USDA-ARS | U.S. Wheat and Barley Scab Initiative

FY22 Performance Progress Report

Due date: July 26, 2023

Cover Page

USDA-ARS Agreement ID:	59-0206-2-149
USDA-ARS Agreement Title:	Use of Traditional and Genomic Plant Breeding to Improve Fusarium Head Blight Resistance Soft Winter Wheat
Principle Investigator (PI):	Clay Sneller
Institution:	The Ohio State University
Institution UEI:	DLWBSLWAJWR1
Fiscal Year:	2022
FY22 USDA-ARS Award Amount:	$266,473
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Period of Performance:	May 1, 2022 – April 30, 2026
Reporting Period End Date:	April 30, 2023

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
VDHR-NWW	Use of Traditional and Molecular Breeding to Develop FHB Resistant SRWW for Ohio	$125,969
VDHR-NWW	Implementing Genomic Selection in the NWW-CP	$140,504
	FY22 Total ARS Award Amount	$266,473

I am submitting this report as an: ☒ Annual Report

I certify to the best of my knowledge and belief that this report is correct and complete for performance of activities for the purposes set forth in the award documents.

_____ 7/29/2023

Principal Investigator Signature Date Report Submitted

* BAR-CP – Barley Coordinated Project
DUR-CP – Durum Coordinated Project
EC-HQ – Executive Committee-Headquarters
FST-R – Food Safety & Toxicology (Research)
FST-S – Food Safety & Toxicology (Service)
GDER – Gene Discovery & Engineering Resistance
HWW-CP – Hard Winter Wheat Coordinated Project
MGMT – FHB Management
MGMT-IM – FHB Management – Integrated Management Coordinated Project
PBG – Pathogen Biology & Genetics
TSCI – Transformational Science
VDHR – Variety Development & Uniform Nurseries
NWW –Northern Soft Winter Wheat Region
SPR – Spring Wheat Region
SWW – Southern Soft Red Winter Wheat Region

Project 1: Use of Traditional and Molecular Breeding to Develop FHB Resistant SRWW for Ohio

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1. **What are the major goals and objectives of the research project?**
   The major goals are 1) to develop new SRWW cultivars with strong FHB resistance and 2) to improve the efficiency of the breeding program

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?**

   Our major activity is screening OSU wheat breeding lines for FHB resistance as well as high yield and test weight.

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

   In June of 2022 we attempted to rate FHB reaction of 1,105 OSU breeding lines in the OSU FHB nursery (Table 1). Unfortunately, the nursery had several conditions that made the ratings difficult and made the data unreliable. First, a derecho came across the nursery and flattened 90% of the plots. Next, maturity and senescence progressed rapidly in the plots making it very difficult to rate FHB Index from the field plots. The lodging caused plants from adjacent plots to lie flat together and this made it very difficult to get uncontaminated grain samples from a single plot. We did manage to get clean grain samples for FDK and DON from our most advanced trials and from the uniform scab nursery.

   Table 1. Number of OSU breeding lines screened for FHB resistance in 2022, and 2023

	Stage-1	Stage-2	Stage-3	Stage-4
2022	560	420	100	25
2023	538	195	54	25
Total	1098	615	154	50

   In the fall of 2022 the OSU program planted the FHB nursery for a June 2023 evaluation (Table 1). That nursery will assess the FHB resistance of 812 OSU breeding lines.

   The OSU program evaluated the FHB resistance of all lines in the 2022 OSU Extension Wheat Performance Trial. As with the OSU breeding lines, we did not believe the data was reliable enough to present to growers.

c) List key outcomes or other achievements.

Of the OSU lines in the 2022 nursery, 87% had lower DON than the MR check (Freedom, 21.7ppm) and 47% had lower DON than the resistant check (Truman, 12.8ppm) (Fig. 1). One line, OH18-65-54, had the greatest yield, and one of the lowest FHB Index and DON values (Table 2). This line was considerably better for FHB resistance than our two previous licensed varieties (OH15-191-52 and OH13-88-61) and will be released as a public cultivar.

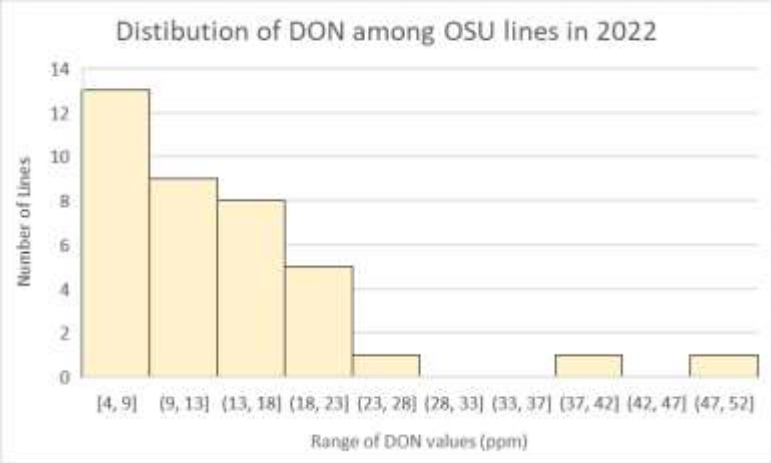

Figure 1. Distribution of DON concentration among OSU breeding lines evaluated in the 2022 FHB Nursery.

