

**USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY14 Final Performance Report
July 15, 2015**

Cover Page

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Fiscal Year:	FY14
USDA-ARS Agreement ID:	59-0206-4-015
USDA-ARS Agreement Title:	Evaluation of Barley and Malt for Don and Deoxinivalenol-3-Glucoside.
FY14 USDA-ARS Award Amount:	\$ 153,045

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
FSTU	Malting Barley Deoxynivalenol Diagnostic Services.	\$ 137,634
FSTU	Formation of Deoxynivalenol-3-Glucoside during Malting.	\$ 15,411
	FY14 Total ARS Award Amount	\$ 153,045



July 15, 2015

Principal Investigator

Date

* MGMT – FHB Management

FSTU – Food Safety, Toxicology, & Utilization of Mycotoxin-contaminated Grain

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

WES-CP – Western 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: *Malting Barley Deoxynivalenol Diagnostic Services.*

1. What major problem or issue is being resolved relevant to Fusarium head blight (scab) and how are you resolving it?

Mycotoxin analyses are essential for most researchers working on FHB of cereals. However, in barley DON is a major economic factor, and new varieties must display increased resistance to DON accumulation as well as to FHB. Screening barley lines for DON is requisite for any breeding program intending to develop varieties for the upper Midwestern and Eastern USA. DON analytical services are primarily provided to three barley varietal developmental programs. These breeding programs stated a need for the analysis of approximately 12,000 samples in FY14. In total, seven collaborating scientists were served. The major issue is to provide DON analytical services in a cost effective, timely and accurate manner. Funds provided by the USWBSI have allowed us to hire additional personnel and to subsidize the cost of analysis.

2. List the most important accomplishments and their impact (i.e. how are they being used) to minimize the threat of Fusarium Head Blight or to reduce mycotoxins. Complete both sections; repeat sections for each major accomplishment:

Accomplishment: A total of 12,854 samples were analyzed for DON from May 2014 to June 2015 (plus 925 check samples = 13,779). Approximately 55% of these samples were from the NDSU, University of Minnesota and Busch Agricultural Resources barley breeding programs. Approximately 39% of samples were from NDSU barley pathology. The remainders of samples were for Food Safety research and cooperators in extension

Impact: This project provides essential support to all barley breeding programs working on the development of FHB-resistant varieties for the Midwestern USA. The occurrence of FHB and DON is a primary factor in the dramatic decrease in barley acreage that has been observed over the past 20 years.

Project 2: *Formation of Deoxynivalenol-3-Glucoside during Malting.*

1. What major problem or issue is being resolved relevant to Fusarium head blight (scab) and how are you resolving it?

DON is the predominate mycotoxin produced by *Fusarium graminearum*, but it has become increasingly clear that a significant amount of the DON may be present in conjugated form, such as DON-3-glucoside (DON3G). Wheat and barley have been shown to have the ability to detoxify deoxynivalenol (DON) by forming glucosides. The presence of these DON-glucosides, or bound DON in barley and wheat are a cause for concern, as by definition, bound DON is that which escapes detection by the routine analytical methods. The presence of DON3G has significance to food safety, processing and breeding for FHB resistance. Research efforts have focused on the formation of DON3G during malting.

2. List the most important accomplishments and their impact (i.e. how are they being used) to minimize the threat of Fusarium Head Blight or to reduce mycotoxins. Complete both sections; repeat sections for each major accomplishment:

Accomplishment: Barley and wheat grain and malt samples (N≈250) were analyzed for DON and DON3G. DON3G was present at relatively low levels in unmalted grains, accounting for less than 10 mol% of the DON. However, levels of DON3G increased dramatically during malting and DON3G was sometimes several-fold higher than the DON. It is assumed that UDP-glucosyl transferases in the grain catalyze the conjugation during seed germination.

Impact: The finding that levels of DON3G can be very high in malt will be of importance to the malting and brewing industries. Evidence to date, suggests that DON3G is less toxic than DON, so there is not an immediate need for testing. However, the findings are still relevant, as it had previously been assumed that DON was rinsed from the grain during malting. The finding that DON3G occurs in wheat and rye malts will also be of interest to the growing craft industry, as these grains are commonly used in malting.

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY14 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 FY14 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 FY14 award period?**

NO

If yes, how many?

- 3. Have any post docs who worked for you during the FY14 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 FY14 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?

FY14 (approx. May 14 – May 15)

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Include below a list of all germplasm or cultivars released with full or partial support of the USWBSI during the FY14 award period. List the release notice or publication. Briefly describe the level of FHB resistance. *If not applicable because your grant did NOT include any VDHR-related projects, enter N/A below.*

N/A

Include below a list of the publications, presentations, peer-reviewed articles, and non-peer reviewed articles written about your work that resulted from all of the projects included in the FY14 grant. Please reference each item using an accepted journal format. If you need more space, continue the list on the next page.

Schwarz, P. B. Qian, S. Y., Zhou, B., Xu, Y., Barr, J. M., Horsley, R. D., Gillespie, J.
Occurrence of deoxynivalenol-3-glucoside on barley from the upper Midwestern United States.
J. Am. Soc. Brew. Chem. 72(3):208-213, 2014.

PI: Schwarz, Paul

Project: Malting Barley Deoxynivalenol Diagnostic Services.

**FY14 FPR – USWBSI ADDENDUM
DON Service Labs – Quality Control Data**

Insert below Quality Control Data/Results from the FY14 Award Period (approx. May 2014-May 2015):

Barley check samples are included with each set of analysis. On average three to four checks are included for each 50 samples. Significant deviation from the expected check values, is a used as a cue to recheck or possibly repeat the set of analyses. The values presented below are from for separate detectors on two gas chromatographs

2014-2014 DO5

Std ID	No. of times analyzed	Average value DON (mg/kg)	CV %
1	244	8.20	14.79
2	166	12.81	9.92
3	72	13.39	10.00
4	16	2.42	9.44
5	282	17.22	7.57
6	118	0.15	18.73
	Total= 898		