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:	NA
USDA-ARS Agreement Title:	Effects of Post-Anthesis Moisture, Cultivar, and Infection Timing on FHB and DON in Wheat.
FY07 ARS Award Amount:	$ 43,000

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Adjusted Award Amount
EEDF	Effects of Post-Anthesis Moisture, Cultivar, and Infection Timing on FHB and DON in Wheat.	$43,000
	Total Award Amount	**$ 43,000**

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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: *Effects of Post-Anthesis Moisture, Cultivar, and Infection Timing on FHB and DON in Wheat.*

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

Deoxynivalenol (DON) levels are important both for their health effects and because DON is a pathogenicity factor in cereals. Our knowledge of the epidemiological and host genetic influences governing DON concentrations is incomplete. While anthesis is thought to be the primary period for FHB infection in wheat, late infections can also lead to DON production. High levels of DON have sometimes been observed in the absence of abundant disease symptoms. Visual disease severity and DON concentration in grain are often correlated, but coefficients are generally low, and vary greatly among locations and years. Our research goal is to improve our understanding of how moisture duration and infection timing affect disease development, *Fusarium* growth, and DON production. Our multi-year, replicated field experiment involved seven winter wheat cultivars with varying resistance levels and types in a misted nursery with 4 durations of misting and 4 inoculation timings. In addition to assaying DON at harvest time, we have monitored DON levels in spikes from flowering until about 10 days after normal harvest time. Taken together, the data will enhance our ability to forecast epidemic severity and economic risk.

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:

The two years in which disease levels were adequate in our inoculated winter wheat field experiment were 2006 and 2007. In both years, FHB incidence, FHB severity, and mean grain DON increased significantly as duration of post-flowering misting increased up to 20 days. We also found that grain DON at harvest exceeded acceptable levels in heads infected at flowering and in heads infected 10 days after flowering, but not in those infected 20 days after flowering. Further, we observed a "high DON in plump kernels" scenario in heads inoculated 10 days after flowering and subjected to extended misting during grain-fill. In other words, in this treatment combination, DON exceeded acceptable levels while visually scabby kernel (VSK) percentages remained indistinguishable from the low levels found in unmisted treatments.

In a time-course study, we found that DON levels declined during grain-fill up to and in some cases during the harvest period. This finding led to our current investigation of whether harvest delay results in increased, decreased, or unchanged DON levels, a question we are addressing under varying levels of harvest-time moisture. This subject is of considerable practical relevance to growers.

Our findings will help increase the accuracy of FHB risk forecasting, relate visual FHB symptoms to grain DON levels at harvest, and construct models that accurately forecast the risk of unacceptable DON levels at harvest. The information will be used by USWBSI risk modelers, and by agricultural scientists and extension workers helping growers understand the factors that lead to FHB and DON damage.

Impact: This is the most systematic investigation ever conducted of the interaction of wheat resistance genotype, FHB infection timing, and post-flowering moisture. Capturing data on disease, kernel infection, and DON throughout the grain-fill period gives us greater insight into the process of disease and toxin development. The finding of increased kernel infection, visual symptoms, and DON with increasing days of post-flowering moisture is an important and novel contribution to our current U.S. national FHB risk forecasting program, which focuses on pre-flowering weather conditions and corn residue. The impact of this research will be a greater capacity to forecast, monitor, and manage DON in wheat. Researchers and extension workers will be better able to advise growers and millers when to anticipate and prepare for problems with DON, and when DON management measures should be prioritized.

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?:

Researchers, extension workers, and growers now have strong evidence that post-flowering moisture duration up to three weeks in length enhances disease severity and DON concentrations in wheat grain. This knowledge will help researchers develop and refine DON risk forecasting models. Our data are also consistent with the hypothesis that cultivar resistance may interact with post-flowering moisture duration, although this needs further investigation. Such models will help growers and millers reduce and manage DON risk and damage. Our results will also eventually help breeders understand whether advanced lines should be screened under extended post-flowering irrigation.

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.

Duration of post-flowering moisture can affect FHB in wheat. 2007. Cowger, C. and Medina-Mora, C. In: Canty, S., Clark, A., Ellis, D., and Van Sanford, D. (Eds.), Proceedings of the National Fusarium Head Blight Forum; 2007 Dec 2-4, Kansas City, MO. Lexington: University of Kentucky. (Conference Proceedings)

Effects of post-flowering moisture on Fusarium head blight and deoxynivalenol levels in winter wheat, 200_. Cowger, C., Patton-Özkurt, J., and Brown-Guedira, G. Phytopathology (in preparation).