USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY10 Final Performance Report
No Cost Extension (6 month)
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Cover Page

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Fiscal Year:	FY10
USDA-ARS Agreement ID:	59-0790-7-074
USDA-ARS Agreement Title:	Heterogeneity & Toxigenic Potential of U.S. *Fusarium graminearum*.
FY10 USDA-ARS Award Amount:	$ 31,220

USWBSI Individual Project(s)

USWBSI Research Category*	**Project Title**	**ARS Award Amount**
PBG	Traits of Biological Relevance in U.S. Populations of *Fusarium graminearum*.	$ 31,220
	Total ARS Award Amount	**$ 31,220**

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: *Traits of Biological Relevance in U.S. Populations of Fusarium graminearum.*

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

   The long term objectives of this project were to identify, and differentiate, genetically coherent populations of the Fusarium Head Blight (FHB) pathogens of small grain cereals, with special focus on the U.S.. This work to examine whether the genetic diversity in the populations of the FHB pathogen may help determine strategies for the deployment of FHB-resistant cultivars of wheat and barley and/or the use of other management tools, including the use of fungicides.

   Specifically in this project we focused on genetically distinct populations of *F. graminearum* in the Upper Midwest (emergent populations) and on nivalenol-producing populations of *F. graminaerum* found nearly exclusively in the Southern U.S.. Our specific goals were 1) to elucidate the genetic structure and molecular characteristics of these populations and to determine their distribution and prevalence in space and time, 2) to determine their phenotypic characteristics, with special focus on aggressiveness and toxigenic potential, and 3) to determine the impact and interaction of the various populations on FHB control strategies including the use of host resistance and fungicides.

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:

   In addition to a widespread and predominant midwestern 15ADON population (MW15ADON population) of *F. graminearum*, we have identified, molecularly and phenotypically characterized, and geographically and temporally mapped, *F. graminearum* populations that are genetically distinct from the MW15ADON population. Genetically distinct populations were previously identified in Minnesota and North Dakota and more recently additional populations were identified in South Dakota (emergent (E) 3ADON and E15ADON populations) and Louisiana (Southern Louisiana population (mainly a NIV type), Gulf Coast population (mainly 3ADON and NIV types)). A newly detected population, with Minnesota being the possible geographic origin, includes isolates that do not produce NIV, DON or their acetylated derivatives. We also detected a *Fusarium asiaticum* population (NIV type) in Louisiana. Isolates were placed into these distinct populations by first using molecular markers to generate isolate-specific genotypes and then by analyzing the genotypic data by a Bayesian model-based clustering method.

   A large collection of ca. 1,500 strains has been established from FHB symptomatic wheat originating from 29 counties in Arkansas. This collection has been analyzed using PCR-RFLP markers and was assessed for trichothecene type: 79.6% were of the 15ADON type, 16.6% were 3ADON and 3.8% NIV. Preliminary analysis indicated that the pathogen population has a large clonal component, with many genotypes being found repeatedly at

various spatial levels (within fields, between fields within a county, and between counties). A novel population (the Arkansas population) has also been identified that is predominantly a 3ADON trichothecene type. In greenhouse experiments we tested 25 isolates of the Arkansas population with a 3ADON type for their aggressiveness and toxigenic potential along with checks including PH-1 and three 3ADON isolates from the emergent populations in the Upper Midwest.

It appears that Arkansas harbors the most diverse pathogen populations of *F. graminearum* in the U.S. Significantly, the Arkansas isolates that belong to the MW15ADON population are diverse for trichothecene type (NIV, 3ADON and 15ADON.

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.

Sarver, B.A.J., Ward, T.J., Gale, L.R., Broz, K., Kistler, H.C., Aoki, T., Nicholson, P., Carter, J. and O'Donnell, K. 2011. Novel Fusarium head blight pathogens from Nepal and Louisiana revealed by multilocus genealogical concordance. *Fungal Genetics and Biology*, 48:1096-1107.

Gale, L.R., Harrison, S.A., Ward, T.J., O'Donnell, K., Milus, E.A., Gale, S.W., and Kistler, H.C. 2011. Nivalenol-type populations of *Fusarium graminearum* and *F. asiaticum* are prevalent on wheat in southern Louisiana. *Phytopathology*, 101:124-134.

Horevaj, P., Gale, L.R., and Milus, E.A. 2011. Resistance in winter wheat lines to initial infection and spread within spikes by deoxynivalenol and nivalenol chemotypes of *Fusarium graminearum*. *Plant Disease*, 95:31-37.

Gale, L.R., Ward, T.J., and Kistler, H.C. 2011. A subset of the newly discovered northland population of *Fusarium graminearum* from the US does not produce the B-type trichothecenes DON, 15ADON, 3ADON or NIV. In: *Proceedings of the 2010 National Fusarium Head Blight Forum*, Milwaukee, Wisconsin, USA, December 7-9, 2010, p. 48.

Yuen, G.Y., Jochum, C.C., Du. L., Arreguin, I., and Gale, L.R. 2011. Preinoculation of wheat heads with a nontoxigenic *Fusarium* isolate inhibits deoxynivalenol production by a toxigenic pathogen. In: *Proceedings of the 2010 National Fusarium Head Blight Forum*, Milwaukee, Wisconsin, USA, December 7-9, 2010, p. 57.