfe, D. Van Sanford (eds.). December 4-6, 2016. Hyatt Regency St. Louis, MO.

Status: Abstract Published and Poster Presented

Acknowledgement of Federal Support: YES (poster) YES (abstract)

Bolanos-Carriel, C., Wegulo, S.N., Hallen-Adams, H., Baenziger, P.S., Eskridge, K.M., Funnell-Harris, D., McMaster, N., and Schmalte III, D. G. 2016. “Effects of fungicides, time, and grain moisture content on postharvest accumulation of DON in winter wheat.” Pages 11-12 in: *Proceedings of the 2016 National Fusarium Head Blight Forum*. S. Canty, K. Wolfe, D. Van Sanford (eds.). December 4-6, 2016. Hyatt Regency St. Louis, MO.

Status: Abstract Published and Poster Presented

Acknowledgement of Federal Support: YES (poster) YES (abstract)

Funnell-Harris, D.L., Graybosch, R.A., Sattler, S.E., Wegulo, S.N., and Clemente, T.E. 2016. “Transgenic wheat lines upregulated for genes in lignin biosynthesis as potential resistance sources against Fusarium head blight.” Page 48 in: *Proceedings of the 2016 National Fusarium Head Blight Forum*. S. Canty, K. Wolfe, D. Van Sanford (eds.). December 4-6, 2016. Hyatt Regency St. Louis, MO.

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Funnell-Harris, D.L., Graybosch, R.A., O'Neill, P.M., and Wegulo, S. 2016. "Response of a collection of waxy (reduced amylose) wheat breeding lines to *Fusarium graminearum*."

Page 79 in: *Proceedings of the 2016 National Fusarium Head Blight Forum*. S. Canty, K. Wolfe, D. Van Sanford (eds.). December 4-6, 2016. Hyatt Regency St. Louis, MO.

Status: Abstract Published and Poster Presented

Acknowledgement of Federal Support: YES (poster) YES (abstract)