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

Cover Page

Principle Investigator (PI):	David Schmale
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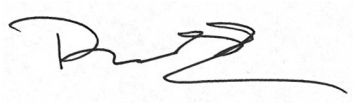
Fiscal Year:	2019
USDA-ARS Agreement ID:	59-0206-6-017
USDA-ARS Agreement Title:	Diagnostic Testing Services for Deoxynivalenol in the Eastern U.S.
FY19 USDA-ARS Award Amount:	$ 67,829
Recipient Organization:	Virginia Polytechnic Institute and State University 1880 Pratt Drive, Suite 2006 Blacksburg, VA 24060
DUNS Number:	003137015
EIN:	54-6001805
Recipient Identifying Number or Account Number:	422288 & 422533
Project/Grant Reporting Period:	6/7/19 - 6/6/21
Reporting Period End Date:	6/6/2021

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
FST-S	Diagnostic Testing Services for Deoxynivalenol in the Eastern U.S.	$ 67,829
	FY19 Total ARS Award Amount	**$ 67,829**



August 23, 2021

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

FY19 Final Performance Progress Report
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Project 1: *Diagnostic Testing Services for Deoxynivalenol in the Eastern U.S.*

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

The overall goals of our project were to (1) provide diagnostic testing services for DON for wheat and barley samples associated with USWBSI-supported research projects in the eastern U.S. and (2) reduce DON contamination in wheat and barley.

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?

In 2019, DON data was delivered for 4,786 wheat and barley samples from the following USWBSI investigators: Glover (1,000 samples), Griffey (2,342 samples), Marshall (200 samples), Mehl (218 samples), Obert (200 samples), Schmale (200 samples), and Wegulo (626 samples). In 2020, DON data was delivered for 5,008 wheat and barley samples from the following USWBSI investigators: Bowen (20 samples), Boyles (353 samples), Cowger (206 samples), Darby (116 samples), Glover (1,392 samples), Griffey/Santantonio (1,540 samples), Koehler (169 samples), Marshall (230 samples), Mehl/Langston (218 samples), Murphy (422 samples), Wegulo (112 samples), and Vaillancourt (20 samples). The testing number does NOT include controls, checks, and re-runs. Most of the samples tested were 100g kernel lots from FHB field trials, but some were smaller lots (~5g samples) from laboratory experiments. Extraction, clean-up, and quantification of DON were conducted following standard protocols using a GC/MS. Research associate Niki McMaster attended the 2019 USWBSI meeting in Milwaukee.

b) What were the significant results?

The proposed project provided essential DON testing services for the USWBSI, and supported the only USWBSI-associated DON testing lab in the eastern U.S. Many of the wheat and barley lines had not been tested previously for mycotoxins.

c) List key outcomes or other achievements.

The research has contributed to the development and release of new FHB-resistant wheat and barley varieties and has ensured rigorous testing of both new and historical wheat and barley varieties for mycotoxin contamination. The Schmale Lab at Virginia Tech continues to be committed to the long-term management of a successful and productive mycotoxin testing lab for the USWBSI. DON testing services were coordinated, supported, and managed by research associate Niki McMaster.

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.

Yes. In response to the COVID19-pandemic, Virginia Governor Northam issued a series of executive orders that ultimately led to the temporary shutdown of our physical Virginia Tech DON testing lab spaces on March 27, 2020. These physical lab spaces remained closed until June 8, 2020, when they were opened again under modified operations following strict safety guidelines and procedures. During the closure of the physical lab spaces, Niki McMaster worked remotely to improve curating, analyzing, and reporting DON data to our stakeholders, and attend a series of virtual training sessions outlined in the professional development section below.

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

In 2019, research associate Niki McMaster participated in a series of webinars to enhance her knowledge of GC/MS, improve her analytical skills, and understand current and future impacts of COVID-19 on the workplace. These included virtual training sessions (webinars) on topics including: (1) Instrumentation shutdown information and lab considerations for GC and GC/MS, (2) GC Analysis Workshop- Tips, Tricks and Tools to Speed Up your Analysis and Increase your Throughput, (3) GCMS Sources- Tips, Tricks and Maintenance, (4) A Tail of Two Peaks: Troubleshooting Poor Peak Shape, (5) Chromatographic Methods to Speed Up Your Analysis and Increase Your Throughput, (6) Powering up: GC and GC/MS, and (7) After the Shutdown: Back to Business as Unusual – a look at how labs are changing and adapting operations post-crisis. In 2020, research associate Niki McMaster continued to improve her analytical skills in mycotoxin detection and quantification.

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

In 2019, Schmale gave a series of lectures on mycotoxins for about 100 undergraduate students at Virginia Tech. In 2020, Schmale gave a series of lectures on mycotoxins for about 150 undergraduate students and 9 graduate students. McMaster communicated with USWBSI stakeholders via phone and email to coordinate sample collection, processing, and testing. Results were disseminated to stakeholders at the 2019 USWBSI meeting in Milwaukee, and the virtual 2020 USWBSI meeting. In 2020, Schmale gave a series of lectures on mycotoxins for about 150 undergraduate students at Virginia Tech. McMaster communicated with USWBSI stakeholders via phone and email to coordinate sample collection, processing, and testing. Results were disseminated to stakeholders at the 2020 virtual USWBSI meeting.

