

USDA-ARS
U.S. Wheat and Barley Scab Initiative
FY19 Performance Report
Due date: July 24, 2020

Cover Page

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Fiscal Year:	2019
USDA-ARS Agreement ID:	59-0206-8-201
USDA-ARS Agreement Title:	Evaluation of Barley and Malt for DON and Deoxynivalenol-3-Glucoside
FY19 USDA-ARS Award Amount:	\$ 152,485
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:	FAR0028542
Project/Grant Reporting Period:	5/5/19 - 5/4/20
Reporting Period End Date:	5/4/2020

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
FST-S	Evaluation of Barley and Malt for DON and Deoxynivalenol-3-Glucoside	\$ 152,485
FY19 Total ARS Award Amount		\$ 152,485



Principal Investigator July 24, 2020
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

Project 1: *Evaluation of Barley and Malt for DON and Deoxynivalenol-3-Glucoside*

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

The goal of this project is to provide barley breeders, pathologists, and other researchers working on the development of Fusarium resistant barley, with affordable, accurate and timely DON analysis.

2. What was accomplished under these goals or objectives? (For each major goal/objective, address items a-b) below.)

a) What were the major activities?

Approximately 8,600 samples were analyzed for USWBSI researchers during the reporting period (exclusive of checks/standard curves=979). Fifteen UWSBSI researchers, in six states were served. If the eastern Spring Barley Nursery (ESBN) is included the total number of researchers and states increases to twenty-one and twelve, respectively. The majority of samples were submitted by five barley breeding programs (ND, MN, MT, ID, CO) and one barley pathology project (ND). The remainder of samples were largely for variety trials, agronomic research, or mycotoxin/food safety related research.

No cooperator requested D3G results in 2019.

Collaborator	Location	Samples
USWBSI Projects		
Brueggeman	NDSU - Fargo	1242
Chapara	NDSU - Langdon	96
Forster	NDSU - Minot	36
Friskop	NDSU Fargo	36
Horsley	NDSU - Fargo	1247
Horsley	Eastern Barley Nursery	225
Ransom	NDSU- Fargo	0
Rao	NDSU - Fargo	0
Schatz	NDSU- Carrington	104
Schwarz/Jin	NDSU -Fargo	107
Smith	UMN	82
Baldwin	USDA-Aberdeen	3559
He	USDA-Aberdeen	0
Satterfield	USDA-Aberdeen	0
Timmerman	Busch Ag Resources	1979
Sherman	MSU	547
Paul	OSU	354
Standard Curve		522
Check Samples		454
Trilogy		3

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Collaborator	Location	Samples
USWBSI Projects		
Total		9617
FHB Related – Outside of USWSI		
Turner	The Land Institute ²	824

¹ Some USDA-Idaho samples were submitted by Brueggeman lab. We believe this includes 600 for He.

² Wheat grass samples from the Land Institute were analyzed last, and they were charged for materials/supplies.

b) What were the significant results?

NA

c) List key outcomes or other achievements.

The analysis of cooperator samples began in August and was completed by early June. During the months of June and July staff are involved in equipment maintenance and also research.

Staff person, Dr Zhao Jin, has utilized confocal laser scanning microscopy to locate *Fusarium* within kernels of infected wheat, rye and barley. This method may prove useful in explaining the patterns of DON development during the malting of FHB infected grain.

3. Was this research impacted by the COVID-19 pandemic (i.e. university shutdowns, reduced or lack of support personnel, etc.)? If yes, please explain how this research was impacted or is continuing to be impacted.

Yes, this work was impacted by COVID-19. In-person classes at NDSU were stopped as of March 23. Because of this we lost 2 time-slip undergraduate students, who were largely responsible for weighing and grinding samples. In addition, the two staff (Mr. Gillespie and Dr Jin) began to work separate shifts as to minimize contact in the lab. All factors combined slowed analyses, although the majority of samples had been completed.

The COVID-19 pandemic has also greatly restricted Dr Jin's access to the NDSU Advanced Imaging & Microscopy Laboratory, which impacts ongoing work on localization of *Fusarium* and mycotoxin within kernels (currently funded). It also restricts access of graduate students (Rao lab) to our lab. These students need to learn DON methodology in order to conduct their research.

We also do not know if we will be able to hire student labor in fall 2020, or if we can have them work safely. As such, the rate of analyses may again be impacted because of grinding and weighing issues.

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

Two undergraduate students, one graduate student and one post-doctoral researcher assist in the laboratory. Undergraduate students have learned basic laboratory skills, while graduate students have learned methods for DON, DON-3-glucoside and other trichothecenes, as well as, laboratory quality control. The post-doctoral researcher has been provided with opportunities to learn mycotoxin analysis by GC, GC-MS, LC-MS, rt-PCR for Fusarium measurement, some aspects of laboratory management and has also conducted independent research on FHB.

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

Data is provided directly to collaborating scientists. Information on DON and other trichothecenes in barley, malt and beer has been disseminated by presentations at conferences and webinars.

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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 - 5/4/20). 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?**

None

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 FY19 award period?**

None

If yes, how many?

- 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?**

None

If yes, how many?

- 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?**

None

If yes, how many?

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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. 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 (S, MS, MR, R, where R represents your most resistant check)	FHB Rating (0-9)	Year Released

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

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Publications, Conference Papers, and Presentations

Instructions: Refer to the FY19-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 - 5/4/20)** 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.

Journal publications.

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

Jin, Z., and Schwarz, P. (2020). Advances in postharvest storage and handling of barley: Methods to prevent or reduce mycotoxin contamination. Pages 227–264 in Achieving Sustainable Cultivation of Barley. G. Fox and C. Li, editors. Burleigh Dodds Science Publishing. <https://doi.org/10.19103/as.2019.0060.15>

Status: Published

Acknowledgement of Federal Support: NO

Other publications, conference papers and presentations.

