


USDA-ARS
U.S. Wheat and Barley Scab Initiative
FY20 Annual Performance Progress Report
Due date: July 29, 2021

Cover Page

Principle Investigator (PI):	Vijay Tiwari
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Fiscal Year:	2020
USDA-ARS Agreement ID:	59-0206-0-184
USDA-ARS Agreement Title:	Developing FHB Resistant Wheat and Barley Cultivars
FY20 USDA-ARS Award Amount:	\$ 27,616
Recipient Organization:	University of Maryland Office of the Comptroller Contract and Grant Accounting RM 4101, Chesapeake Bldg College Park, MD 20742-3141
DUNS Number:	80-388-2299
EIN:	45-6002439
Recipient Identifying Number or Account Number:	5252532
Project/Grant Reporting Period:	5/15/20 - 5/14/21
Reporting Period End Date:	5/14/2021

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
VDHR-SWW	Developing FHB Resistant Soft Red Wheat Cultivars for Maryland	\$ 27,616
FY20 Total ARS Award Amount		\$ 27,616



7/29/2021

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: *Developing FHB Resistant Soft Red Wheat Cultivars for Maryland*

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

- 1) Breeding soft red winter wheat adapted to the Mid-Atlantic with resistance to scab and to increase the increase the adaptation of FHB resistant lines by the wheat growers in Mid-Atlantic region.
- 2) Evaluation of advanced lines in Uniform Scab nurseries, Maryland State Test and Uniform Regional Nurseries.
- 3) Map and integrate new sources for Scab resistance in to breeding germplasm and to enhance collaborations with regional breeders using Mason-Dixon trials, DHs, screening nurseries, and other resources. Data on resistant germplasm will be disseminated to ensure that the work completed by MD-wheat breeding program will have regional impact in support USWBI's objectives.

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?

- 1) A large number of crosses 300 new crosses were made with parental lines that have native resistance as well as known genes and QTL. Our breeding program started after a gap of four years with very limited germplasm. Collaboration and support from the regional soft red winter wheat breeding programs, speed breeding and DH program allowed us to generate advanced breeding germplasm. Evaluation of advanced germplasm identified some high-yielding FHB resistant lines. We are in discussion with our Crop Improvement Association and PSLA's Germplasm release committee to release at least two FHB resistant cultivars with good grain yield. This year we are testing 35 elite cultivars with moderate to high scab resistance for statewide yield trials. These lines will also be tested under regional Southern Uniform Scab Nurseries to generate multi-year scab resistance data.
- 2) Tested the US Southern Soft Red Winter Wheat trials for natural scab scores
- 3) Tested the US Eastern Soft Red Winter Wheat trials for natural scab scores
- 4) Tested collaborative Mason Dixon Soft Red Winter Wheat trials for natural scab scores as well as their performance under misted FHB nursery trials.
- 5) Evaluated the performance Southern Uniform lines under misted Scab Nursery

- 6) Developed and evaluated TILLING and deletion populations of soft red winter wheat cultivars for FHB resistance. These populations provided some mutants with excellent FHB resistance. Further evaluation of these lines is in progress.

b) What were the significant results?

- 1) Identification of significant scab resistance in the MD germplasm
- 2) Development of advanced breeding germplasm that will help producing FHB resistant MD wheat cultivars.
- 3) Identification of novel sources of FHB resistance as well as DON detoxification
- 4) Identification of two high-yielding and FHB resistant MD cultivars. Work in progress for their release as the PVP cultivars.

c) List key outcomes or other achievements.

New sources of FHB resistance identified from triticale germplasm as well as from deletion and EMS mutant populations.

Significant progress made on fine mapping of Jamestown 1B QTL.

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.

Yes Covid affected our research significantly as we could not get any student working in the lab for almost 6-7 months. It also affected harvesting and recycling of harvested germplasm under speed breeding set up. Fortunately this summer we got our full strength back and we expect to produce exciting results under this project.

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

A PhD student, a Master student and three undergraduate students have been involved in this project, and has been getting trained in FHB phenotyping, marker developments, PCRs, DNA extraction, sequence analysis, and basic wheat genetics.

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

The results were communicated as invited talks at the Commodity Classic event, as well as to Maryland Grain Producer and Utilization Board as well as to Maryland Crop Improvement Association.

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY20 award period (5/15/20 - 5/14/21). 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 FY20 award period?**

Yes No

If yes, how many? 2

- 2. Did any graduate students in your research program supported by funding from your USWBSI grant earn their Ph.D. degree during the FY20 award period?**

Yes No

If yes, how many? 1

- 3. Have any post docs who worked for you during the FY20 award period and were supported by funding from your USWBSI grant taken faculty positions with universities?**

Yes No

If yes, how many? [Click to enter number here.](#)

- 4. Have any post docs who worked for you during the FY20 award period and were supported by funding from your USWBSI grant gone on to take positions with private ag-related companies or federal agencies?**

Yes No

If yes, how many? [Click to enter number here.](#)

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PI: Tiwari, Vijay

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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 FY20 award period (5/15/20 - 5/14/21). 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	FHB Rating (0-9)	Year Released
Nothing to report yet.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year
Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year
Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year
Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year
Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year
Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year
Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year
Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year
Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year
Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year
Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year
Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year
Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year
Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year

NOTE: List the associated release notice or publication under the appropriate sub-section in the 'Publications' section of the FPR.

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 (5/15/20 - 5/14/21)** 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/NFHF20_Proceedings.pdf.

Status: Abstract Published and Poster Presented

Acknowledgement of Federal support: YES (Abstract and Poster)

Journal publications.

Chhabra, B., Tiwari V.K., Gill, B.S., Dong, Y., Rawat, N. (2021). Discovery of a susceptibility factor for Fusarium head blight on chromosome 7A of wheat. *Theoretical and Applied Genetics*. DOI: 10.1007/s00122-021-03825-y.

Status: Published

Acknowledgement of Federal Support: YES

Steadham, J., Schulden, T., Kalia B., Gill, B.S., Bowden, L., Chhuneja, P., Erwin, J., Tiwari, V.K., Rawat, N. (2021). An approach for high-resolution genetic mapping of distant wild relatives of bread wheat. *Theoretical and Applied Genetics*. DOI: 10.1007/s00122-021-03851-w.

Status: Published

Acknowledgement of Federal Support: YES

Wallace, S.; Chhabra, B.; Dong, Y.; Ma, X.; Coleman, G.; Tiwari, V.; Rawat, N. Exploring Fusarium Head Blight Resistance In a Winter Triticale Germplasm Collection. *Preprints* **2021**, 2021040300 (doi: 10.20944/preprints202104.0300.v1)

Status: Published

Acknowledgement of Federal support: YES

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

Nothing to report.

Other publications, conference papers and presentations.

Presentations:

Tiwari, V. (July 22, 2021). Progress on Developing Scab resistant soft red winter wheat cultivars. The 23rd Annual Maryland Commodity Classic Meeting at the Queen Anne's County 4-H Park, MD.

Status: Presented

Acknowledgement of Federal support: YES

Tiwari, V. (January 2, 2021). Progress on Developing soft red winter wheat cultivars for Maryland. Maryland Grain Producer Board Meeting at the Hilton Garden Inn Grasonville, MD.

Status: Presented

Acknowledgement of Federal support: YES

Tiwari, V. (January 2, 2021) Progress on Evaluation of yield and agronomic traits of small grains in Maryland. Maryland Grain Producer Board Meeting at the Hilton Garden Inn Grasonville, MD.

Status: Presented

Acknowledgement of Federal support: YES