USDA-ARS
U.S. Wheat and Barley Scab Initiative
FY18 Performance Report
Due date: July 12, 2019

Cover Page

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Fiscal Year:	2018
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.
FY18 USDA-ARS Award Amount:	$ 15,254
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:	06/13/18 - 06/12/19
Reporting Period End Date:	06/12/19

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.	$ 15,254
	FY18 Total ARS Award Amount	$ 15,254

July 10, 2019
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

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 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? *Address items 1-4) below for each goal or objective.*

1) major activities

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. Four cultivars adapted to Nebraska were used: Overland (moderately resistant), Millennium (moderately resistant), Roubidoux (susceptible), and Wesley (susceptible). Fungicide x inoculation treatments were 1) untreated, inoculated check; 2) Prosaro® (6.5 fl. oz.) at anthesis, inoculated; 3) Miravis Ace (11.5 fl. oz.) at anthesis, inoculated; 4) Miravis Ace at Feekes 10.5, inoculated; 5) Prosaro at anthesis, non-inoculated; and 6) untreated, non-inoculated check. Fungicides were applied with a CO_2-powered backpack sprayer equipped with four Teejet 800-1 VS nozzles and calibrated to deliver 20 gallons of fungicide-water mixture per acre. In treatments 1 to 4, plots were spray-inoculated with spores of *Fusarium graminearum* (1×10^5 spores/mL) 24 hours after fungicide application. 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, test weight, *Fusarium*-damaged kernels (FDK), and DON concentration were determined. A weather station at the experiment site recorded weather data starting in mid-April through end of June.

2) specific objectives

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, and 2) Enhance communication and end user education/outreach on integrated management of FHB and DON

3) significant results

Dry, almost drought-like conditions in the second half of May into early June, the period during which FHB infections occur, prevented disease onset and development, resulting in an FHB index of only 0-2% and 0.0 ppm DON with no significant (P = 0.05) differences among cultivars or fungicide x inoculation treatments. Only trace levels of FDK were detected and yield and test weight were similarly not significantly different among treatments.

4) key outcomes or other achievements

The key outcomes were 1) FHB and DON did not develop to measurable levels due to unfavorable (dry) 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 2018 FHB Forum in St. Louis, MO in December 2018.

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

FHB and DON did not develop due to dry weather. This was communicated to growers and crop consultants during crop production clinics held in various locations in Nebraska in January of 2019, with the take-home message being that a fungicide should not be applied to control FHB when environmental conditions don't favor disease development.

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY18 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 FY18 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 FY18 award period?**

   Yes

   If yes, how many? One

3. **Have any post docs who worked for you during the FY18 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 FY18 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?

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 FY18 award period. All columns must be completed for each listed germplasm/cultivar. Use the key below the table for Grain Class abbreviations.

NOTE: 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 FY18-FPR_Instructions for detailed instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY18 grant. Only include citations for publications submitted or presentations given during your award period (06/13/18 - 06/12/19). 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.

Paul, P. A., Salgado, J. D., Bergstrom, G., Bradley, C. A., Byamukama, E., Byrne, A. M., Chapara, V., Cummings, J. A., Chilvers, M. I., Dill-Macky, R., Friskop, A., Kleczewski, N., Madden, L. V., Nagelkirk, M., Stevens, J., Smith, M., Wegulo, S. N., Wise, K., and Yabwalo, D. 20.19. Integrated effects of genetic resistance and prothioconazole + tebuconazole application timing on Fusarium head blight in wheat. Plant Dis. 103:223-237.
Status: Published
Acknowledgement of Federal Support: YES

Funnell-Harris, D. L., Graybosch, R. A., O'Neill, P. M., Duray, Z. T., and Wegulo, S. N. 2019. Amylose-free ("*waxy*") wheat colonization by *Fusarium* spp. and response to Fusarium head blight. Plant Dis. 103:972-983 Accepted pending revision – August 15, 2018.
Status: Published
Acknowledgement of Federal Support: YES

Books or other non-periodical, one-time publications

Other publications, conference papers and presentations.

