

USDA-ARS
U.S. Wheat and Barley Scab Initiative
FY20 Annual Performance Progress Report
Due date: August 31, 2021

Cover Page

Principle Investigator (PI):	Xuehui Li
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Fiscal Year:	2020
USDA-ARS Agreement ID:	59-0206-0-161
USDA-ARS Agreement Title:	Genetic Characterization and Selection for Fusarium Head Blight Resistance in Durum Wheat
FY20 USDA-ARS Award Amount:	\$ 39,468
Recipient Organization:	North Dakota State University Office of Grant & Contract Accounting NDSU Dept 3130, PO Box 6050 Fargo, ND 58108-0650
DUNS Number:	80-388-2299
EIN:	45-6002439
Recipient Identifying Number or Account Number:	FAR0031935
Project/Grant Reporting Period:	6/1/20 - 5/31/21
Reporting Period End Date:	5/31/2021

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	\$ 39,468
FY20 Total ARS Award Amount		\$ 39,468

Xuehui Li

8/12/2021

Principal Investigator

Date

* MGMT – FHB Management
FST – Food Safety & Toxicology
R- Research
S – Service (DON Testing Labs)
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: *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 these three items below.)

a) What were the major activities?

Towards Objective 1

A total of 150 S1 families of a C2 population were evaluated for FHB severity at two locations, Fargo and Prosper in 2021. Top 15 families will be selected. The 150 S1 families were also evaluated in greenhouse. Top 2 plants from each of the top 15 selected families were selected and are being intercrossed to generate C3 population.

Towards Objective 2

The 150 parents of the C2 population were genotyped using 90K SNP array in 2021. Genomic selection models are being developed and validated using the genotyping data along with phenotypic data collected from the C1 and C2 populations.

Towards Objective 3

Top five half-sib families from our hard red spring wheat recurrent selection C1 population with great FHB resistance was selected and crossed to durum wheat cultivar Riveland. Over 500 F₂ or BC1F1 progenies from the hexaploid/tetraploid (6x/4x) crosses were planted and then the fertile ones were self-pollinated. Their F₃ or BC1F2 progenies are being evaluated for FHB severity in greenhouse.

b) What were the significant results?

Using historical FHB severity data collected from NDSU durum wheat breeding program, an initial GS model was developed with a good prediction accuracy of 0.55 for FHB severity.

c) List key outcomes or other achievements.

Some durum wheat S1 families from our recurrent selection population showed better FHB resistance than check cultivar Riveland.

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- 3. Was this research impacted by the COVID-19 pandemic (i.e. university shutdowns and/or restrictions, 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 FY20 award period (6/1/20 - 5/31/21). 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? [Click to enter number here.](#)

- 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? [Click to enter number here.](#)

- 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? [Click to enter number here.](#)

- 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? [Click to enter number here.](#)

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Publications, Conference Papers, and Presentations

Instructions: Refer to the PR_Instructions for detailed more instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY20 grant award. Only citations for publications published (submitted or accepted) or presentations presented during the **award period (6/1/20 - 5/31/21)** 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:

Winn, Z.J., Acharya, R., Lyerly, J., Brown-Guedira, G., Cowger, C., Griffey, C., Fitzgerald, J., Mason R.E., and Murphy, J.P. (2020, Dec 7-11). Mapping of Fusarium Head Blight Resistance in NC13-20076 Soft Red Winter Wheat (p. 12). In: Canty, S., Hoffstetter, A. and Dill-Macky, R. (Eds.), *Proceedings of the 2020 National Fusarium Head Blight Forum*. https://scabusa.org/pdfs/NFHBF20_Proceedings.pdf.

Status: Abstract Published and Poster Presented

Acknowledgement of Federal Support: YES (Abstract and Poster)

Journal publications.

None.

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

None.

Other publications, conference papers and presentations.

Wang, R., Hegstad, J., Xu, S., Elias, E., Zhong, S., and Li, X. (2020, Dec. 7-11). Developing Durum Wheat FHB Resistant Germplasm using Interspecific Crosses and Early Generation Selection (p. 22). In: Canty, S., Hoffstetter, A. and Dill-Macky, R. (Eds.), *Proceedings of the 2020 National Fusarium Head Blight Forum*. https://scabusa.org/pdfs/NFHBF20_Proceedings.pdf.

Status: Abstract Published and Poster Presented

Acknowledgement of Federal Support: No (Abstract and Poster)