USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY16 Final Performance Report
Due date: July 28, 2017

Cover Page

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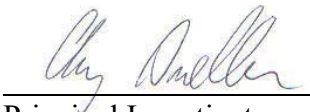
Fiscal Year:	2016
USDA-ARS Agreement ID:	59-0206-4-034
USDA-ARS Agreement Title:	Discovering, Understanding, and Utilizing Wheat Genes for FHB Resistance in Ohio.
FY16 USDA-ARS Award Amount:	$ 85,437
Recipient Organization:	The Ohio State University Research Foundation Accounting Dept. 1960 Kenny Road, 4th Floor Columbus, OH 43210
DUNS Number:	07-165-0709
EIN:	31-6401599
Recipient Identifying Number or Account Number:	GRT00034867 BG001
Project/Grant Reporting Period:	7/6/16 - 7/5/17
Reporting Period End Date:	07/05/17

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
VDHR-NWW	Utilizing Wheat Genes for FHB Resistance in Ohio.	$ 60,194
VDHR-NWW	Coordinated Phenotyping of Uniform Nurseries and Official Variety Trials.	$ 17,476
VDHR-NWW	Implementing Genomic Selection for FHB Resistance in Soft Winter Wheat (SWW).	$ 7,767
	FY16 Total ARS Award Amount	**$ 85,437**



Principal Investigator — July 28, 2017 Date

* MGMT – FHB Management
FST – Food Safety & Toxicology
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 project?

Host resistance to FHB must be combined with high yield for growers to accept FHB resistant cultivars. This can be done by screening the breeding lines that are in development, building parents with good resistance and yield levels, and by designing crosses amongst such parents.

2. What was accomplished under these goals? *Address items 1-4) below for each goal or objective.*

1) major activities
- Screening 899 OSU lines
- 98 Crosses made utilizing native sources of resistance o=and Fhb1.
- Seed increased of 62 breeding lines with potential for relase as new cultivars with good yield and FHB resistance.

2) specific objectives
- Screening 899 OSU lines
- 98 Crosses made utilizing native sources of resistance o=and Fhb1.
- Seed increased of 62 breeding lines with potential for relase as new cultivars with good yield and FHB resistance.

3) significant results

We assessed the FHB resistance of 899 OSU lines in the 2016-17 season in an inoculated and misted nursery. Disease pressure was high with the average FHB index of the checks being Truman (R) =12%, Freedom (MR) =24%, Pioneer 2545 (S) = 50%. The test identified many lines with good potential FHB resistance. In the OSU advance trials 75% of the lines were ≤ Freedom and 14% were ≤ Truman. The percentage of lines of MR and R lines the 1st year of phenotype (e.g., no previously selection for FHB) was preater than was observed in the P+NUWWSN or the Ohio Wheat Performance Trials (OWPT) of commercial cultivars

Table 1. Percentage of lines in each category

	Advanced	1st Year	P+NUWWSN	OWPT
% < TRUMAN	14	32	27	19
% < FREEDOM	75	83	34	77
% > PIO2545	0	1	6	0
n=	344	555	96	91

We made many crosses with OH08-118-18, an OSU lines with strong FHB resistance in the 2016 NUSSN and that has *Fhb1*.

3) key outcomes or other achievements
We released two new cultivars (Kokosing=OH08-206-69 and OH09-207-68) with good-excellent yield and good FHB resistance (see below)

2015-16 USWBSI

NAME	INC	SEV	IND	FDK	ISK	DON
TRUMAN	34.4	15.4	7.7	16.3	27.9	4.8
FREEDOM	58.3	19.3	16.2	36.0	42.9	9.5
ERNIE	58.4	28.8	21.6	25.6	41.7	6.6
PIONEER2545	73.9	41.3	34.7	39.7	55.3	13.0
OH09-207-68	44.8	19.1	8.7	22.3	30.3	4.8
OH08-206-69	55.1	18.8	12.9	27.8	38.8	6.8
# ENVIRONMENTS	9	10	10	4	4	1

