

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:	59-0206-8-214
USDA-ARS Agreement Title:	Genetic Improvement of Grain Yield and Disease Resistance in Wheat.
FY18 USDA-ARS Award Amount:	\$ 83,213
Recipient Organization:	Purdue University AG Spsored Program Services 615 W. State Street West Lafauette, IN 47907
DUNS Number:	07-205-1394
EIN:	35-6002041
Recipient Identifying Number or Account Number:	17000549
Project/Grant Reporting Period:	6/8/18 - 6/7/19
Reporting Period End Date:	06/07/19

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
VDHR-NWW	Genetics of, and Breeding for, Fusarium Head Blight Disease Resistance in Wheat.	\$ 80,114
VDHR-NWW	Male Sterile Facilitated Recurrent Selection for FHB Resistance.	\$ 1,163
VDHR-NWW	Coordinated Phenotyping of Uniform Nurseries and Official Variety Trials.	\$ 1,936
	FY18 Total ARS Award Amount	\$ 83,213


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* 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: *Genetics of, and Breeding for, Fusarium Head Blight Disease Resistance in Wheat.*

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

The major goals of this project are to characterize agronomic traits and the Fusarium head blight responses of the Purdue University's soft red winter wheat germplasm, inherited from Dr. Ohm. For a second year (2018-19), we planted nearly 400 lines for yield and FHB resistance testing. The data that will be produced from this project, in addition to the data produced in 2017-18 season, will be used for selecting advance lines as potential varieties or parental lines, and completing a two-year genome-wide association studies to identify QTL controlling FHB resistance.

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

1) major activities

Activities included planting Purdue panel (n = 392) in single-replicate trials two locations Agronomy Center for Research and Education (ACRE) in West Lafayette, IN and in Ag Alumni Seed Inc. in Romney, IN. We also planted a preliminary yield trial in one location and an advanced yield trial in two locations in West Lafayette and Vincennes, IN. We also planted Purdue panel for FHB screening.

2) specific objectives

Objective 1. One of the objectives of 2018-19 funding cycle was to characterize Purdue University's soft red winter wheat germplasm for agronomic traits (grain yield, plant height, and days to heading). In 2017-18 season, we planted the first year study of only 336 lines (due to seed limitation) in a single-replicate trial in West Lafayette, IN. In 2018-19 season, we were able to plant 392 germplasm in single-replicated trials in two locations in West Lafayette and Romney, IN. We are harvesting these trials now (the week of July 8-12).

Objective 2. Similar to objective 1, we examined the response of Purdue panel against Fusarium head blight disease. We planted the germplasm in row plots and artificially inoculated them under misting system. This experiment allowed us to obtain disease incidence, severity. The grains will be used to measure Fusarium Damaged Kernels (FDK) and DON.

Objective 3. The goal of this objective was to conduct yield testing of superior breeding lines in preliminary and advanced nurseries and identify germplasm that can be chosen for regional nurseries.

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3) significant results

We are in the middle of harvest and have not analyzed the data yet.

4) key outcomes or other achievements

See #3.

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

The project supported employment of a postdoctoral research associate until April 2019. After the postdoc left, I hired a research technician to complete the experiments. In addition, a PhD student, not funded by USWBSI, has been working on the genetics of resistance using genome-wide association studies. This PhD student is financially supported by the startup funding provided to PI by Purdue College of Agriculture.

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

We have not analyzed the data yet.

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Project 2: *Male Sterile Facilitated Recurrent Selection for FHB Resistance.*

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

The goal of this project was to utilize male-sterility in wheat to facilitate hybridization without laborious manual emasculation and pollination. This is helpful for pyramiding resistance genes against FHB disease.

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

1) major activities: We planted male sterile rows in between high yielding and moderately FHB resistant lines.

2) specific objectives: To ease hybridization and pyramiding yield and FHB traits.