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the **FY19 award period (6/7/19 - 6/6/21)**. 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.

FY19 Final Performance Progress Report
PI: Schmale, David
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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 (6/7/19 - 6/6/21)**. 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
Not applicable to this project.	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
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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 (6/7/19 - 6/6/21**) 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.

Valverde-Bogantes, E., Bolanos-Carriel, C., Hallen-Adams, H.E., McMaster, N., Schmale, D.G., and Wegulo, S. 2020. Aggressiveness and Deoxynivalenol Production of Nebraska Isolates of *Fusarium boothii* and *F. graminearum.* Plant Health Progress, 10.1094/PHP-01-20-0001-RS.
Status: Published
Acknowledgement of Federal Support: Yes

Jimenez-Sanchez, C., Wilson, N., McMaster, N., Gantulga, G., Freedman, B., Senger, R., and Schmale, D.G. 2020. A Mycotoxin Transporter (4D) from a Library of Deoxynivalenol-Tolerant Microorganisms. Toxicon X, 5, 100023.
Status: Published
Acknowledgement of Federal Support: Yes

Bolanos-Carriel, C., Wegulo, S., Hallen-Adams, H., Baenziger, P., Eskridge, K., Funnell-Harris, D., McMaster, N., and Schmale, D.G. 2020. Effects of field-applied fungicides, grain moisture, and time on deoxynivalenol during postharvest storage of winter wheat grain. Canadian Journal of Plant Science, 100(3): 304-313.
Status: Published
Acknowledgement of Federal Support: Yes

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

FY19-NCE FPR – USWBSI ADDENDUM
DON Service Labs – Quality Control (QC) Data

Note: What is being requested is the across lab quality control data (separate QC from Trilogy).

Insert below Quality Control Data/Results from the FY19-NCE Award Period (6/7/19 - 6/6/21):

During the performance period, 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.

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
	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

PI: Schmale, David
Project: Diagnostic Testing Services for Deoxynivalenol in the Eastern U.S.

Testing Period	Trilogy Sample	Trilogy Quant	Lab 1	Lab 2-1	Lab 2-2	Lab 3-1	Lab 3-2	Lab 4-1	Lab 4-2
20-Aug	Low	1.40	1.16	0.70	1.20	1.15	1.06	1.09	1.07
	Med	3.80	3.09	2.90	3.00	2.98	2.86	2.85	3.10
	High	8.60	6.74	8.70	7.60	6.82	6.11	6.49	6.26
20-Sep	Low	0.70	0.60	0.80	0.60	0.72	0.64	0.63	0.61
	Med	3.60	2.80	3.40	3.00	2.75	2.46	2.97	3.25
	High	9.30	8.20	8.50	8.10	7.39	7.23	6.72	6.73
20-Oct	Low	1.60	1.40	1.70	1.60	1.57	1.41	1.22	1.11
	Med	4.50	5.40	5.70	5.40	4.85	4.64	3.42	3.17
	High	8.60	7.80	8.80	7.90	7.84	7.32	6.85	6.91
20-Nov	Low	1.90	1.70	1.40	1.40	1.59	1.68	1.91	1.94
	Med	3.60	2.90	2.40	2.25	2.46	2.62	3.19	2.96
	High	8.60	7.50	7.20	6.30	6.13	6.24	7.09	6.56
20-Dec	Low	0.70	0.70	0.60	0.63	0.50	0.52	0.55	0.53
	Med	3.40	3.90	3.10	3.10	2.80	2.8	2.64	2.60
	High	8.60	7.50	7.10	6.60	6.16	6.28	6.40	6.26
21-Jan	Low	1.40	1.10	1.30	1.20	1.28	1.08	1.11	1.12
	Med	3.80	4.15	3.80	3.70	3.92	3.64	3.32	3.37
	High	11.00	9.75	8.90	8.60	7.96	7.88	8.07	8.45
21-Feb	Low	1.80	1.80	1.10	1.11	1.55	1.59	1.52	1.56
	Med	3.60	2.55	2.22	2.18	2.43	2.61	2.85	3.02
	High	8.60	8.33	5.10	5.39	6.84	6.65	6.82	6.26
21-Mar	Low	1.60	1.20	1.00	1.70	1.58	1.36	1.07	1.08
	Med	4.30	4.10	2.90	3.90	4.6	4.68	3.26	3.38
	High	8.60	6.30	5.30	6.40	7.00	7.48	6.50	6.79
21-Apr	Low	0.70	0.55	0.90	0.60	0.64	0.72	0.59	0.59
	Med	2.40	1.85	2.30	1.70	2.07	2.26	2.08	1.97
	High	8.60	6.25	7.40	6.00	6.65	6.94	6.48	6.33

b. QC data from internal checks of subsamples of grain lots from Trilogy in each GC/MS run (to test for consistency among GC/MS runs). In FY19, 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. In FY20, Trilogy sample 19-Aug-1 was measured 288 times, and determined to have an average DON concentration of 3.85 ppm with a standard error of the mean of 0.026.

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