

**USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY06 Final Performance Report (approx. May 06 – April 07)
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Cover Page

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Fiscal Year:	2006
USDA-ARS Agreement ID:	59-0790-4-134
USDA-ARS Agreement Title:	Validating a Rapid Immunological Test for <i>Fusarium graminearum</i> .
FY06 ARS Award Amount:	\$ 14,343

USWBSI Individual Project(s)

USWBSI Research Area *	Project Title	ARS Award Amount
VDUN	ELISA-based F. graminearum Phenotyping for Grain Breeding and Genetic Programs.	\$ 14,343
	Total Award Amount	\$ 14,343


7-16-07

 Principal Investigator Date

* CBCC – Chemical, Biological & Cultural Control
 EEDF – Etiology, Epidemiology & Disease Forecasting
 FSTU – Food Safety, Toxicology, & Utilization of Mycotoxin-contaminated Grain
 GET – Genetic Engineering & Transformation
 HGR – Host Genetics Resources
 HGG – Host Genetics & Genomics
 PGG – Pathogen Genetics & Genomics
 VDUN – Variety Development & Uniform Nurseries

Project 1: *ELISA-based F. graminearum Phenotyping for Grain Breeding and Genetic Programs.*

1. What major problem or issue is being resolved and how are you resolving it?

Evaluating Fusarium head blight (FHB) involves inoculating barley (*Hordeum vulgare* L.) with *Fusarium graminearum* Schwabe [teleomorph *Gibberella zeae* (Schwein.) Petch] followed by visual observation of disease and analysis for deoxynivalenol (DON). However, disease symptoms and DON are not always correlated because both are affected by environmental variables. An ELISA, detection system was developed and compared to DON and visual assessment of FHB in a barley doubled-haploid mapping population and the North American barley scab evaluation nursery (NABSEN). All methods of evaluation had genotype x environment interactions typical of FHB experiments, but the ELISA had lower experiment-wise coefficients of variability. Visual symptomology was not correlated with abundance of *Fusarium* (ELISA) in grain nor the DON content after harvest. Samples that were low in ELISA were also low in DON but not all samples low in DON had low *Fusarium* abundance. We found that temperature and osmotic potential affect DON production by *Fusarium*. Neither temperature, osmotic potential, nor *Fusarium* species had an effect on abundance of antigen in mycelia of the fungi when grown in vitro.

2. List the most important accomplishment and its impact (how is it being used?).

Complete all three sections (repeat sections for each major accomplishment):

Accomplishment: Evaluating Fusarium head blight (FHB) involves inoculating barley (*Hordeum vulgare* L.) with *Fusarium graminearum* Schwabe [teleomorph *Gibberella zeae* (Schwein.) Petch] followed by visual observation of disease and analysis for deoxynivalenol (DON). However, disease symptoms and DON are not always correlated because both are affected by environmental variables. An ELISA, detection system was developed and compared to DON and visual assessment of FHB in a barley doubled-haploid mapping population and the North American barley scab evaluation nursery (NABSEN). All methods of evaluation had genotype x environment interactions typical of FHB experiments, but the ELISA had lower experiment-wise coefficients of variability. Visual symptomology was not correlated with abundance of *Fusarium* (ELISA) in grain nor the DON content after harvest. Samples that were low in ELISA were also low in DON but not all samples low in DON had low *Fusarium* abundance. We found that temperature and osmotic potential affect DON production by *Fusarium*. Neither temperature, osmotic potential, nor *Fusarium* species had an effect on abundance of antigen in mycelia of the fungi when grown in vitro.

Impact: ELISA is a more robust estimate of fungal infestation than FHB or DON individually, and is a practical alternative to dual testing for FHB and DON in plant breeding and genetic programs. Increased precision and accuracy of fungal infestation will increase the effectiveness of plant breeding programs breeding for resistance to *Fusarium*. The ELISA protocol is simple and robust and can, therefore, be expanded for use in disease etiology, forecasting, and management.

As a result of that accomplishment, what does your particular clientele, the scientific community, and agriculture as a whole have now that they didn't have before?

The scientific community now has an efficient system for *Fusarium* screening. Antibody-producing cell lines are being maintained and can be easily commercialized if warranted by demand.

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.

Journal articles

Hill, N.S., P. Schwarz, L.S. Dahleen, S.M. Neate, R. Horsley, A.E. Glenn, and K. O'Donnell. 2006. ELISA analysis for *Fusarium* in Barley: Development of methodology and Field Assessment. *Crop Science* 2636-2642.

N.S. Hill, S.M. Neate, B. Cooper, R. Horsley, P. Schwarz, L.S. Dahleen, K.P. Smith, K. O'Donnell, J. Reeves. 200X. ELISA analysis for *Fusarium* in barley: Application in field nurseries. *Crop Science* (submitted)

N.S. Hill, S. Neate, B. Cooper, R. Horsley, P. Schwarz, L.S. Dahleen, K.P. Smith, R. Dill-Macky, K. O'Donnell, J. Reeves. Is There Value in Quantifying *Fusarium* Mycelium for Breeding FHB Resistance? In. S.M. Canty, A. Clark, and D. Van Sanford (ed). Proceedings of the 2006 National *Fusarium* Head Blight Forum; 10-12 December, 2006; Durham, NC. East Lansing, MI p. 98.

D.B. Cooper, L. Skoglund, and N.S. Hill. Complementary screening techniques for selection of barley breeding lines with improved reaction to *Fusarium* head blight. In. S.M. Canty, A. Clark, and D. Van Sanford (ed). Proceedings of the 2006 National *Fusarium* Head Blight Forum; 10-12 December, 2006; Durham, NC. East Lansing, MI p. 93.

N.S. Hill, S. Neate, B. Cooper, R. Horsley, P. Schwarz, L.S. Dahleen, K.P. Smith, R. Dill-Macky, K. O'Donnell, J. Reeves. What is the Value in Quantifying *Fusarium* Mycelium Rather than DON for Breeding FHB Resistance? *Fusarium and aspergillus elimination symposium*, Ft. Worth, TX.

N.S. Hill, S. Neate, B. Cooper, R. Horsley, P. Schwarz, L.S. Dahleen, K.P. Smith, R. Dill-Macky, K. O'Donnell, J. Reeves. ELISA analysis for *Fusarium* in barley: Application in field nurseries. *Agronomy Abstracts*. p. 345. American Society of Agronomy. Madison, WI.