USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY12 Final Performance Report
July 16, 2013

Cover Page

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Fiscal Year:	FY12
USDA-ARS Agreement ID:	59-0206-9-068
USDA-ARS Agreement Title:	Determination and Characterization of Deoxynivalenol in Barley.
FY12 USDA-ARS Award Amount:	$ 129,716[*]

USWBSI Individual Project(s)

USWBSI Research Category[**]	**Project Title**	**ARS Award Amount**
FSTU-S	Malting Barley Deoxynivalenol Diagnostic Services.	$ 129,716
	Total ARS Award Amount	**$ 129,716**

Principal Investigator Date

[*] Partial funding for this research is under ARS agreement # 59-0206-9-062

[**] MGMT – FHB Management
FSTU – Food Safety, Toxicology, & Utilization of Mycotoxin-contaminated Grain
GDER – Gene Discovery & Engineering Resistance
PBG – Pathogen Biology & Genetics
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: *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 USA. DON analytical services are primarily provided to three barley varietal developmental programs. These breeding programs stated a need for the analysis of approximately 11,000 samples in FY12. In total, six 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.

Research on bound DON (DON-3-glucoside) is important to efforts on food safety and breeding for FHB resistance. 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.

2. List the most important accomplishment and its impact (i.e. how is it 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 9343 samples were analyzed from May 2012 to June 2013. Seventy-five percent of these samples were from the NDSU, University of Minnesota and Busch Agricultural Resources barley breeding programs. Approximately 15% of samples were from NDSU barley pathology.

Barley samples (n=250) were analyzed for DON-3-glucoside using HPLC QTOF MS/MS Levels DON3G in commercial barley samples were found to range from non-detectable to 3.1 mg/kg. DON-3-G was generally present at levels representing <15 mol% of the DON. A small number of samples were found to have DON-3-G in excess of DON, but these were close to the level of detection. However, DON-3-G was detected in laboratory malts at levels up to 65 mg/kg. DON-3-G, on average, increased 48-fold during malting, and was often present at levels in excess of DON.

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

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 grant. Please reference each item using an accepted journal format. If you need more space, continue the list on the next page.

Presentations:

Schwarz, P. Quality Assurance Issues in DON Testing. 2012 National Fusarium Head Blight Forum. Orlando, Florida. December 4, 2012.

Schwarz, P. Levels of Deoxynivalenol-3-Glucoside in Fusarium-Infected Barley. The 4th International Symposium on Fusarium Head Blight. Nanjing, China. August 26, 2012.

PI: Schwarz, Paul
Project: Malting Barley Deoxynivalenol Diagnostic Services.

FY12 FPR – USWBSI ADDENDUM
DON Service Labs – Quality Control Data

Insert below Quality Control Data/Results from the FY12 Award Period (May 2012-May 2013):

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 average CV of the checks was approximately 23.6%, which represents a decrease in repeatability from the previous year (18%). The highest CV (37.6%) was for a check sample with very low DON, which is typical of samples with very low means. Laboratory staff have been instructed to evaluate all procedures for the source(s) of error. The promary goal for 2014 is to significantly improve repatability in the laboratory.

Standard ID	No. of times analyzed	Average value DON (mg/kg)	CV (%)
1	92	2.20	27.3
2	93	7.46	21.8
3	148	14.01	21.2
4	57	4.78	23.5
5	51	1.45	19.5
6	221	13.97	21.4
7	91	0.25	37.6
8	38	24.75	12.7
Total	791		