USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY07 Final Performance Report (approx. May 07 – April 08)
July 15, 2008

Cover Page

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Fiscal Year:	2007
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.
FY07 ARS Award Amount:	$ 44,878

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Adjusted Award Amount
CBCC	Integrating Strategies to Mitigate Fusarium Head Blight and DON in Winter Wheat.	$19,512
EEDF	Predicting Development of Fusarium Head Blight and DON in Winter Wheat.	$ 25,366
	Total Award Amount	**$ 44,878**

July 14, 2008

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
IIR – Integrated/Interdisciplinary Research
PGG – Pathogen Genetics & Genomics
VDUN – Variety Development & Uniform Nurseries

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

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

The major problem being addressed is integration of management strategies to more effectively manage Fusarium head blight (FHB) and deoxynivalenol (DON) in winter wheat. 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, moderately susceptible). The three cultivars were planted in the fall of 2006. In the spring of 2007, corn-kernel inoculum of *Fusarium graminearum* was applied to the soil surface of all plots. During anthesis heads were kept wet by overhead impulse sprinklers. 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 (how is it being used?). Complete all three sections (repeat sections for each major accomplishment):

Accomplishment:

It was demonstrated that Prosaro significantly reduced FHB index in all three cultivars and that the lowest FHB index resulted from applying Prosaro to the moderately resistant cultivar Harry. Plots treated with Prosaro also had significantly higher yield and lower FDK than non-treated plots. Prosaro significantly reduced DON only in the cultivar Harry.

Impact:

It was demonstrated that combining a fungicide application with resistance/tolerance can effectively reduce FHB and DON in winter wheat, and that reduction in DON from fungicide application is cultivar-dependent. Integrating fungicide application with resistant/tolerant wheat cultivars will result in significant reduction in losses from FHB and DON.

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?:

Data demonstrating the effectiveness of integrating fungicide application with resistance/tolerance to FHB in winter wheat are now available. Growers will use these data to make informed decisions regarding choice of FHB management strategies.

Project 2: *Predicting Development of Fusarium Head Blight and DON in Winter Wheat.*

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

The major problem being resolved is generation of data to be used in development and deployment of Fusarium head blight (FHB) and deoxynivalenol (DON) prediction models in winter wheat. The current FHB prediction models lack a module for prediction of DON content. 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 that account for variation of disease within a given field. In one experiment, three winter wheat cultivars (Jagalene, Harry, and 2137) were planted in the fall of 2006 on two planting dates, 5 and 27 October. In the spring of 2007 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, two winter wheat cultivars (Harry and 2137) were planted on 9 October 2006 and inoculated with conidia of *F. graminearum* at early anthesis in the spring of 2007. In June 2007, 20 heads were randomly tagged in each of 11 disease severity categories ranging from 0% to 50% at 5% increments. DON concentration was determined in each disease severity category.

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:

In the first experiment it was shown that cultivars differed in FHB index with Harry having a significantly lower index (45%) than either 2137 (62%) or Jagalene (62%) on the final disease assessment date. Cultivars also differed in DON concentration in harvested grain with Jagalene, Harry, and 2137 having 1.99, 1.71, and 1.52 ppm of the toxin, respectively. In the second experiment, a significant positive correlation was found between FHB severity in 11 severity categories and DON in cultivars Harry (r = 0.74) and 2137 (r = 0.70). However, DON concentration was higher in Harry (up to 4.7 ppm) than in 2137 (up to 1.7 ppm).

Impact:

It was demonstrated that winter wheat cultivars grown in Nebraska differ in their reaction to FHB and DON accumulation. It was also been demonstrated a cultivar with a low FHB index (Harry) accumulated more DON than a cultivar with a higher FHB index (2137). A positive relationship was found between FHB severity and DON concentration. The data generated will enhance the development and deployment of FHB and DON prediction models.

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?:

Data on reaction of three winter wheat cultivars grown in Nebraska to FHB and DON accumulation are available. These data will contribute to improvement of FHB and DON prediction models.

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.

Hernandez Nopsa, J. and Wegulo, S. N. 2007. Relationships between yield, grain quality variables, and Fusarium head blight intensity in winter wheat. Page 93 in: Proceedings of the 2007 National Fusarium Head Blight Forum. The Westin Crown Center, Kansas City, MO. 2-4 December 2007 (abstr.).

Hernandez Nopsa, J. and Wegulo, S. N. 2008. Effects of cultivars, inoculation timing, and Fusarium head blight intensity on deoxynivalenol accumulation in winter wheat. Phytopathology 98:S67 (abstr.).

Nita, M., De Wolf, E., Madden, L., Paul, P., Shaner, G., Adhikari, T., Ali, S., Stein, J., Osborn, L., and Wegulo, S. 2008. Use of mechanistic simulation models to predict disease intensity of Fusarium head blight and deoxynivalenol concentration. Phytopathology 98:S113 (abstr.).

Bockus, W. W. and Wegulo, S. N. 2008. Effect of foliar fungicides on Fusarium head blight of winter wheat, 2007. Plant Disease Management Reports 2:CF011.