

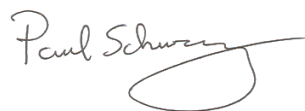
**USDA-ARS**  
**U.S. Wheat and Barley Scab Initiative**  
**FY17 Final Performance Report – NCE for FY18**  
**Due date: July 12, 2019**

**Cover Page**

<b>Principle Investigator (PI):</b>	Paul Schwarz
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<b>Fiscal Year:</b>	2017 (NCE for FY18)
<b>USDA-ARS Agreement ID:</b>	59-0206-4-015
<b>USDA-ARS Agreement Title:</b>	Evaluation of Barley and Malt for Don and Deoxynivalenol-3-Glucoside.
<b>FY17 USDA-ARS Award Amount:</b>	\$ 255,611
<b>Recipient Organization:</b>	North Dakota State University Office of Grant & Contract Accounting NDSU Dept 3130, PO Box 6050 Fargo, ND 58108-0650
<b>DUNS Number:</b>	80-388-2299
<b>EIN:</b>	45-6002439
<b>Recipient Identifying Number or Account Number:</b>	FAR0022048
<b>Project/Grant Reporting Period:</b>	5/5/18 - 5/4/19
<b>Reporting Period End Date:</b>	05/04/19

**USWBSI Individual Project(s)**

<b>USWBSI Research Category*</b>	<b>Project Title</b>	<b>ARS Award Amount</b>
FST	Evaluation of Barley and Malt for DON and Deoxynivalenol-3-Glucoside.	\$ 155,530
	<b>FY17 Total ARS Award Amount</b>	<b>\$ 255,611</b>



July 12, 2019

Principal Investigator

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

**1. What are the major goals and objectives of the 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?** *Address items 1-4) below for each goal or objective.*

1) major activities

Approximately 10,000 samples were analyzed for DON during the reporting period (exclusive of checks/standard curves=896). Eighteen researchers, in fourteen states were served. The majority of samples (7263) 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. An additional 652 samples were analyzed for DON-3-glucoside as part of two external research projects.

2) specific objectives: no objectives to report.

3) significant results:

Ninety-six percent of all samples submitted for 2018 were analyzed and results returned by May 4, 2019. No samples were refused for lack of capacity.

The laboratory cooperates with the Eastern Spring Barley Nursey (ESBN), which has a goal of evaluating malting barley varieties for production in eastern states. FHB can be a major obstacle to production in some regions. 275 samples from researchers in OH, MI, ME, MA, VT, PA, NY were tested for DON.

4) key outcomes or other achievements

The analysis of cooperator samples generally begins in August and is completed by May. 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.

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Food Safety graduate student, Pradeep Sarkate, has been developing a LC QTOF-MS method for the quantitation of the low concentrations of multiple *Fusarium* mycotoxins in barley and wheat. This method focuses on simplified sample extraction protocol such as dilute and shoot.

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

Two undergraduate students, two graduate students 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.

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

Data is provided directly to collaborating scientists. Information on DON, DON-3-glucoside and other trichothecenes in barley, malt and beer has been disseminated by presentations at conferences and webinars.

## **Training of Next Generation Scientists**

**Instructions:** Please answer the following questions as it pertains to the FY17-NCE 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 FY17-NCE 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 FY17-NCE period?**

No

**If yes, how many?**

- 3. Have any post docs who worked for you during the FY17-NCE 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 FY17-NCE period and were supported by funding from your USWBSI grant gone on to take positions with private ag-related companies or federal agencies?**

No

**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 FY17-NCE 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 FY17-NCE\_FPR-Instructions for detailed instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY17-NCE grant period. Only include citations for publications submitted or presentations given during your award period (5/5/18 - 5/4/19). If you did not have any publications or presentations, state 'Nothing to Report' directly above the Journal publications section.

**NOTE:** Directly below each reference/citation, you must indicate the Status (i.e. published, submitted, etc.) and whether acknowledgement of Federal support was indicated in publication/presentation. See example below for a poster presented at the FHB Forum:

Conley, E.J., and J.A. Anderson. 2018. Accuracy of Genome-Wide Prediction for Fusarium Head Blight Associated Traits in a Spring Wheat Breeding Program. In: Proceedings of the XXIV International Plant & Animal Genome Conference, San Diego, CA.

Status: Abstract Published and Poster Presented

Acknowledgement of Federal Support: YES (poster), NO (abstract)

### **Journal publications.**

Wan, J., Zhong, S., Schwarz, P., Chen, B., Rao, J. (2019). Physical properties, antifungal and mycotoxin inhibitory activities of five essential oil nanoemulsions: Impact of oil compositions and processing parameters. *FOOD CHEMISTRY*, 291: 199-206.

Status: Published

Acknowledgement of Federal Support: YES

Wu, D., Lu, J., Zhong, S., Schwarz, P., Chen, B., Rao, J. (2019). Influence of nonionic and ionic surfactants on the antifungal and mycotoxin inhibitory efficacy of cinnamon oil nanoemulsions. *FOOD & FUNCTION*, 10 (5): 2817-2827.

Status: Published

Acknowledgement of Federal Support: YES

Wan, J., Zhong, S., Schwarz, P., Chen, B., Rao, J. (2019). Enhancement of antifungal and mycotoxin inhibitory activities of food-grade thyme oil nanoemulsions with natural emulsifiers. *FOOD CONTROL*, 106.