Conference Papers

Jin, Z., Solanki, S., Tang, R., Gillespie, J., Borowicz, O., Brueggeman, R. and Schwarz, P. 2019. “Fungal localization and mycotoxin production in Fusarium infected grain and malt kernels. Patterns of fungal distribution in Fusarium infected barley, rye and triticale grain and malt.” In: Canty, S., A. Hoffstetter, H. Campbell and R. Dill-Macky (Eds.), *Proceedings of the 2018 National Fusarium Head Blight Forum* (p.40). Milwaukee, WI; December 8-10. University of Kentucky, Lexington, KY.

Status: Published

Acknowledgement of Federal Support: YES (Abstract and Poster)

Jin, Z., Solanki, S., Tang, R., Brueggeman, R. and Schwarz, P. 2019. Patterns of fungal distribution in Fusarium infected barley, rye and triticale grain and malt. In Proceedings of the 2019 American Society of Brewing Chemists Annual Meeting. ASBC, St Paul, MN

Status: Published

Acknowledgement of Federal Support: YES (Abstract and Poster)

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Moraes, W., Ng, S.G, Schwarz, P., Madden, L., and Peirce, P. 2019. Pre-harvest rainfall and harvesting strategy effects on the quality of Fusarium Head Blight affected grain. In: Canty, S., A. Hoffstetter, H. Campbell and R. Dill-Macky (Eds.), Proceedings of the 2019 National Fusarium Head Blight Forum (p.18). Milwaukee, WI; December 8-10. University of Kentucky, Lexington, KY.

Status: Published

Acknowledgement of Federal Support: YES (Abstract and Poster)

PI: Schmale, David

Project: Diagnostic Testing Services for Deoxynivalenol in the Eastern U.S.

FY19 PR – USWBSI ADDENDUM DON Service Labs – Quality Control (QC) Data

Note: What is being requested is the lab’s quality control (i.e. check) data.

Insert below Lab’s Quality Control Data/Results from the FY19 Award Period (6/7/19 - 6/6/20):

Quality control data were collected at Virginia Tech through (a) the blind testing of samples with unknown DON levels (coordinated by the USWBSI through Trilogy Analytical Laboratories), and (b) the testing of subsamples of grain lots in each GC/MS run (to test for consistency among GC/MS runs). Known standards are run throughout the the GC/MS run to establish our standard curves.

- a. QC data for blind testing of samples from Trilogy Labs (coordinated by Trilogy Labs, and communicated through Amber Hoffstetter; amber.hoffstetter@scabusa.org). Lab ID ‘Lab3’ is the Virginia Tech lab (highlighted in grey). 3-1 and 3-2 represent two different GC-MS machines. Lab IDs 1-4 are other USWBSI labs. Data are in ppm.

Testing Period	Trilogy Sample	Trilogy Quant	Lab 1	Lab 2	Lab 3-1	Lab 3-2	Lab 4-1	Lab 4-2
Aug19	Low	1.40	1.00	0.53	1.06	0.92	1.01	0.97
	Med	4.50	3.60	2.90	4.20	3.72	3.08	3.04
	High	11.00	8.00	6.30	8.58	8.11	7.63	8.37
Sep19	Low	2.10	2.10	2.90	1.24	1.36	1.37	1.36
	Med	3.80	4.30	5.60	2.41	2.56	2.40	2.38
	High	8.60	9.60	11.00	6.01	6.13	5.67	5.79
Oct19	Low	1.00	1.30	1.40	0.87	0.95	0.88	0.89
	Med	3.60	2.90	4.50	2.71	3.01	2.34	2.53
	High	8.60	10.00	8.90	7.55	7.37	6.35	6.39
Nov19	Low	0.50	0.38	0.38	0.49	0.47	0.50	0.48
	Med	3.60	2.80	2.19	2.66	2.53	2.86	2.86
	High	9.30	5.65	5.30	6.76	6.80	7.13	7.09
Dec19	Low	1.20	1.10	0.95	0.76	0.77	0.88	0.82
	Med	3.80	4.10	3.20	2.28	2.71	2.91	2.65
	High	8.60	9.40	7.00	6.23	6.52	6.93	6.41
Jan20	Low	0.70	0.90	0.68	0.58	0.60	0.66	0.61
	Med	3.80	5.80	2.90	3.18	3.04	3.17	3.28
	High	8.60	10.20	7.90	6.02	5.92	7.15	7.13
Feb20	Low	1.00	0.90	0.85	0.86	0.84	0.94	0.85
	Med	3.60	2.60	2.71	2.69	2.63	2.68	2.49
	High	8.60	5.80	5.97	5.94	5.60	6.73	6.69
Mar20	Low	0.50	0.50	0.50	0.52	0.52	0.52	0.52

PI: Schmale, David

Project: Diagnostic Testing Services for Deoxynivalenol in the Eastern U.S.

Testing Period	Trilogy Sample	Trilogy Quant	Lab 1	Lab 2	Lab 3-1	Lab 3-2	Lab 4-1	Lab 4-2
	Med	3.40	2.70	3.40	3.42		2.73	2.68
	High	9.30	7.50	6.70	6.32		6.48	6.38

b. QC data from internal checks of subsamples of grain lots from Trilogy (13-Aug-03) in each GC/MS run (to test for consistency among GC/MS runs). Trilogy sample 13-Aug-03 was measured 225 times, and determined to have an average DON concentration of 4.44 ppm with a standard error of the mean of 0.046.

