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

Cover Page

Principle Investigator (PI):	Xuehui Li
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Fiscal Year:	2019
USDA-ARS Agreement ID:	59-0206-7-157
USDA-ARS Agreement Title:	Genetic Characterization and Selection for Fusarium Head Blight Resistance in Durum Wheat
FY19 USDA-ARS Award Amount:	$ 35,620
Recipient Organization:	North Dakota State University Office of Grant & Contract Accouting NDSU Dept 3130, PO Box 6050 Fargo, ND 58108-0650
DUNS Number:	80-388-2299
EIN:	45-6002439
Recipient Identifying Number or Account Number:	FAR0028453
Project/Grant Reporting Period:	8/1/19 - 7/31/20
Reporting Period End Date:	7/31/2020

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
DUR-CP	Genomics-Assisted Recurrent Selection to Enhance FHB resistance in Durum Wheat	$ 35,620
	FY19 Total ARS Award Amount	**$ 35,620**

Xuehui Li
Principal Investigator

9/16/2020
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: *Genomics-Assisted Recurrent Selection to Enhance FHB resistance in Durum Wheat*

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

(1) Improve FHB resistance of a durum wheat population through recurrent selection
(2) Explore genomics-assisted selection to enhance the efficiency of recurrent selection
(3) Develop new durum wheat inbred lines with improved FHB resistance through introgression of resistance genes from hard red spring wheat

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?

Towards Objective1
A total of 200 S1 families of a C1 population were evaluated for FHB resistance at two locations, Fargo and Prosper in 2020. Top 20 families were selected and are being intercrossed to generate C2 population which will be evaluated in 2021.

Towards Objective 2
The 200 parents of the C1 population will be genotyped using AVR chip or 90K SNP array in 2020 winter. Genomic selection model will then be developed and validated using the genotyping data along with phenotypic data collected from the field nurseries in 2020.

Towards Objective 3
A male-sterile half-sib family from our hard red spring wheat recurrent selection population with great FHB resistance was selected and crossed to durum wheat cultivar Riveland. Over 500 F_2 progenies from the hexaploid/tetraploid (6x/4x) crosses were planted and then the fertile ones were self-pollinated. Their F_3 progenies are being evaluated for FHB resistance in greenhouse.

b) What were the significant results?
Objective 1: Several S1 families of the C1 population showed better FHB resistance than the durum wheat cultivar Riveland based on the phenotypic evaluation at two field nurseries in 2020.

c) List key outcomes or other achievements.
Different from an inbred line, the hard red spring wheat male-sterile half-sib families with great FHB resistance contain diverse resistance genes. With our approach of crossing the male-sterile half-sib family to durum wheat, we can easily get a lot of pentaploid F_1 seeds and also increase chance of successful introgression of diverse resistance genes from hard red spring wheat into durum wheat.

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.

None.

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

All members of my group including graduate students and hourly students have been involved in inoculation and disease scoring in greenhouse and field nurseries. This provided them a training opportunity for phenotypic evaluation of FHB resistance.

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

The results of FHB resistance of our recurrent selection population and other germplasm were shared with wheat breeders and research scientists through personal communication and the annual FHB forum.

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY19 award period (8/1/19 - 7/31/20). 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?**
   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 FY19 award period?**
   No

   If yes, how many?

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?**
   No

   If yes, how many?

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?**
   No

   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 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

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 (8/1/19 - 7/31/20**) 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* (p. 12), Milwaukee, WI; December 8-10. University of Kentucky, Lexington, KY.
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.

Wang, R., Y. Liu, E. Salsman, J. Hegstad and X. Li. 2019. "QTL pyramiding to improve Fusarium Head Blight resistance in durum wheat." In: S. Canty, A. Hoffstetter, H. Campbell and R. Dill-Macky (Eds.), *Proceedings of the 2019 National Fusarium Head Blight Forum* (p. 123), Milwaukee, WI; December 8-10. University of Kentucky, Lexington, KY.
Status: Abstract Published and Poster Presented
Acknowledgement of Federal Support: YES (Abstract and Poster)