Table 2. Performance of OSU breeding lines and checks. DON data is from 2022 while the FHB Index data is from 2020 and 2021.

NAME	YLD Bu/ac	HD days	HGT inches	TW Lbs/bu	FHB IND %	DON ppm
OH18-65-54	101.2	145.0	34.8	57.1	22.2	5.0
OH13-88-61	100.9	149.8	38.7	56.0	61.1	24.2
OH15-191-52	99.9	147.8	37.2	55.0	49.5	22.7
OH18-46-89	98.1	146.7	38.7	56.5	33.5	12.9
OH18*105-13	97.2	143.8	38.7	56.6	34.1	7.1
SC13S26	96.5	152.0	36.0	55.9	46.6	
OH18*104-99	95.2	144.0	41.9	56.7	24.5	5.9
OH18-65-13	95.1	145.0	35.1	56.8	26.7	4.1
OH18-78-33	94.6	146.8	37.1	55.3	38.7	19.3
OH18-73-92	93.7	145.0	36.5	57.1	36.9	6.2
P2130	93.2	148.5	34.1	55.2	46.7	15.2
P2134	92.8	150.8	39.5	57.2	20.0	7.8
OH18*105-58	92.6	143.7	38.9	56.1	45.0	11.6
OH18*1-10	92.4	147.3	33.4	56.2	69.5	26.6
OH18*48-106	92.1	145.8	36.1	55.1	49.1	13.8
OH18*76-27	90.5	145.2	39.5	56.3	13.1	5.3
TRUMAN	.	143.7	.	.	24.0	12.8
FREEDOM	.	142.7	.	.	42.6	21.7
PIONEER2545	.	141.7	.	.	65.0	40.1

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

All students at the OSU program work on this project. That includes 4 PhD students, 2 visiting scholars, and perhaps 10 different undergraduate students.

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

The results have been communicated to Ohio Seed Improvement Association, Ohio Foundation Seeds, Ohio Corn and Wheat, and Ohio wheat growers through field days.

Project 2: Implementing Genomic Selection in the NWW-CP

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

   This project is designed to facilitate the coordinated use of genomic selection among the six NWW-CP breeding programs.

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 are 1) joint genotyping of breeding lines across all six programs, 2) using genomic selection to predict the value of all breeding lines from all programs, 3) availability of a coordinator to execute advanced analyses and assist in advancing genotyping technologies. The breeders in the NWW-CP also establish the Big6 uniform trial consisting of 370 lines that will be evaluated across all six states.

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

   A total of 4830 new breeding lines from 6 programs were genotyped in this FY. The data was distributed to each of the breeders for use in their genomic selection schemes. In addition, the project contributed to the development of a Allegro genotyping system designed for SRWW.

   The coordinator for this project, Brian Ward, departed in October of 2022. We have no contracted with an outside entity to perform the bioinformatics required for calling SNPs from the GBS data, and to assist the individual breeding programs.

   The Big6 trial was successfully established in 9 locations across the six states.

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

   In 2022, each program used their own phenotypic and genotypic data to make predictions and advance lines through the stages of product development testing.

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

   The genotypic data is being used by students at all six programs in their variety development activities and in some cases in their individual dissertations or theses.

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

   The marker data is distributed to all programs and the phenotypic data is compiled on the T3 server

Publications, Conference Papers, and Presentations

Please include a listing of all your publications/presentations about your FHB work that were a result of funding from your FY22 grant award. Only citations for publications published (submitted or accepted) or presentations presented during the **award period** should be included.

Did you publish/submit or present anything during this award period May 1, 2022 – April 30, 2023?

☐ Yes, I've included the citation reference in listing(s) below.

☒ No, I have nothing to report.

Journal publications as a result of FY22 award

List peer-reviewed articles or papers appearing in scientific, technical, or professional journals. Include any peer-reviewed publication in the periodically published proceedings of a scientific society, a conference, or the like.

Identify for each publication: Author(s); title; journal; volume: year; page numbers; status of publication (published [include DOI#]; accepted, awaiting publication; submitted, under review; other); acknowledgement of federal support (yes/no).

Books or other non-periodical, one-time publications as a result of FY22 award

Report any book, monograph, dissertation, abstract, or the like published as or in a separate publication, rather than a periodical or series. Include any significant publication in the proceedings of a one-time conference or in the report of a one-time study, commission, or the like.

Identify for each one-time publication: Author(s); title; editor; title of collection, if applicable; bibliographic information; year; type of publication (book, thesis, or dissertation, other); status of publication (published; accepted, awaiting publication; submitted, under review; other); acknowledgement of federal support (yes/no).

Other publications, conference papers and presentations as a result of FY22 award

Identify any other publications, conference papers and/or presentations not reported above. Specify the status of the publication.