Status: Published

Acknowledgement of Federal Support: YES

Wu, D., Wan, J., Lu, J., Wang, X., Zhong, S., Schwarz, P., Chen, B., Rao, J. (2018). Chitosan coatings on lecithin stabilized emulsions inhibit mycotoxin production by Fusarium pathogens. *FOOD CONTROL*, 92, 276-285.

Status: Published

Acknowledgement of Federal Support: YES

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Wan, J., Zhong, S., Schwarz, P., Chen, B., Rao, J. (2018). Influence of oil phase composition on the antifungal and mycotoxin inhibitory activity of clove oil nanoemulsions. *FOOD & FUNCTION*, 9(5), 2872-2882.

Status: Published

Acknowledgement of Federal Support: YES

Jin, Z., Gillespie, J., Barr, J., Wiersma, J. J., Sorrells, M. E., Zwinger, S., Gross, T., Cumming, J., Bergstrom, G. C., Brueggeman, R., Horsley, R. D., Schwarz, P. (2018). Malting of Fusarium Head Blight-Infected Rye (*Secale cereale*): Growth of *Fusarium graminearum*, Trichothecene Production, and the Impact on Malt Quality. *TOXINS*, 10(9).

Status: Published

Acknowledgement of Federal Support: YES

Jin, Z., Zhou, B., Gillespie, J., Gross, T., Barr, J., Simsek, S., Brueggeman, R., Schwarz, P. (2018). Production of deoxynivalenol (DON) and DON-3-glucoside during the malting of Fusarium infected hard red spring wheat. *FOOD CONTROL*, 85, 6-10.

Status: Published

Acknowledgement of Federal Support: YES

Baldwin, T., Islamovic, E., Klos, K., Schwarz, P., Gillespie, J., Hunter, S., Bregitzer, P. (2018). Silencing efficiency of dsRNA fragments targeting Fusarium graminearum TRI6 and patterns of small interfering RNA associated with reduced virulence and mycotoxin production. *PLOS ONE*, 13(8).

Status: Published

Acknowledgement of Federal Support: YES

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

None

### **Other publications, conference papers and presentations.**

#### Abstracts

Jin, Z., Solanku, S., Tang, R., Gillespie, J., Barr, J., Brueggeman, R. and Schwarz, P. Patterns of fungal distribution in Fusarium infected barley, rye and triticale grain and malt. Proceeding of the 2018 National Fusarium Head Blight Forum, St Louis, MO. December 2-4. Page 54.

Rao, J.J., Zhong, S.B., Schwarz, P., and Chen, B.C. Development of emulsion-based delivery systems for control of *Fusarium* growth and mycotoxins during food processing. 2018 Proceeding of the 2<sup>nd</sup> Mycokey International Conference, Wuhan China. September 16-18, 2018. Page. 187-188.

#### Oral presentations

(Schwarz, P). Impact of Plant Disease on Malting. Vermont Grain Growers Conference. Essex, VT. March 29, 2109. (invited speaker).

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Status: Presented

Acknowledgement of Federal Support: YES (in presentation)

(Schwarz, P). Impact of Disease on Malting Grain Quality. Craft Maltsters Conference. February 2, 2019. (invited speaker).

Status: Presented

Acknowledgement of Federal Support: YES (in presentation)

(Schwarz, P). Panel discussion with DON lab leaders. 2018 National FHB Forum. Sr Louis, MO. December 3, 2018.

Status: Presented

Acknowledgement of Federal Support: YES.

(Schwarz, P). Science meets practice: Joint effort to fight against mycotoxins – is it possible and what are the critical steps? 1<sup>st</sup> Mycokey Technical Workshop: Integrated preventive actions to avoid mycotoxins in malting and brewing. Helsinki, Finland. May 24, 2018 (invited presentation as part of panel discussion).

Status: Presented

Acknowledgement of Federal Support: YES (in presentation)

(Schwarz, P). Problems in malting and brewing with FHB infected barley. Oil crops research institute Chinese Academy of Agricultural Sciences. Wuhan, China. September 18, 2018 (invited presentation).

Status: Presented

Acknowledgement of Federal Support: NO

(Jin, Z). Malting quality of Fusarium head blight–infected rye (*Secale cereale*). Brewing Summit (ASBC and MBAA joint meeting). San Diego, CA. August 12, 2018.

Status: Presented

Acknowledgement of Federal Support: YES (in presentation)



**PI:** Schwarz, Paul

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**FY17-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 FY17-NCE Award Period (5/5/18 - 5/4/19):**

The variance with internal check samples shown below is approximately the same as seen in recent years. Values should ideally be in the teens or lower, with the expectation of checks with very low DON values. When the mean is small, even minor variations in results result in higher CV's.

However, it should be noted that the below values are from 3 instruments (4 ECD and 1 MS detector). If the results are calculated on an instrument or detector basis, the magnitude of the CV's decreases.

Std. ID		No. of times analyzed		Average DON ppm		CV
						%
7	malt	89		4.04		20.21
12	barley	88		2.28		26.54
15	malt	42		17.87		19.59
17	barley	114		0.56		31.45
20	malt	81		2.18		24.63
22	barley	8		0.01		nd
29	malt	41		18.05		16.82
31	malt	48		10.72		18.54
44/45	barley	89		23.07		20.42
Mix	barley	98		21.42		18.92
corn	corn	95		4.65		20.74
Myco-20	standard	103		0.73		35.98
Myco-200	standard	103		6.72		22.40