2013-14 USWBSI

NAME	INC	SEV	IND	FDK	ISK	DON
TRUMAN	48.6	19.7	13.3	27.9	37.6	9.1
ERNIE	62.4	31.2	21.8	28.9	44.3	9.6
FREEDOM	67.6	38.4	30.6	44.9	58.1	12.1
PIONEER2545	71.4	53.3	44.6	50.4	63.9	17.8
OH08-206-69	71.2	38.3	29.8	43.5	58.0	8.7
AVERAGE	64.2	35.6	27.6	34.9	50.4	10.5
Number of Envs	12	11	11	8	7	6

	IND %			
OSU TRIALS	Avg.	2016	2014	2013
TRUMAN	28.8	32.4	32.9	21.2
FREEDOM	53.4	47.1	55.7	57.3
PIONEER2545	81.1	76.7	94.0	72.7
OH08-206-69	32.5	43.4	29.8	24.4
OH09-207-68	25.4	26.1	25.0	25.2
MALABAR			42.1	36.7
BROMFIELD				41.1

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

All students work on the FHB project even if they are not directly funded by the project. This includes scoring disease, harvesting grain samples for DON analysis, as some assistance with data analysis.

We had one student intern in the summer of 2016. The project involved one post-doc and one PhD student in FY 16 (Mao Huang and Nelly Arguello)

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

Results have presented in two field days (one in 2016, one in 2017) and one seed industry meetings

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

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

Accurately predicting the FHB resistance of a breeding line or cultivar requires extensive phenotyping in field trials. The OSU program has coordinated a uniform trial of ~120 SRWW lines that are tested in 8-15 locations per year. The lines come from ~13 public and private breeding programs. This provides robust data on FHB resistance so the breeders can make informed decisions on what lines to release and which to use as parents.

In addition to breeding lines, we also screen the OSU Official Variety Trial (OVT) for FHB resistance.

2. What was accomplished under these goals? *Address items 1-4) below for each goal or objective.*

1) major activities
Organized entries for the 2016-17 P+NUWWSN, disseminate the seed, grow and collected data from the P+NUWWSN tests at OSU, compile data from the 2015-16 tests, prepare report on the 2015-16 tests, disseminate the report

2) specific objectives
Organized entries for the 2016-17 P+NUWWSN, disseminate the seed, grow and collected data from the P+NUWWSN tests at OSU, compile data from the 2015-16 tests, prepare report on the 2015-16 tests, disseminate the report

3) significant results
The 2015-16 NUWWSN had 50 entries (46 lines & four checks) from 12 programs and we obtained phenotypic data on seven traits from 14 locations. The PNUWWSN had 42 entries (38 lines & four checks from 10 programs and we obtained phenotypic data from 12 locations.

We observed good levels of FHB resistance in the 2016 uniform tests, though perhaps not as quite as good as in the 2015 and 2014 tests.

- 58.7% of the entries in the PNUWWSN and the NUWWSN had an FHB index < that of Freedom (this was 68% in 2015, 69% in 2014, and 90% in2013)
- Only 2.2% of the PNUWWSN and the NUWWSN entries had an FHB index < that of Truman (vs 23% in 2015, 4% in 2015 and 24% in 2013)
- 40.2% of the PNUWWSN and NUWWSN entries had less DON than Freedom (vs 83% in 2015, 90 % in 2014, and 65% in 2014)
- 19.6% of the PNUWWSN and the NUWWSN entries had less DON than Truman (vs 63% and 35% in 2015 and 2014)
- In the NUWWSN, 7of 50 entries (14%) were not significantly different than the most resistant entry for all six FHB traits with an LSD while 8 of 42 entries (19.0%) in the PNUWWSN were not different than the most resistant entry for all six FHB.

The report on the 2015-16 P+NUWWSN was distributed to all participants and is available on the USWBSI web site.

The 2016-17 NUWWSN tests have 60 entries (46 lines & four checks) while the PNUWWSN had 43 entries (39 lines & four checks from 10 programs and we obtained phenotypic data from 12 locations.

4) key outcomes or other achievements
The results have been distributed and have informed the selection for FHB resistance for 11 breeders (9 public, 2 private).

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

All students work on the FHB project even if they are not directly funded by the project. This includes scoring disease, harvesting grain samples for DON analysis, as some assistance with data analysis.