3) significant results

The male sterile plants showed a much smaller overall biomass that adapted lines in the same field, indicating that they are not well-adapted. This can be explained by the fact that we planted a seed batch from IL.

4) key outcomes or other achievements

In-season observation and the overall small plant stands indicate that we either should plant male sterile plants or hybridize them with adapted lines for several cycles before conducting line extraction.

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

NA.

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

NA.

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Project 3: *Coordinated Phenotyping of Uniform Nurseries and Official Variety Trials.*

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

Coordinated Phenotyping of Uniform Nurseries and Official Variety Trials are used to evaluate advanced breeding germplasm across a wide range of environments. The ultimate goal of this project is to provide the breeders with a multi-environment yield data that is necessary for selection and variety release.

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

1) major activities

In 2018-19, the NWW included MI in the five-state trials and therefore, the name of the five-state trials was changed to six-state trials. The six-state trials were planted in three replicates, while the uniform eastern trial was planted in four replicates in the Agronomy Center for Research and Education (ACRE), West Lafayette, IN. Plot size was 4ft x 12ft, trimmed to 4ft x 10ft later. Experiments were planted by a standard 7-row small grain yield planter and harvested by a Wintersteiger plot combine. We measured days to heading (DH), days to maturity (DM), and plant height (PLH) before harvest. We are harvesting these trials now (the week of July 8-12).

This year when we planted the PNUWWSN and NUWWSN trial, we received plenty of rain that resulted in prolonged water logging around germination and emergence. This resulted in the poor germination and emergence such that we lost part of the experiment completely and up to 70% damage to the rest of the plots.

Note: After rain and water logging, we stopped planting the rest of FHB nursery. With the help of our farm superintendent we prepared another field for the rest of the trials (Purdue panel) which were planted nearly two weeks after the initial planting date, which turned to be a successful emergence and crop stand. We were able to complete FHB phenotyping in this field.

2) specific objectives

The objective of coordinated nurseries was to evaluate germplasm and provide breeder's in the six states with the data they need to perform selection and germplasm advancement. The objective of PNUWWSN and NUWWSN trial was to evaluate the FHB resistance of advanced lines.

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3) significant results

We just harvested the coordinated nursery. We will report soon to the breeders and coordinators.

4) key outcomes or other achievements

The results of these experiments will help breeders to perform an informed selection.

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

A postdoc funded by this project had the opportunity to help planting these trials and work in the program until April 2019 before moving to the wheat breeding program at North Dakota State University.

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

We have not yet disseminated any data.

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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? No.**

If yes, how many?

- 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? No.**

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? No.**

If yes, how many?

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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

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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 (6/8/18 - 6/7/19). 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. See example below for a poster presentation with an abstract:

Conley, E.J., and J.A. Anderson. 2018. Accuracy of Genome-Wide Prediction for Fusarium Head Blight Associated Traits in a Spring Wheat Breeding Program. In: Proceedings of the XXIV International Plant & Animal Genome Conference, San Diego, CA.

Status: Abstract Published and Poster Presented

Acknowledgement of Federal Support: YES (poster), NO (abstract)

Journal publications.

No.

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

No.

Other publications, conference papers and presentations.

Gaire, R., Brown-Guedira, G, Ohm, H., and Mohammadi, M. 2018. Genome-wide Analysis of Grain Yield in Purdue Wheat Germplasm: Protecting Germplasm during Tenure Transition. 2018 National Fusarium Head Blight Forum. December 2-4, Hyatt Regency St. Louis, MO, USA.

Status: Presented as poster in the USWBSI conference.

Acknowledgement of Federal Support: Yes

Gaire, R., Brown-Guedira, G., Ohm, H., and Mohammadi, M. 2018. Genome-wide association study for Fusarium head blight resistant in Purdue soft red winter wheat population. 2018 National Fusarium Head Blight Forum. December 2-4, Hyatt Regency St. Louis, MO, USA.

Status: Presented as poster in the USWBSI conference.

Acknowledgement of Federal Support: Yes