USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY19 Final Performance Progress Report
Due date: August 31, 2021

Cover Page

Principle Investigator (PI):	Clay Sneller
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Fiscal Year:	2019
USDA-ARS Agreement ID:	59-0206-8-208
USDA-ARS Agreement Title:	Improving SRWW Resistance to FHB using Traditional and Molecular Breeding
FY19 USDA-ARS Award Amount:	$ 114,563
Recipient Organization:	The Ohio State University Office of Research Office of Sponsored Programs Research Administration Building 1960 Kenny Road, 4th Floor Columbus, OH 43210
DUNS Number:	83-212-7323
EIN:	31-6025986
Recipient Identifying Number or Account Number:	GRT00052677/60066967
Project/Grant Reporting Period:	7/6/19 - 7/5/21
Reporting Period End Date:	7/5/2021

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
VDHR-NWW	Utilizing Wheat Genes for FHB Resistance in Ohio	$ 65,403
VDHR-NWW	Coordinated Phenotyping of Uniform Nurseries and Official Variety Trials	$ 18,024
VDHR-NWW	Use of Genomic Selection to Improve FHB Resistance and Yield in Northern SWW	$ 5,729
HWW-CP	Genomics Selection for Hard Winter Wheat	$ 25,407
	FY19 Total ARS Award Amount	**$ 114,563**

9/1/21

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

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Project 1: *Utilizing Wheat Genes for FHB Resistance in Ohio*

1. **What are the major goals and objectives of the research project?**
   The major goal is to combine high yield and strong FHB resistance into new cultivars adapted to Ohio and the Midwest.

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?**
   The major activities were:
   1) screening >900 OSU breeding lines for resistance to FHB,
   2) making > 100 crosses to combine high yield with strong FHB resistance,
   3) advancing similar crosses through the breeding pipeline, and
   4) using MAS and GS to introgress *Fhb1* and select for good FHB resistance

   b) **What were the significant results?**
   The 2020-2021 FHB nursery was very successful with excellent disease pressure and good precision for FHB. Several lines with a desired combination of yield and FHB resistance were identified. In addition, we noted a high incidence of strong MR in the OSU germplasm.

   c) **List key outcomes or other achievements.**
   Two lines (OH15-191-52, OH16-184-77) were identified with > yield than the checks and with FHB resistance similar to Truman (Table 1). OH15-191-52 topped Ohio and regional yield trials and has been released for licensing. OH16-184-77 displayed greater FHB resistance than Truman. As in most recent years, ~80% of OSU lines have an FHB Index that is < that of the moderate resistant check Freedom.

Table 1. Results of three years of testing of OH breeding lines.

NAME	YLD	HD	HGT	TW	FHB %	Fhb1?
OH15-191-52	94.0	146.5	38.5	54.7	30.3	YES
OH16-184-77	91.8	143.0	36.0	55.7	10.6	YES
OH09-207-68	90.1	146.0	41.0	55.6	40.0	
OH13-88-61	89.9	145.5	38.0	55.0	37.0	
OH16-184-73	89.6	143.5	36.5	54.6	19.5	YES
OH16-167-76	88.4	140.5	35.5	56.1	29.7	
OH16-168-48	88.2	140.5	37.5	56.2	22.5	
OH15-42-1	88.1	146.5	37.0	52.1	42.9	
OH15-131-31	87.2	143.7	37.0	53.5	19.8	YES
OH14-222-49	87.1	144.0	38.0	54.6	28.1	
KOKOSING	84.3	144.0	40.0	54.5	46.0	
TRUMAN	.	147.0	.	.	21.1	
FREEDOM	.	147.0	.	.	46.4	
PIONEER2545	.	146.0	.	.	85.3	

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

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

The project is training three PhD students and 5-8 summer students

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

Data from the past trials contributed to one publication. The results from the 2021 screening of the Official Variety Trial has been published by OSU extension and is available on-line.

Project 2: *Coordinated Phenotyping of Uniform Nurseries and Official Variety Trials*

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

   This project aims to assess the FHB resistance of advanced breeding lines from 8 public breeding programs (IL,IN, MI, KY, OH, NY, VA, NE) and two private companies (KWS, Limagrain) in a uniform trial. The project also assesses the FHB resistance of all entries in the official variety trials (OVT) from IL, MI, KY. OH, and NY

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?**

   The cooperative trials had 97 entries that were evaluated at a total of 9 environments. The data was summarized, and a preliminary report was submitted to each participant. The breeders in MI, NY, OH, KY, and IL evaluated the FHB resistance of lines in their OVT. Entries in the UE, 5STAdv, 5STPre, Mason-Dixon trials were also assessed for FHB resistance by various collaborators.

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

   Only moderate levels of FHB resistance were noted in the two USWBSI uniform trial with 29% of the lines having an Index value that was equal to or lower than that of Freedom and 6% had an index value that was not statistically different than that of Truman.

   c) **List key outcomes or other achievements.**

   A key outcome was obtaining FHB ratings on the OVT in five states as this information is vital for growers to select wheat lines with high yield and FHB strong resistance. In addition, the screening of advanced breeding lines suggest that breeders are making progress at improving FHB resistance in elite gene pools.

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

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

   At OSU, the project is training three PhD students and 5-8 summer students.

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

The results of the 2019-2020 USWBSI uniform trials has been sent to all cooperators and posted on the USWBSI website. Results from the 2020-2021 OVT have been disseminated to growers via extension websites, grower meetings, hardcopies, and ScabSmart.