We had one student intern in the summer of 2016. The project involved one post-doc and one PhD student in FY 16 (Mao Huang and Nelly Arguello)

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

The report on the 2015-16 P+NUWWSN was distributed to all participants and is available on the USWBSI web site.

Project 3: *Implementing Genomic Selection for FHB Resistance in Soft Winter Wheat (SWW).*

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

1) To implement Genomic Selection (GS) for FHB resistance in soft winter wheat by completing two cycles of GS.
2) Initiate evaluation of the effectiveness of GS.

2. What was accomplished under these goals? *Address items 1-4) below for each goal or objective.*

1) major activities
We genotyped ~760 F2 plants with GBS markers, predicted their value, and made crosses among the lines predicted to have the best value. This completed the third cycle of GS. Some of the F2 plants came from crosses that could segregate for Fhb1 and these F2s were genotyped with a KASP assay for the presence of Fhb1 resistant allele. Lines with superior GEBVs and with resistance at Fhb1 were selected and crossed

We planted ~300 lines selected for good predicted FHB resistance (and some with poor predicted values) from cycle 1 and cycle 2 of GS to assess their FHB resistance in inoculated and misted FHB nurseries in the 2016-17 seasons.

2) specific objectives
- Execute a third cycle of GS
- Assess FHB resistance of lines selected from cycles 1 and 2 of GS

3) significant results
There were F2 plants with good predicted FHB resistance among the genotyped F2, include some with *Fhb1*.

The field data has not been analyzed

4) key outcomes or other achievements
The field data has not been analyzed.

We are redoing all of the bioinformatics to recall alleles in the training population and the F2s from all three cycles. Once done we will analyze the changes in FHB resistance through the three cycles and compare it to that of the training population.

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

All students work on the FHB project even if they are not directly funded by the project. This includes scoring disease, harvesting grain samples for DON analysis, as some assistance with data analysis.

We had one student intern in the summer of 2016. The project involved one post-doc and one PhD student in FY 16 (Mao Huang and Nelly Arguello)

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

Two manuscripts were submitted in 2016. The papers are being revised and will be submitted to a different journal

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY16 award period. 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 FY16 award period?** NO

   If yes, how many?

2. **Did any graduate students in your research program supported by funding from your USWBSI grant earn their Ph.D. degree during the FY16 award period?** NO

   If yes, how many?

3. **Have any post docs who worked for you during the FY16 award period and were supported by funding from your USWBSI grant taken faculty positions with universities?** NO

   If yes, how many?

4. **Have any post docs who worked for you during the FY16 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

   If yes, how many? 1

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 FY16 award period. All columns must be completed for each listed germplasm/cultivar. Use the key below the table for Grain Class abbreviations. *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** (S, MS, MR, R, where R represents your most resistant check)	**FHB Rating** (0-9)	**Year Released**
Kokosing (OH08-206-69), public	SRW	MR	We don't use 0-9	2016
OH09-207-68, licensed	SRW	R	We don't use 0-9	2016

Add rows if needed.

NOTE: List the associated release notice or publication under the appropriate sub-section in the 'Publications' section of the FPR.

Abbreviations for Grain Classes

Barley - BAR
Durum - DUR
Hard Red Winter - HRW
Hard White Winter - HWW
Hard Red Spring - HRS
Soft Red Winter - SRW
Soft White Winter - SWW

Publications, Conference Papers, and Presentations

Instructions: Refer to the FY16-FPR_Instructions for detailed instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY16 grant. Only include citations for publications submitted or presentations given during your award period (7/6/16 - 7/5/17). If you did not have any publications or presentations, state 'Nothing to Report' directly above the Journal publications section.

Journal publications.

None

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

None

Other publications, conference papers and presentations.

Clay Sneller, Mao Huang and Nelly Arguello. 2016. "Trends in FHB Resistance in the Northern Uniform FHB Nursery." In S. Canty, K. Wolfe and D. Van Sanford (Eds.), *Proceedings of the 2016 National Fusarium Head Blight Forum.* East Lansing, MI/Lexington, KY: U.S. Wheat and Barley Scab Research Initiative. P. 93.
Status: Abstract Published and Poster (# 43) Presented
Acknowledgement of Federal Support: Yes