USDA-ARS
U.S. Wheat and Barley Scab Initiative
FY20 Annual 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:	2020
USDA-ARS Agreement ID:	59-0206-0-123
USDA-ARS Agreement Title:	Development of Hard Spring Wheat Cultivars Resistant to Fusarium Head Blight
FY20 USDA-ARS Award Amount:	$ 127,539
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:	FAR0031951
Project/Grant Reporting Period:	5/5/20 - 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	$ 127,539
	FY20 Total ARS Award Amount	**$ 127,539**

28 July 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

FY20 Annual Performance Progress Report
PI: Green, Andrew
USDA-ARS Agreement #: 59-0206-0-123
Reporting Period: 5/5/20 - 5/4/21

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 using traditional methods, marker assisted selection, and genomic prediction.
2) Introgress novel germplasm from pre-breeding into adapted spring wheat backgrounds with suitable end-use quality for breeding and cultivar development.
3) Characterize non-Fhb1 resistance (i.e. 'Glenn', 'SY Rowyn') present in breeding program through marker-assisted selection and phenotyping.

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) Three successful FHB nurseries where we screened 12,000 plots with good expression of disease resistance across genotypes.
2) Line development of 2000 recombinant inbred lines from four populations made with PI277012 based materials prepared by Steven Xu.
3) Marker assisted selection completed in cooperation with ARS genotyping lab for crossing parents and Y3 and Y4 lines. Advancement decisions made with genotypic marker data and phenotypic data to identify lines not carrying major QTL.

b) What were the significant results?

1) Y4 experiment has 26 entries with MR or better FHB resistance, and Y3 experiment has 84 entries with MR or better FHB resistance. All lines also carry superior agronomic performance and end-use quality.
2) Screening for FHB resistance, yield, Bacterial leaf streak resistance, and quality screening to be executed in 2021 to identify elite lines carrying necessary traits.
3) 58% of Y3 lines were found to contain adequate FHB resistance despite carrying no major QTL for FHB. Our GS models are preliminary, but have R2 associated with FHB traits nearing 0.7. The lack of trackable FHB QTL in our program underscores the importance of our predictive modeling research. Training populations are being enhanced this year after genotyping more individuals.

c) List key outcomes or other achievements.

1) *Fusarium* damaged kernel data used to make selection decisions and found to be positively correlated with DON (R2~.65). Key in a year where DON data were slow to be returned due to COVID related shutdowns.

2) Large population sizes should be useful for cultivar development and could also be used for genetic mapping studies or other FHB related student projects.
3) New Research Scientist hired (April 2021) to refine preliminary GS models, test validations, and begin pilot study in implementing the predictions into breeding selection in 2022.

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.

No, our field plot testing increased in 2020 and we managed to record useful data from three successful misted, inoculated nurseries. DON data were slow to be returned to us, but we understand that this was largely due to personnel restrictions in physical laboratory spaces.

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

Rating FHB visually, FDK ratings, Proper preparation of DON samples, FHB Breeding

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

Winter meetings for farmers, Extension trial guide, Virtual field days

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY20 award period (5/5/20 - 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 FY20 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 FY20 award period?**
   ☐Yes ☒No
   If yes, how many? Click to enter number here.

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? 1

FY20 Annual Performance Progress Report
PI: Green, Andrew
USDA-ARS Agreement #: 59-0206-0-123
Reporting Period: 5/5/20 - 5/4/21

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 (5/5/20 - 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
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 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 (5/5/20 - 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:

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.

Nothing to report.

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.