

USDA-ARS
U.S. Wheat and Barley Scab Initiative
FY19 Performance Report
Due date: September 30, 2020

Cover Page

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Fiscal Year:	2019
USDA-ARS Agreement ID:	59-0200-6-018
USDA-ARS Agreement Title:	Investigating Sources of Fusarium Head Blight Resistance from Wheat and its Wild Relatives
FY19 USDA-ARS Award Amount:	\$ 37,925
Recipient Organization:	University of Maryland Office of the Comptroller Contract and Grant Accounting RM 4101, Chesapeake Bldg College Park, MD 20742-3141
DUNS Number:	790934285
EIN:	52-6002033
Recipient Identifying Number or Account Number:	KFS 5258230
Project/Grant Reporting Period:	9/6/19 - 9/5/20
Reporting Period End Date:	9/5/2020

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
MGMT	Analyzing Commercial Wheat and Barley Cultivars for FHB Reaction in MD/DE	\$ 12,305
GDER	Wheat Variants Deficient in a FHB Susceptibility Factor	\$ 25,620
FY19 Total ARS Award Amount		\$ 37,925



Principal Investigator

9/28/20

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: *Analyzing Commercial Wheat and Barley Cultivars for FHB Reaction in MD/DE*

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

Evaluation of Fusarium head blight (FHB) reaction in popular local varieties of wheat and barley is critical for management of scab by growers. The major goal of this project is to conduct misted nursery to assess variety response to FHB in Maryland (MD) and Delaware (DE) cultivars. Specific objectives of the research project are:

1. Conduct misted nursery for local wheat and barley varieties from Maryland and Delaware.
2. Make the results available to the growers in a timely manner so that they can use them in making planting decisions in the growing season.
3. Organize field day to make growers aware of the importance of planting resistant varieties in management of FHB.

The misted nursery data made available here will help guide growers in Maryland and Delaware in selecting high-yielding wheat varieties with moderate resistance to FHB and DON. Field visits/ field days will be organized to make growers aware of the importance of selecting resistant varieties to manage FHB.

2. What was accomplished under these goals or objectives? *(For each major goal/objective, address items a-b) below.)*

a) What were the major activities?

1. Misted nursery was conducted for testing FHB response of seventy-one local wheat and barley varieties from Maryland and Delaware. The experiments were conducted in 3 replications. Data on FHB severity and index was collected and statistically analyzed. DON data is still awaited.
2. The results on FHB severity and index were collected and provided to the farmers in July, as soon as the data was completed and statistically analyzed. Samples for DON analyses were sent to the assigned lab, but that data was not available to include in the factsheet for use by farmers due to Covid-19.
3. Field day could not be organized due to severe Covid-19 restrictions in place at the appropriate time.

b) What were the significant results?

Evaluation of resistance levels of local cultivars based on visual symptom was performed.

c) List key outcomes or other achievements.

Factsheet on the visual symptom evaluation for varieties was prepared and disseminated to the farmers.

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3. Was this research impacted by the COVID-19 pandemic (i.e. university shutdowns, reduced or lack of support personnel, etc.)? If yes, please explain how this research was impacted or is continuing to be impacted.

Yes, the research was significantly hampered by Covid-19. DON content of grains is the most important factor for FHB resistance to famers. However, this year due to Covid-19, although we submitted our grain samples for DON content measurement in July, to our assigned lab, the samples are still backlogged for it. Secondly, we could not conduct field day for farmers because of Covid-19 severe restrictions in place at that time.

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

Two students were involved in the project, who got trained for corn inoculum preparation, phenotypic data collection and evaluation.

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

A Factsheet with results on FHB severity and index was disseminated to extension agents, growers and other stakeholders in the state.

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Project 2: *Wheat Variants Deficient in a FHB Susceptibility Factor*

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

The goal of this project is to identify native wheat gene variants that improve FHB resistance and reduce DON accumulation.

The **specific objectives** of this project are to:

1. Characterize the response to *Fusarium graminearum* in backcrossed progeny of Lpx3 variants.
2. Develop wheat lines containing mutant combinations at more than one Lpx3 homeologous loci and characterize their response to *Fusarium graminearum*.

2. What was accomplished under these goals or objectives? (For each major goal/objective, address items a-b) below.)

a) What were the major activities?

1. One back-cross each was made of the two A (Mut Kronos-2644 and Kronos-265) and B genome (Mut Kronos-3671 and Kronos-4443) Kronos mutants with wild type parent.
2. The mutations at the A and B genomes were combined together for all four combinations.
3. Mutations in both the genomes confirmed in the four AxB F1 combinations.
4. One Back-cross was made of each of the four AB combined mutant with wild type Kronos parent.

b) What were the significant results?

