

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

Cover Page

Principle Investigator (PI):	Andrew Green
Institution:	North Dakota State University
E-mail:	andrew.j.green@ndsu.edu
Phone:	701-231-8478
Fiscal Year:	2019
USDA-ARS Agreement ID:	59-0206-8-200
USDA-ARS Agreement Title:	Development of Hard Spring Wheat Cultivars Resistant to Fusarium Head Blight
FY19 USDA-ARS Award Amount:	\$ 122,465
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:	FAR0028564
Project/Grant Reporting Period:	5/5/19 - 5/4/21
Reporting Period End Date:	5/4/2021

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
VDHR-SPR	Development of Hard Spring Wheat Cultivars Resistant to Fusarium Head Blight	\$ 122,465
FY19 Total ARS Award Amount		\$ 122,465



2021-7-26

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: *Development of Hard Spring Wheat Cultivars Resistant to Fusarium Head Blight*

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

- 1) Continue to develop varieties adapted to the Northern Plains spring wheat region which are at least moderately resistant to Fusarium head blight.
- 2) Screen breeding lines, varieties, and uniform nurseries in misted, inoculated nurseries, and test those entries for DON accumulation.
- 3) Characterize non-Fhb1 resistance present in breeding program through marker-assisted selection and phenotyping.
- 4) Identify germplasm which is low in DON accumulation in addition to having a low visual rating score for disease presence.
- 5) Introgress novel germplasm from pre-breeding into adapted spring wheat backgrounds with suitable end-use quality for breeding and cultivar development.
- 6) Utilize marker assisted selection for FHB resistance in cooperation with the USDA-ARS genotyping facility

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) January 2020- ND Frohberg (MR) released.
- 2) Breeding materials and released varieties screened in three nurseries in 2020 (Fargo, Langdon, Prosper).
- 3) Genomic selection training panel screened in 2020, containing multiple non-Fhb1 resistance sources. GWAS and inclusion in GS model ongoing.
- 4) DON data collected on all three screening nurseries- project is now using index based selection with low overall priority on visual scores.
- 5) Work with PI277012 based resistance (5A) from S. Xu. Rapid inbreeding of four populations completed in 2020-21 to produce ~2000 fixed lines.
- 6) MAS of crossing parents and elite breeding material conducted in 2020.

b) What were the significant results?

- 1) Registered and Certified Seed produced in 2021- Available to farmers in 2022.
- 2) Good genotypic variation for seed (FDK/DON) traits for index selection for 2021 trials.
- 3) Preliminary GS models show r^2 around 0.7 for FHB related traits. This would negate the need for MAS on non-Fhb1 resistance and lead to superior results.
- 4) FDK data taken on all experimental lines used for advancement decisions after poor separation of genotypes using field visual scores. DON data were returned late due to COVID setbacks in the lab. Having reliable FDK data prevented us from utilizing visual scores which were not significantly different.

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- 5) F2 populations screened in 2020 and F4:5 lines screened in 2021 for yield testing in 2022.
- 6) Validation of known QTL has resulted in some parents being removed from the crossing block and has facilitated experimental line advancement. We often use MAS as a “tie-breaker” between sister lines exhibiting similar levels of phenotypic resistance.

c) List key outcomes or other achievements.

Nothing to report.

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.

Our group maintained normal operations throughout 2020 despite some nursery cooperators limiting involvement in out of town nurseries.

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

Virtual USWBSI forum was available to project staff to enhance knowledge. Three graduate students and one post-doc were involved in training for FHB breeding during this period.

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

FHB data were used in preparation of the North Dakota Spring Wheat Trial Results and Seed Selection Guide in 2020. Field days were held virtually with recorded presentations on promising varieties, potentially reaching a greater audience than traditional meetings.

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Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the **FY19 award period (5/5/19 - 5/4/21)**. 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? [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?**

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? 1

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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 (5/5/19 - 5/4/21)**. 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
ND Frohberg	HRS - Hard Red Spring	MR - Moderately Resistant	5	2020
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
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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.

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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 (5/5/19 - 5/4/21)** 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.

Justin Leier, Sintayehu Daba, Andrew Friskop, Blaine Johnson, Jack Rasmussen, Senay Simsek and Andrew Green. 2020. "Fusarium head blight resistance in F₁ hybrid spring wheat" *Canadian Journal of Plant Pathology*, DOI: [10.1080/07060661.2020.1777207](https://doi.org/10.1080/07060661.2020.1777207)
Status: Published.
Acknowledgement of Federal Support: Yes

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

Nothing to Report.

Other publications, conference papers and presentations.

North Dakota Hard Red Spring Wheat Variety Trial Results for 2020 and Selection Guide (A574-20, Oct. 2020).
Status: Published
Acknowledgement of Federal Support: No.