USDA-ARS
U.S. Wheat and Barley Scab Initiative
FY18 Performance Report
Due date: July 12, 2019

Cover Page

<table>
<thead>
<tr>
<th>Principle Investigator (PI):</th>
<th>Paul Schwarz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Institution:</td>
<td>North Dakota State University</td>
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<tr>
<td>E-mail:</td>
<td><a href="mailto:Paul.Schwarz@ndsu.edu">Paul.Schwarz@ndsu.edu</a></td>
</tr>
<tr>
<td>Phone:</td>
<td>701-231-7732</td>
</tr>
<tr>
<td>Fiscal Year:</td>
<td>2018</td>
</tr>
<tr>
<td>USDA-ARS Agreement ID:</td>
<td>59-0206-8-201</td>
</tr>
<tr>
<td>USDA-ARS Agreement Title:</td>
<td>Evaluation of Barley and Malt for DON and Deoxynivalenol-3-Glucoside.</td>
</tr>
<tr>
<td>FY18 USDA-ARS Award Amount:</td>
<td>$164,306</td>
</tr>
<tr>
<td>Recipient Organization:</td>
<td>North Dakota State University</td>
</tr>
<tr>
<td></td>
<td>Office of Grant &amp; Contract Accounting</td>
</tr>
<tr>
<td></td>
<td>NDSU Dept 3130, PO Box 6050</td>
</tr>
<tr>
<td></td>
<td>Fargo, ND 58108-0650</td>
</tr>
<tr>
<td>DUNS Number:</td>
<td>80-388-2299</td>
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<tr>
<td>EIN:</td>
<td>45-6002439</td>
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<td>Recipient Identifying Number or Account Number:</td>
<td>FAR0028542</td>
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<tr>
<td>Project/Grant Reporting Period:</td>
<td>5/5/18 - 5/4/19</td>
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<td>Reporting Period End Date:</td>
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USWBSI Individual Project(s)

<table>
<thead>
<tr>
<th>USWBSI Research Category*</th>
<th>Project Title</th>
<th>ARS Award Amount</th>
</tr>
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<tbody>
<tr>
<td>FST</td>
<td>Evaluation of Barley and Malt for DON and Deoxynivalenol-3-Glucoside.</td>
<td>$164,306</td>
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<td>FY18 Total ARS Award Amount</td>
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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
  NWG – Northern Soft Winter Wheat Region
  SWG – 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 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.
Food Safety graduate student, Pradeep Sarkate, has been developing a LC QTOF-MS method for the quantitation of the low concentrations of multiple \textit{Fusarium} mycotoxins in barley and wheat. This method focuses on simplified sample extraction protocol such as dilute and shoot.

3. \textbf{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. \textbf{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 FY18 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 FY18 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 FY18 award period?
   No
   If yes, how many?

3. Have any post docs who worked for you during the FY18 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 FY18 award 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?
**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 FY18 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.

<table>
<thead>
<tr>
<th>Name of Germplasm/Cultivar</th>
<th>Grain Class</th>
<th>FHB Resistance (S, MS, MR, R, where R represents your most resistant check)</th>
<th>FHB Rating (0-9)</th>
<th>Year Released</th>
</tr>
</thead>
<tbody>
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</tbody>
</table>

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 FY18-FPR_Instructions for detailed instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY18 grant. 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 presentation with an abstract:

Status: Abstract Published and Poster Presented
Acknowledgement of Federal Support: YES (poster), NO (abstract)

Journal publications.

Status: Published
Acknowledgement of Federal Support: YES

Status: Published
Acknowledgement of Federal Support: YES

Status: Published
Acknowledgement of Federal Support: YES

Status: Published
Acknowledgement of Federal Support: YES

(Form – PR18)

Status: Published
Acknowledgement of Federal Support: YES


Status: Published
Acknowledgement of Federal Support: YES


Status: Published
Acknowledgement of Federal Support: YES


Status: Published
Acknowledgement of Federal Support: YES

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

none

Other publications, conference papers and presentations.


Status: Presented
Acknowledgement of Federal Support: YES (in presentation)

Status: Presented
Acknowledgement of Federal Support: YES (in presentation)

Status: Presented
Acknowledgement of Federal Support: YES.

Oral presentation (Schwarz, P). Science meets practice: Joint effort to fight against mycotoxins – is it possible and what are the critical steps? 1st 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)

Status: Presented
Acknowledgement of Federal Support: NO

Status: Presented
Acknowledgement of Federal Support: YES (in presentation)
Note: What is being requested is the across lab quality control data (separate QC from Trilogy).

Insert below Quality Control Data/Results from the FY18 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 exception 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.

<table>
<thead>
<tr>
<th>Std. ID</th>
<th>No. of times analyzed</th>
<th>Average DON ppm</th>
<th>CV %</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>malt</td>
<td>89</td>
<td>4.04</td>
</tr>
<tr>
<td>12</td>
<td>barley</td>
<td>88</td>
<td>2.28</td>
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<tr>
<td>15</td>
<td>malt</td>
<td>42</td>
<td>17.87</td>
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<tr>
<td>17</td>
<td>barley</td>
<td>114</td>
<td>0.56</td>
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<tr>
<td>20</td>
<td>malt</td>
<td>81</td>
<td>2.18</td>
</tr>
<tr>
<td>22</td>
<td>barley</td>
<td>8</td>
<td>0.01</td>
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<tr>
<td>29</td>
<td>malt</td>
<td>41</td>
<td>18.05</td>
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<tr>
<td>31</td>
<td>malt</td>
<td>48</td>
<td>10.72</td>
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<tr>
<td>44/45</td>
<td>barley</td>
<td>89</td>
<td>23.07</td>
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<tr>
<td>Mix</td>
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<td>98</td>
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<td>corn</td>
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<td>95</td>
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<td>Myco-20</td>
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<td>103</td>
<td>6.72</td>
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