USDA-ARS
U.S. Wheat and Barley Scab Initiative
FY17 Final Performance Report
Due date: July 31, 2018

Cover Page

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Fiscal Year:	2017
USDA-ARS Agreement ID:	59-0206-6-014
USDA-ARS Agreement Title:	University of Nebraska Sponsored Programs 312 N 14th, Alexander West Lincoln, NE 68588-0430
FY17 USDA-ARS Award Amount:	$ 13,808
Recipient Organization:	25-6235-0270-001
DUNS Number:	59-0206-6-014
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Recipient Identifying Number or Account Number:	47-0049123
Project/Grant Reporting Period:	6/13/17 - 6/12/18
Reporting Period End Date:	06/12/18

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.	$ 13,808
	FY17 Total ARS Award Amount	$ 13,808

July 25, 2018
Principal Investigator 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

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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 main goal of this project was to investigate the effects of cultivar resistance and fungicide application programs on Fusarium head blight (FHB) and deoxynivalenol (DON) winter wheat.

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

1) major activities

Four winter cultivars adapted to Nebraska [Overland (moderately resistant), Millennium (moderately resistant), McGill (moderately susceptible), and Overley (susceptible)] were planted at the Havelock Research Farm near Lincoln, NE in the fall of 2016. The fungicides Prosaro®, Caramba®, Proline®, and Folicur® were be applied according to the following treatments, each replicated four times: 1) Untreated, inoculated check, 2) Prosaro at anthesis, 3) Prosaro at anthesis + Caramba four days later, 4) Caramba at anthesis + Folicur four days later, 5) Proline at anthesis + Folicur four days later, and 6) Untreated, non-inoculated check. Fungicides were applied with a sprayer equipped with paired Twinjet XR8001 nozzles, mounted at an angle of 30-45^{o} from the horizontal, facing forward and calibrated to deliver 20 gallons of fungicide-water mixture per acre. In treatments 1 to 5, plots were spray-inoculated with spores of *Fusarium graminearum* (1 x 10^5 spores/mL) 24 hours after the anthesis fungicide application. The experimental design was a randomized complete block (RCBD) with a split-plot arrangement of cultivar as the whole-plot and fungicide treatment program as the sub-plot. FHB index was measured at the soft dough growth stage. At or following harvest, yield, *Fusarium*-damaged kernels (FDK), and DON concentration were determined. A weather station installed at the experiment site recorded weather data starting in mid-April through harvest. Data were forwarded to Drs. Pierce Paul and Larry Madden for metanalysis.

2) specific objectives

The specific objectives were to 1) Determine the effect of winter wheat cultivar resistance on FHB and DON, 2) Determine the effect of a "late" or "post-anthesis" application of a fungicide following an anthesis application on FHB and DON in winter wheat, and 3) Compare efficacy among combinations of fungicides in controlling FHB and DON.

3) significant results

Environmental conditions were unfavorable for FHB development in Nebraska in 2017. FHB index was generally low with no significant differences among cultivars averaged over fungicide treatments and ranging from 12% in Overland (moderately resistant) to 17% in Camelot (moderately susceptible). FHB index ranged from 6% to 12% in the fungicide spray treatments (averaged over cultivars) and the untreated, non-inoculated check. The FHB index among these five treatments was not significantly different at P = 0.05, but was significantly lower than the 42% index in the untreated, inoculated check. A rain storm with high winds in May caused significant lodging that varied widely among plots and

likely resulted in premature whitening of heads that was mistaken for FHB, hence the high estimate of index in the non-treated, inoculated check. This conclusion was reached because DON levels were less than 0.5 ppm in all plots despite an index of 42% in the untreated inoculated check. The level of FDK was also low, ranging from 2% to 4% among cultivars and fungicide treatments. Despite the lack of statistical significance among the fungicide treatments, Prosaro at anthesis + Caramba four days later resulted in the lowest index (7%) followed by Caramba at anthesis + Folicur four days later (9%), Proline at anthesis + Folicur four days later (11%), and Prosaro at anthesis (12%). This indicated a slight but non-significant benefit in reducing FHB index from a post-anthesis application that followed an anthesis application. Yield differed significantly among cultivars and was highest in Camelot (76 bu/A) followed by Wesley (67 bu/A) and Overland and Millennium (61 bu/A). There were no significant differences in yield among fungicide treatments averaged over cultivars.