J.D. Salgado, G. Bergstrom, C. Bradley, K. Bowen, E. Byamukama, A. Byrne, A. Collins, C. Cowger, J. Cumming, V. Chapara, M.I. Chilvers, E. De Wolf, R. Dill-Macky, H.M. Darby, P.D. Esker, A. Friskop, J. Halvorson, N. Kleczewski, L.V. Madden, J. Marshall, H. Mehl1, M. Nagelkirk, J. Starr, J. Stevens, D. Smith, M. Smith, S. Wegulo, K. Wise, D. Yabwalo, H.M. Young-Kelly, and P.A. Paul. 2018. Efficacy of Miravis® Ace for FHB and DON management across environments and grain market classes: a progress report. Pages 40-44 in: Proceedings of the 2018 National Fusarium Head Blight Forum. Hyatt Regency St. Louis at the Arch, St. Louis, Missouri, USA. December 2-4, 2018.
Status: Published
Acknowledgement of Federal Support: YES (oral presentation), YES (proceedings)

J.D. Salgado, G. Bergstrom, C. Bradley, K. Bowen, E. Byamukama, A. Byrne, A. Collins, C. Cowger, J. Cummings, V. Chapara, M.I. Chilvers, R. Dill-Macky, H.M. Darby, A. Friskop, N. Kleczewski, L.V. Madden, J. Marshall, H. Mehl, M. Nagelkirk, J. Stevens, D. Smith, M. Smith, S. Wegulo, K. Wise, D. Yabwalo, H.M. Young-Kelly and P.A. Paul. 2018. Efficacy of Two-treatment Fungicide Programs for FHB Management: A Multi-State Coordinated Project. Pages 45-46 in: Proceedings of the 2018 National Fusarium Head Blight Forum. Hyatt Regency St. Louis at the Arch, St. Louis, Missouri, USA. December 2-4, 2018.
Status: Published
Acknowledgement of Federal Support: YES (poster), YES (abstract)

Duray, D. L. Funnell-Harris, R. A. Graybosch, S. E. Sattler, S. N. Wegulo, and T. E. Clemente. 2018. Response of wheat constitutively expressing lignin genes to Fusarium head blight. Page 70 in: Proceedings of the 2018 National Fusarium Head Blight Forum. Hyatt Regency St. Louis at the Arch, St. Louis, Missouri, USA. December 2-4, 2018.
Status: Published
Acknowledgement of Federal Support: YES (poster), YES (abstract)

Valverde-Bogantes, S. N. Wegulo, C. Bolanos-Carriel, H. Hallen-Adams, A. Bianchini, N. McMaster and D. G. Schmale III. 2018. First Report of *Fusarium boothii* causing Head Blight of Wheat in the United States. Page 92 in: Proceedings of the 2018 National Fusarium Head Blight Forum. Hyatt Regency St. Louis at the Arch, St. Louis, Missouri, USA. December 2-4, 2018.
Status: Published
Acknowledgement of Federal Support: YES (poster), YES (abstract)

Bolanos-Carriel, S. N. Wegulo, H. Hallen-Adams, P. S. Baenziger, K. Eskridge and D. Funnell-Harris. 2018. Determining the optimum Inoculum concentration and spike bagging period for discriminating between FHB-susceptible and –resistant wheat cultivars under greenhouse conditions. Pages 106-107 in: Proceedings of the 2018 National Fusarium Head Blight Forum. Hyatt Regency St. Louis at the Arch, St. Louis, Missouri, USA. December 2-4, 2018.
Status: Published
Acknowledgement of Federal Support: YES (poster), YES (abstract)

Wang, V. Belamkar, S. Wegulo and P. S.n Baenziger. 2018. Evaluation for Fusarium head blight (scab) resistance by detached leaf assay in backcross populations of wheat. Page 140 in: Proceedings of the 2018 National Fusarium Head Blight Forum. Hyatt Regency St. Louis at the Arch, St. Louis, Missouri, USA. December 2-4, 2018.
Status: Published
Acknowledgement of Federal Support: YES (poster), YES (abstract)