USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY08 Final Performance Report (approx. May 08 – April 09)
July 15, 2009

Cover Page

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Fiscal Year:	2008
USDA-ARS Agreement ID:	59-0790-7-078
USDA-ARS Agreement Title:	Contribution of Local Inoculum Sources to Regional Atmospheric Populations of G. zeae.
FY08 USDA-ARS Award Amount:	$ 57,900

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Adjusted Award Amount
FSTU	Diagnostic Testing Services for Deoxynivalenol in the Eastern United States.	$46,501
MGMT	Relative Contribution of within-Field Inoculum to FHB Infection.	$ 11,399
	Total Award Amount	**$ 57,900**

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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
HWW-CP – Hard Winter Wheat Coordinated Project
VDHR – Variety Development & Uniform Nurseries – Sub categories are below:
SPR – Spring Wheat Region
NWW – Northern Winter Wheat Region
SWW – Southern Sinter Wheat Region

Project 1: *Diagnostic Testing Services for Deoxynivalenol in the Eastern United States.*

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

Concerns about the mycotoxin deoxynivalenol (DON) continue to mount, and there is a growing need to develop and expand USWBSI diagnostic laboratories for mycotoxins throughout the United States. DON testing services are vital to the development of new varieties of wheat and barley with reduced mycotoxin potential and are necessary to identify and/or exclude appropriate strategies for managing FHB. In FY08, the Schmale Lab at Virginia Polytechnic Institute and State University launched a new regional diagnostic laboratory for mycotoxins in the eastern United States. DON was detected and quantified using a GC/MS. FY08 DON testing services in the Schmale Lab provided analytical services necessary to develop new cultivars of wheat and barley with reduced potential for DON contamination and to improve chemical and cultural practices necessary to reduce DON contamination in wheat and barley.

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:

DON was quantified from a total of 5,428 samples of wheat and barley from six USWBSI investigators (Bergstrom, Cowger, Griffey, and Grybauskas, Adhikari, and Trail) in six states (New York, North Carolina, Virginia, Maryland, North Dakota, and Michigan). Most of the samples received for testing in FY08 were 100g kernel lots from FHB field trials, but some were ground 5-25g samples from greenhouse experiments. Extraction, clean-up, and quantification of DON were conducted following standard protocols using a GC/MS. DON testing services were managed by two talented scientists (Patricia Gundrum and Diane Reaver) and four dedicated undergraduates (D'Lourdes Cuadra, Shannon Grosse, Tamara Fetters, and Will Russell).

State	Institution	USWBSI Investigator	Estimated for FY08	Samples tested in FY08	Status
North Carolina	NCSU	Christina Cowger	904	1,145	Complete
Virginia	VPI & SU	Carl Griffey	3,500	3,329	Complete
New York	Cornell	Gary Bergstrom	1,000	433	Complete
Maryland	UMD	Arv Grybauskas	None	444	Complete
Multiple	Multiple	Tika Adhikari, Frances Trail	None	77	Ongoing
			5,404	5,428	

Impact:

The ultimate goals of this work were to provide analytical services necessary to develop new cultivars of wheat and barley with reduced potential for DON contamination and to facilitate DON testing that will improve chemical and cultural practices necessary to reduce DON contamination in wheat and barley. The availability of these new testing services continues to expedite the acquisition and delivery of data from DON analyses and ensures increased uniformity, quality, and sample capacity for stakeholders in the eastern United States. The project addressed the FY08 FSTU priority to 'provide analytical support for DON/trichothecene quantification for the Initiative's stakeholders'. Our work continues to expand and enhance the mycotoxin testing capacity of the USWBSI, helping to minimize the threat of FHB to producers, processors, and consumers of wheat and barley. Schmale met with millers, producers, and researchers in the state of Virginia in FY08 to discuss new diagnostic technologies for DON and related management strategies for FHB, an effort aligned with the FY08 FSTU priority to 'provide requisite information on DON/trichothecene safety issues to producers, millers, researchers, risk assessors, and regulators'.

Project 2: *Relative Contribution of within-Field Inoculum to FHB Infection.*

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

There are aspects yet to be discovered about the origin and nature of inocula for FHB in winter wheat. Viable spores of *G. zeae* may travel over great distances from their source, but the attribution of local and more distant sources of inocula to FHB epidemics continues to challenge epidemiologists. Knowledge of the relative contribution of within-field inoculum sources of *G. zeae* to infection of local wheat is important for developing and/or excluding strategies for managing FHB. The ultimate goal of our work is to improve management strategies for FHB based on an increased understanding of potential inoculum sources of *G. zeae*. Our central hypothesis is that both local (within-field) and regional (outside-of-field) inocula contribute to FHB in winter wheat. To test this hypothesis, unique genotypes of *G. zeae* were released in small experimental plots in 8 wheat and barley fields in two states (NY and VA) over two calendar years (2007 and 2008). AFLPs were used to track the released clones in heterogeneous populations of the fungus recovered from infected plants.