4) key outcomes or other achievements

The key outcomes were 1) FHB and DON did not develop to significant levels due to unfavorable environmental conditions. Knowing this information will enable growers to make a decision not to apply a fungicide to control FHB and DON under unfavorable conditions, which will save them time and money. 2) Weather data collected will be used to improve the accuracy of FHB and DON forecasting models.

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 2017 FHB Forum in Milwaukee, WI in December 2017.

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

Results were disseminated through six field days attended by approximately 480 growers and crop consultants in the scab-prone areas of Nebraska. A presentation was delivered at one major seed day (when seed is being purchased) that was attended by approximately 110 growers, seed dealers, and crop consultants. Results and information on FHB and other wheat diseases and their management were also disseminated through oral presentations at the 2017 Crop Production Clinics which were held in January at nine locations throughout the state and attended by 1,558 growers and crop consultants. Other dissemination channels were radio and TV interviews, the Nebraska Farmer Magazine (a regional magazine), and articles in the University of Nebraska CropWatch newsletter which has a national audience; had 213,813 page views in 2017; and has 5,961 Twitter followers and 3,324 email subscribers.

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY17 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 FY17 award period?**

   If yes, how many? None.

2. **Did any graduate students in your research program supported by funding from your USWBSI grant earn their Ph.D. degree during the FY17 award period?**

   If yes, how many? None.

3. **Have any post docs who worked for you during the FY17 award period and were supported by funding from your USWBSI grant taken faculty positions with universities?**

   If yes, how many? None.

4. **Have any post docs who worked for you during the FY17 award period and were supported by funding from your USWBSI grant gone on to take positions with private ag-related companies or federal agencies?**

   If yes, how many? None.

Release of Germplasm/Cultivars

Instructions: In the table below, list all germplasm and/or cultivars released with full or partial support through the USWBSI during the FY17 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

Publications, Conference Papers, and Presentations

Instructions: Refer to the FY17-FPR_Instructions for detailed instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY17 grant. Only include citations for publications submitted or presentations given during your award period (6/13/17 - 6/12/18). If you did not have any publications or presentations, state 'Nothing to Report' directly above the Journal publications section.

NOTE: Directly below each reference/citation, you must indicate the Status (i.e. published, submitted, etc.) and whether acknowledgement of Federal support was indicated in publication/ presentation.

Journal publications.

Bhatta, M., T. Regassa, **S. N. Wegulo**, and P. S. Baenziger. 2018. Foliar fungicide effects on disease severity, yield, and agronomic characteristics of modern winter wheat genotypes. Agronomy Journal. 110. 1-9. 10.2134/agronj2017.07.0383.
Status: Published
Acknowledgement of Federal Support: NO

Takemoto, J. Y., **Wegulo, S. N.,** Yuen, G. Y., Stevens, J. A., Jochum, C. C., Chang, C-W. T., Kawasaki, Y., and Miller, G. W. **2018.** Suppression of wheat Fusarium head blight by a novel amphiphilic aminoglycoside fungicide K20. Fungal Biol. 122:465-470.
Status: Published
Acknowledgement of Federal Support: NO

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

Wegulo, S.N. 2017. Integrated wheat disease management. Pages 417-441 in: Achieving Sustainable Cultivation of Wheat Vol. 1: Breeding, quality traits, pests and diseases. P. Langridge (Ed.). Burleigh Dodds Science Publishing, Cambridge, UK.
Status: Published
Acknowledgement of Federal Support: NO

Other publications, conference papers and presentations.

Bolanos-Carriel, C., Hallen-Adams, H., **Wegulo, S. N**., **Baenziger, P. S.**, Eskridge, K. M., Funnell-Harris, D., McMaster, M., and Schmale III, D. G. 2017. Toxin gene expression analysis and deoxynivalenol concentration during postharvest storage of wheat grain from a Fusarium head blight epidemic in Nebraska. Page 31 in: Proceedings of the 2017 National Fusarium Head Blight Forum. Hyatt Regency Milwaukee, Milwaukee, Wisconsin, USA. December 3-5, 2017.
Status: Published
Acknowledgement of Federal Support: YES