USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY11 Final Performance Report
One-Year No Cost Extension (NCE) through FY12
July 16, 2013

Cover Page

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Fiscal Year:	FY11 (NCE for FY12)
USDA-ARS Agreement ID:	59-0206-1-111
USDA-ARS Agreement Title:	Deoxynivalenol: Human Metabolism of Key Metabolites and Toxicity Predictors.
FY11 USDA-ARS Award Amount:	$ 24,390

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
FSTU	Deoxynivalenol: Human Metabolism of Key Metabolites and Toxicity Predictors.	$ 24,390
	Total ARS Award Amount	**$ 24,390**

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Principal Investigator Date

* 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: *Deoxynivalenol: Human Metabolism of Key Metabolites and Toxicity Predictors.*

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

   Deoxynivalenol metabolism to less toxic forms may occur in the plant by glucosylation, in animals and humans by de-epoxidation, and by glucuronidation. It is proposed that deoxynivalenol-3-glucoside (D3G) will not be taken up by the intestine until it is deglucosylated by gut bacteria in the lower intestine, at which point, it could also be de-epoxidated in individuals who have the gut bacteria capable of doing this. We are attempting to further clarify the metabolism, uptake and toxicity of D3G in Caco-2 cells, a model of the human intestine, and to determine the metabolism of D3G in mouse cecal contents from conventional and Altered Schaedler Flora (ASF) mice. The ASF mice have a defined simplified set of gut bacteria (8 bacterial species) that permit healthy function of the intestine. If ASF mice can deglucosylate and deepoxidate D3G, this will facilitate identification of bacterial genes and enzymes responsible for these reactions. If ASF mice cannot deglucosylate and deepoxidate D3G, these mice can serve as a model to probe the mechanisms of toxicity of DON in comparison with conventional mice.

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:
   synthesis of D3G by chemical means

   Impact:
   Once the synthesized D3G is fully purified, this can be used in the Caco-2 and cecal content studies to understand D3G metabolism.

   Accomplishment:
   synthesis of D3G by biochemical means, in progress

   Impact:
   Once the enzymatically synthesis of D3G is accomplished (we are attempting this with collaboration of Dr. Olga Zabotina, ISU, who is an expert on UDP-glucosyltransferases (UDPGlucoT) in plants; we have cloned a plant UDPGlucoT into E. coli, and are preparing cell extracts for enzymatic reaction), this can be used in the Caco-2 and cecal content studies to understand D3G metabolism. This technique will also allow testing of a number of other plant UDP-GlucoTs for their activity to form D3G, which could be used for genetic engineering of high D3G-producing plants.

   Accomplishment:
   Analysis of D3G metabolism in Caco-2 cells and mouse cecal contents, in progress

Impact:

This analysis will clarify the toxicity of D3G to intestinal cells, the ability of intestinal cells to metabolize and take up D3G, and also determine the extent to which D3G can be converted to DON or de-epoxyDON in a proposed mouse model for DON toxicity studies. This will lay the foundation for development of probiotic bacteria that are capable of de-epoxidating DON in humans, a necessary companion of engineering plants that can readily convert DON to D3G.

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.

None, one anticipated by December 2013.