1. Background mutations have been significantly cleared up from the individual mutants
2. A and B genome mutations have been combined in all four possible combinations of mutants.
3. Significant background clearing in the AB combined mutation by back-crossing.

c) List key outcomes or other achievements.

Significant back-ground mutation removal in the plants to study the evaluation of the effect of *Lpx3* mutations in both the genomes individually as well as in combined state in both the genomes.

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3. Was this research impacted by the COVID-19 pandemic (i.e. university shutdowns, reduced or lack of support personnel, etc.)? If yes, please explain how this research was impacted or is continuing to be impacted.

We wanted to make a second round of back-crosses in the plants after confirming mutations in all the BC1 plants to achieve a high level of clarity in the background mutations. However, due to the University closure, we could not plant the BC1 seeds. We now have access to the plant growth facilities at UMD and will perform FHB evaluation of the confirmed BC1 plants this fall season, in addition to making back-cross 2 in selected combinations.

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

An MS student associated with this project received training in molecular plant pathology. During the course of this project, these personnel received training on the application of molecular methods for studying *Fusarium* infection, in planning of experiments, data collection and recording, and data analysis and interpretation. The graduate student was provided training in developing scientific writing and presentation skills. The graduate student was enrolled in dissertation hours under the PI.

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

The results were disseminated to the scientific community by: a- presenting a talk on the project goals and findings at UWSBSI forum meeting in 2019, and b- presenting a poster on the results of the project.

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Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY19 award period (9/6/19 - 9/5/20). 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 FY19 award period?**

If yes, how many?

One MS student partially supported from the USWBSI grant graduated successfully from the Rawat Lab.

- 2. Did any graduate students in your research program supported by funding from your USWBSI grant earn their Ph.D. degree during the FY19 award period?**

If yes, how many?

No

- 3. Have any post docs who worked for you during the FY19 award period and were supported by funding from your USWBSI grant taken faculty positions with universities?**

If yes, how many?

No

- 4. Have any post docs who worked for you during the FY19 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?

No

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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 FY19 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 FY19-FPR_Instructions for detailed more instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY19 grant award. Only citations for publications published (submitted or accepted) or presentations presented during the **award period (9/6/19 - 9/5/20)** should be included. If you did not publish/submit or present anything, state ‘Nothing to Report’ directly above the Journal publications section.

NOTE: Directly below each citation, you **must** indicate the Status (i.e. published, submitted, etc.) and whether acknowledgement of Federal support was indicated in the publication/presentation. See example below for a poster presentation with an abstract:

De Wolf, E., D. Shah, P. Paul, L. Madden, S. Crawford, D. Hane, S. Canty, R. Dill-Macky, D. Van Sanford, K. Imhoff and D. Miller. 2019. “Impact of Prediction Tools for Fusarium Head Blight in the US, 2009-2019.” In: S. Canty, A. Hoffstetter, H. Campbell and R. Dill-Macky (Eds.), *Proceedings of the 2019 National Fusarium Head Blight Forum*, Milwaukee, WI; December 8-10. University of Kentucky, Lexington, KY. p. 12.

Status: Abstract Published and Poster Presented

Acknowledgement of Federal Support: YES (Abstract and Poster)

Journal publications.

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

Other publications, conference papers and presentations.

Shah, J., Alam, S.T., Chabra, B., Mohan, V., Shulaev, E., Nagarajan, A., Gill, J., Rawat, N. (2019). Targeting wheat genes associated with susceptibility to *Fusarium graminearum* for enhancing FHB resistance. In: S. Canty, A. Hoffstetter, H. Campbell and R. Dill-Macky (Eds.), *Proceedings of the 2019 National Fusarium Head Blight Forum*, Milwaukee, WI; December 8-10. University of Kentucky, Lexington, KY. p. 57.

Status: Abstract Published and Poster Presented

Acknowledgement of Federal Support: YES (Abstract and Poster)

Shah, J., Alam, S., Chabra, B., Mohan, V., Shulaev, E., Nagarajan, A., Gill, J., Rawat, B., Tyagi, N., Lee, H., and H. N. Trick. Targeting Pathogenicity Mechanisms to Promote FHB-Resistance in Wheat. In: S. Canty, A. Hoffstetter, H. Campbell and R. Dill-Macky (Eds.), *Proceedings of the 2019 National Fusarium Head Blight Forum*, Milwaukee, WI; December 8-10. University of Kentucky, Lexington, KY. p. 56.

Status: Abstract Published and Talk Presented

Acknowledgement of Federal Support: YES (Abstract and Talk)