USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY19 Final Performance Progress Report
Due date: July 29, 2021

Cover Page

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Fiscal Year:	2019
USDA-ARS Agreement ID:	59-0206-6-002
USDA-ARS Agreement Title:	Value of Genetic Resistance and Fungicides on FHB Control in Durum
FY19 USDA-ARS Award Amount:	$ 10,500
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:	FAR0025286
Project/Grant Reporting Period:	5/10/19 - 5/9/21
Reporting Period End Date:	5/9/2021

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
DUR-CP	Value of Genetic Resistance and Fungicides on FHB Control in Durum	$ 10,500
	FY19 Total ARS Award Amount	**$ 10,500**

Richard O. Horsley 7-17-2021

Principal Investigator Date

* MGMT – FHB Management
FST – Food Safety & Toxicology
R – Research
S – Service (DON Testing Lab)
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: *Value of Genetic Resistance and Fungicides on FHB Control in Durum*

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

   The level of genetic resistance to FHB in durum wheat varieties is lower than is found in spring wheat varieties. Therefore, the integration of fungicides with the best genetic resistance is critical if FHB losses in durum are to be minimized. The objective of this research was to quantify the effect of currently available durum cultivars when combined with the best fungicide practices on the control of FHB and DON. This research was conducted under misted and inoculate conditions and under natural levels of inoculum without misting. A few promising advanced lines were included in order to obtain data on how they perform at the yield-plot-level.

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?**

   Variety by fungicide trials were conducted at the REC in Carrington in 2019 and the REC in Langdon in 2020 under misted conditions and at Prosper under natural conditions.

   b) **What were the significant results?**

   In 2019, due to very excessive moisture during the growing season, yield data were discarded at both locations. DON values, however, were collected and summarized. Somewhat surprising, DON levels were higher at the Prosper location (average = 8.1 ppm), which was not misted, than at Carrington which was misted (average = 3.6). Two experimental lines (D151346 and D151343) averaged across treatments and locations had the lowest DON levels. Fungicide reduced DON levels from 10.8 to 5.4 ppm averaged across genotypes at Prosper and from 4.2 to 3.0 ppm at Carrington. It is not clear why fungicide was so much more effective at Prosper than at Carrington. Fungicide applied at Prosper to D151343 resulted in 1.3 ppm DON, the only treatment resulting in DON levels acceptable in the market.

   In 2020, conditions were favorable for the development of high yield (averaged across genotypes yield with fungicide was greater than 80 bu/acre in both locations) in 2020, so we were able to get good information on the agronomic performance of the cultivars and lines tested. In Prosper (not misted), when averaged over all genotypes, fungicides increased yields by 5 bu/acre and reduced DON by 0.7 ppm. The yield and DON levels in genotypes when grown without fungicides ranged from 67.9 to 87.6 bu/acre and 1.7 and 4.5 ppm, respectively. The lowest overall DON level (0.8 ppm) was achieved with the advanced line SX189GL04 was treated with fungicide. Under misted conditions at Langdon, fungicide increased yield by 11 bu/acre and reduced DON by 4.4 ppm on average. The range in yield and DON for the genotypes without fungicide was 66.0 to 80.2 bu/acre and 5.5 and 11.6 ppm, respectively. The combination of fungicide and the best genoype resulted in a DON level of 1.8 ppm. There are two advanced lines that have

promising levels of FHB resistance, though their yield was somewhat lower than the best cultivars.

c) List key outcomes or other achievements.

The information from these trials demonstrates the relative value of fungicides in controlling FHB and in enhancing yield in two distinct environments. The data were also very helpful in categorizing varieties as to their relative resistance to FHB. This information is published in the variety selection guide and is used by growers when selecting new varieties. Data on yield and DON levels of advanced lines has also been helpful to the breeding programs.

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.

There were no major constraints due to COVID-19 to the implementation of the work in 2020 and the planned trials have also been planted in 2021 at two locations.

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

Five graduate students gained experience with testing fungicides on a range of varieties and on evaluating them for FHB resistance during the period of this report.

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

The results were used to update variety information in the durum variety selection guide published by NDSU Extension. The data from the experiments were also shared with the two breeders that developed the lines included in the trial.

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the **FY19 award period (5/10/19 - 5/9/21)**. 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?**
   ☐Yes ☒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?**
   ☒Yes ☐No
   If yes, how many? 1

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?**
   ☐Yes ☒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?**
   ☐Yes ☒No
   If yes, how many? Click to enter number here.

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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 (5/10/19 - 5/9/21)**. 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.	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 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 (5/10/19 - 5/9/21**) 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:

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

Journal publications.

Cowger, C., C. Bradley, J. Ransom, G. Bergstrom. 2020. Managing a destructive, episodic crop disease: A national survey of wheat and barley growers' experience with Fusarium Head Blight. Plant Disease. https://doi.org/10.1094/PDIS-10-18-1803-SR.
Status: Published
Acknowledgement of Federal Support: YES

McKee, G., C. Cowger, R, Dill-Macky, A. Friskop, Pravin Gautam, J. Ransom and W. Wilson. 2019. Disease management and estimated effects on DON (Deoxynivalenol) contamination in Fusarium infested barley. Agriculture 9(7): 155; https://doi.org/10.3390/agriculture9070155.
Status: Published
Acknowledgement of Federal Support: YES

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

Nothing to report.

Other publications, conference papers and presentations.

Nothing to report.