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 three sections (repeat sections for each major accomplishment):

Accomplishment:

Our unique release-recapture study provided direct (genetic) evidence of the relative contribution of local inoculum to local infection of wheat heads by *G. zeae*. Locally released clones as well as background inocula contributed to FHB. Released clones were recovered at their highest frequencies within source plots, at greatly reduced frequencies at 10 and 20 feet from source plots, and only occasionally from non-inoculated sites. Spike infection percentages approached background levels within 10-20 feet of clonal inoculum sources for both fields. FHB symptom incidences, infected spike incidences, and DON levels (NY fields only) fell off sharply to background levels within 10-20 feet of clonal sources in the fields under study in 2008. Background sources of *G. zeae* were still significant contributors to FHB epidemics, despite strong local sources of inoculum directly beneath harvested spikes.

Impact:

Improved integrated management strategies for FHB may result from a more complete understanding of both local (within-field) and more distant (atmospheric) sources of inoculum of *G. zeae*. Our findings suggest that debris management (e.g., tillage) in single fields may not result in sufficiently large reductions in FHB or DON.

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.

Fetters, T.L., Griffey, G.C., and Schmale, D.G. 2008. Reducing the cost of deoxynivalenol testing services in wheat and barley: Moving toward a smaller grain sample. Page 96 in Proc. 2008 National Head Blight Forum, Indianapolis, IN.

Gundrum, P.G., Reaver, D.M., Cuadra, D., Grosse, S., Russell, W., Fetters, T., Griffey, C.G., Cowger, C., Bergstrom, G.C., Grybauskas, A., and Schmale, D.G. 2008. FY08 Deoxynivalenol (DON) testing services at Virginia Polytechnic Institute and State University. Page 97 in Proc. 2008 National Head Blight Forum, Indianapolis, IN.

Khatibi, P.A., McCormick, S., Alexander, N., and Schmale, D.G. Bioprospecting for *TRI101* in *Fusarium*: Searching for a better enzyme to detoxify deoxynivalenol. Page 112 in Proc. 2008 National Head Blight Forum, Indianapolis, IN.

Keller, M.D., Schmale, D.G., Waxman, K.D., and Bergstrom, G.C. 2008. Released clones and background inocula contributed to Fusarium head blight in winter cereals in New York and Virginia. Page 37 in Proc. 2008 National Head Blight Forum, Indianapolis, IN.

Scoza, L.B, Astolfi, P., Reartes, D.S., Schmale, D.G. III, Moraes, M.G., and Del Ponte, E.M. 2009. Trichothecene mycotoxin genotypes of Fusarium graminearum sensu stricto and Fusarium meridionale in wheat from southern Brazil. Plant Pathology 58: 344–351.

If your FY08 USDA-ARS Grant contained a VDHR-related project, include below a list all germplasm or cultivars released with full or partial support of the USWBSI. List the release notice or publication. Briefly describe the level of FHB resistance. If this is not applicable (i.e. no VDHR-related project) to your FY08 grant, please insert 'Not Applicable' below.

Not applicable.

PI: Schmale, David
Project: Diagnostic Testing Services for Deoxynivalenol in the Eastern United States.

FY08 FPR – USWBSI ADDENDUM
DON Service Labs – Quality Control Data

Insert below Quality Control Data/Results from the FY08 Award Period (May 08-May 09):

Quality control data is listed here from a blind test including twelve different samples processed in three USWBSI labs (QC1). All of our GC/MS runs include DON standards as controls.

QC 1			
Line/Sample	**DON (ppm) Lab 1**	**DON (ppm) Lab 2**	**DON (ppm) VT Lab**
Doyce	2.4	1.7	1.8
H-585	0.8	0.4	0.4
VA01H-125	0.5	0.1	0.2
VA01H-68	1.1	0.7	0.6
VA03H-100	1.3	0.6	1.1
VA03H-58	0.5	0.4	0.6
VA03H-61	1.6	0.8	0.8
VA03H-64	1.1	0.6	0.4
VA04H-111	0.9	0.7	0.6
VA04H-25	0.5	0.5	0.5
VA04H-53	2.2	0.9	1.0
VA04H-59	1.8	1.9	1.4