

**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:	59-0790-7-080
USDA-ARS Agreement Title:	Integrated Management and Prediction of Fusarium Head Blight and DON in Winter Wheat.
FY08 USDA-ARS Award Amount:	\$ 40,725

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Adjusted Award Amount
MGMT	Integrating Strategies to Mitigate Fusarium Head Blight and DON in Winter Wheat.	\$17,923
MGMT	Incorporating Infection Cycle Components into FHB and DON Prediction Models.	\$ 22,802
	Total Award Amount	\$ 40,725



July 13, 2009

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

(Form FPR08)

Project 1: *Integrating Strategies to Mitigate Fusarium Head Blight and DON in Winter Wheat.*

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

The major problem being resolved is to more effectively manage Fusarium head blight (FHB, scab) and deoxynivalenol (DON) in winter wheat through integration of management strategies. We are resolving the problem by comparing the effect of a fungicide (Prosaro = prothioconazole + tebuconazole) application at early flowering to no fungicide application on three cultivars with different levels of tolerance to FHB (2137, susceptible; Harry, moderately resistant; and Jagalene, susceptible). The three cultivars were planted in the fall of 2007. In the spring of 2008, corn-kernel inoculum of *Fusarium graminearum* was applied to the soil surface of all plots. Prosaro was applied or not applied to plots of all three cultivars. Data on FHB index, yield, *Fusarium*-damaged kernels (FDK) and DON were obtained from the plots.

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:

It was demonstrated that fungicide application reduced FDK in Jagalene and 2137 and reduced DON in Jagalene. Harry, with a moderately resistant phenotype, was shown to accumulate more DON than the susceptible 2137, implying that both DON accumulation and reaction to FHB should be considered when selecting cultivars.

Impact:

Data demonstrating differences among cultivars in their reaction to FHB and DON when treated with fungicide or not treated with fungicide will enable producers to choose the combination of cultivar and fungicide application that will be most effective in reducing FHB and DON. Losses from FHB and DON will be reduced and profits for producers will increase.

Project 2: Incorporating Infection Cycle Components into FHB and DON Prediction Models.

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

The major problem being resolved is to generate data to be used in the development and deployment of Fusarium head blight (FHB) and deoxynivalenol (DON) prediction models in winter wheat. The problem is being resolved by investigating the effect of planting date, cultivar, and inoculation timing on FHB intensity, and predicting DON based on visual assessments of FHB. In one experiment, three winter wheat cultivars (Jagalene, Harry, and 2137) were planted in the fall of 2007 on two planting dates, Oct 27 and Nov 10. In the spring of 2008 each cultivar was inoculated with conidia of *Fusarium graminearum* at early and mid anthesis. FHB index, yield, *Fusarium*-damaged kernels (FDK), and DON were determined. In a second experiment, three winter wheat cultivars (Jagalene, Harry, and 2137) were planted on 27 October 2007 and inoculated with conidia of *F. graminearum* at early anthesis in the spring of 2008. In June 2008, 20 heads were randomly tagged in each of 13 disease severity categories: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 70, and 90%. DON concentration was determined in each disease severity category.

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:

FHB, DON, and weather data were obtained and furnished to the FHB and DON model development team. In the first experiment, it was demonstrated that FHB index and DON were higher in the first planting date than in the second planting date. On the final disease assessment date, the cultivar Jagalene had the highest FHB index (57%) followed by 2137 (47%) and Harry (24%). DON concentration was lower for 2137 (5.0 ppm) than for Harry (7.0 ppm) and Jagalene (7.3 ppm). FHB index was higher when inoculation was done at mid anthesis (51%) than at early anthesis (40%). In the second experiment, a significant positive correlation was demonstrated between FHB severity and DON in all three winter wheat cultivars tested. Differences in DON accumulation among the three cultivars were demonstrated, with Harry accumulating the highest concentration (32 ppm) followed by Jagalene (29 ppm) and 2137 (19 ppm).

Impact:

The data generated from both experiments will be used to develop prediction models for FHB and DON. Data on cultivar reaction to FHB and DON will enable producers to make informed decisions about the choice of cultivar to plant. Deployment of FHB and DON prediction models and choice of cultivars with the best resistance/tolerance to FHB and DON will reduce losses from FHB and DON and thereby increase profits for producers.

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.

1. De Wolf, E., Nita, M., Paul, P., Madden, L., Stein, J., Ali, S., and Wegulo, S. 2008. Advances in the epidemiology of Fusarium head blight and applications in prediction models. Page 18 in: Proceedings of the 2008 Fusarium Head Blight Forum. Crowne Plaza Hotel, Indianapolis, Indiana. 2-4 December, 2008.
2. Hernandez-Nopsa, J., and Wegulo, S. N. 2008. Effects of FHB severity and cultivars on DON accumulation in winter wheat. Page 23 in: Proceedings of the 2008 Fusarium Head Blight Forum. Crowne Plaza Hotel, Indianapolis, Indiana. 2-4 December, 2008.
3. Hernandez-Nopsa, J., and Wegulo, S. N. 2009. Effect of cultivar on the relationship between Fusarium head blight severity and deoxynivalenol concentration in winter wheat. *Phytopathology* 99:S53 (Abstr.).
4. Nita, M., De Wolf, E., Paul, P., Madden, L., Stein, J., Ali, S., and Wegulo, S. 2008. Prediction models for deoxynivalenol accumulation risk using empirical and mechanistic modeling approaches. Page 49 in: Proceedings of the 2008 Fusarium Head Blight Forum. Crowne Plaza Hotel, Indianapolis, Indiana. 2-4 December, 2008.
5. Nita, M., De Wolf, E., Paul, P., Madden, L., Stein, J., Ali, S., and Wegulo, S. 2009. Prediction of deoxynivalenol accumulation for Fusarium head blight of wheat using empirical and mechanistic modeling approaches. *Phytopathology* 99:S94 (Abstr.).
6. Paul, P. A., Madden, L., McMullen, M., Hershman, D., Sweets, L., Wegulo, S., Halley, S., Osborne, L., Ruden, K., and Padgett, B. 2008. Integrated management of FHB and DON in small grain: 2008 uniform trials. Page 52 in: Proceedings of the 2008 Fusarium Head Blight Forum. Crowne Plaza Hotel, Indianapolis, Indiana. 2-4 December, 2008.
7. Wegulo, S. N., and Hernandez-Nopsa, J. 2008. Effects of fungicide treatments and cultivars on FHB and DON in winter wheat. Pages 70-71 in: Proceedings of the 2008 Fusarium Head Blight Forum. Crowne Plaza Hotel, Indianapolis, Indiana. 2-4 December, 2008.

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.