Project 3: *Use of Genomic Selection to Improve FHB Resistance and Yield in Northern SWW*

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

   The major goal is to establish genomic selection in the NWW-CP using a common platform

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?**
   The major activities were 1) enter phenotypic data from past yield and FHB trials into T3, 2) coordinate the genotyping of >4,500 lines with a common genotyping platform, 3) call SNPs on >18,000 lines, 4) generate predicted values on all lines including all lines in the 2020-2021 field trails

   b) **What were the significant results?**
   Based on predicted values, breeders were able to select among all lines from all breeders and enter the superior lines in their 2021-2022 trials.

   c) **List key outcomes or other achievements.**
   We generated predicted values for yield, test weight and FHB resistance for >18,000 lines. These values were made available to all breeders.

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

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

   OSU is training 3 PhD students

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

   Predicted value were disseminated to all breeders. The project had on publication: Sneller, C, C. Ignacio, B. Ward, J. Rutkoski, M. Mohammadi. 2021. Using genomic selection to leverage resources among breeding programs: consortium-based breeding. Agronomy *1*(8), 1555; **https://doi.org/10.3390/agronomy11081555**

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Project 4: *Genomics Selection for Hard Winter Wheat*

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

   We hypothesize that screening HRW from NE and SD in Ohio can results in greater disease pressure and better FHB scoring than what can be obtained in the Great Plains. We also hypothesize that a GS model trained with Ohio FHB data on HRW can predict the FHB reaction of other HRW from NE and SD.

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?**
   The major activity in Ohio was planting and rating the FHB resistance of 430 HRW from NE and SD in Ohio. This included rescreening some lines that were tested in the 2019-2020 season. We rated FDK on all samples from the 2019-2020 season and grain samples were sent to NE and SD for DON analysis.

   b) **What were the significant results?**
   High disease pressure was present in the 2020-2021 FHB trial. Rating though was complicated by a high incidence of Stagonospora Glume Blotch.

   c) **List key outcomes or other achievements.**
   13% of the HWW lines had an FHB index that was < that of the MR check Freedom. 23% had an FHB index that was greater than that of the susceptible check) (Figure 1)

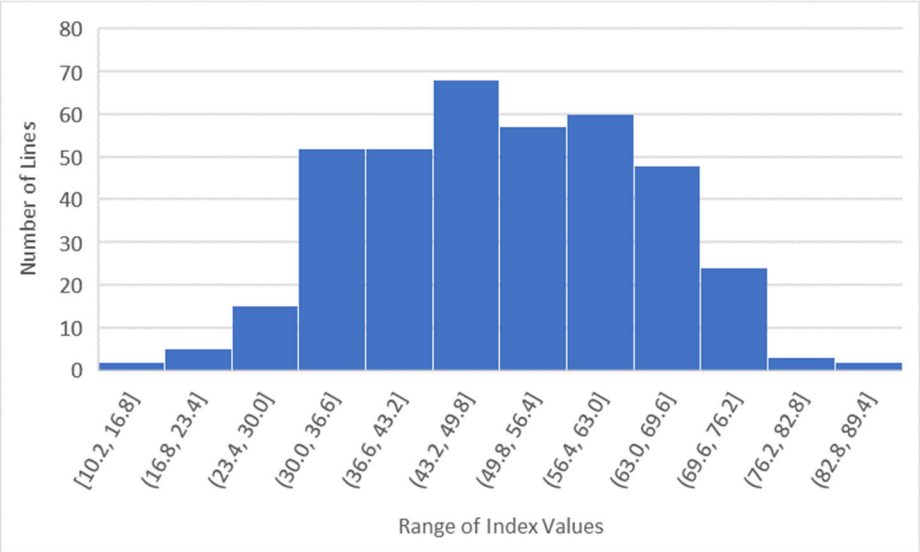

Figure 1. Distribution of FHB Index score from Ohio for HRW lines from NE and SD.

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

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

   OSU trained 3 PhD students

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

   The results were sent to NE and SD

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the **FY19 award period (7/6/19 - 7/5/21)**. 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 ☐ Not Applicable
   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 ☐ Not Applicable
   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 ☐ Not Applicable
   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 ☐ Not Applicable
   If yes, how many? Click to enter number here.

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 (7/6/19 - 7/5/21)**. 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
OH15-191-52	SRW - Soft Red Winter	MR - Moderately Resistant	3	2021
OH13-88-61	SRW - Soft Red Winter	MR - Moderately Resistant	4	2021
OH14-222-49	SRW - Soft Red Winter	MR - Moderately Resistant	3	2021
OH15-131-31	SRW - Soft Red Winter	MR - Moderately Resistant	2	2021
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 (7/6/19 - 7/5/21**) 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.

Sneller, C, C. Ignacio, B. Ward, J. Rutkoski, M. Mohammadi. 2021. Using genomic selection to leverage resources among breeding programs: consortium-based breeding. Agronomy *1*(8), 1555; https://doi.org/10.3390/agronomy11081555
Status: Published
Acknowledgement of Federal Support: No

Rutkoski J, C Sneller, et al. 2021. Genetic trends in Fusarium head blight resistance due to 20 years of winter wheat breeding and cooperative testing in the Northern US. Plant Disease https://doi.org/10.1094/PDIS-04-21-0891-SR
Status: Published
Acknowledgement of Federal Support: Yes

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

Nothing to report.

Other publications, conference papers and presentations.

Borrenpohl, D., Huang, M., Olson, E., and Sneller, C. 2019. "The Value of Early Stage Phenotyping for Wheat Breeding in the Age of Genomic Selection." In: S. Canty, A. Hoffstetter, and R. Dill-Macky (Eds.), *Proceedings of the 2019 National Fusarium head*

blight Forum (p. 86). Milwaukee, WI, Dec. 8-10, 2019. U.S. Wheat & Barley Scab Initiative, Online: https://scabusa.org/pdfs/NFHBF19_Proceedings_Web.pdf.

Status: Abstract Published and Poster Presented

Acknowledgement of Federal Support: No