

**USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY06 Final Performance Report (approx. May 06 – April 07)
July 16, 2007**

Cover Page

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USDA-ARS Agreement ID:	NA
USDA-ARS Agreement Title:	Effects of Post-Anthesis Moisture, Cultivar, and Infection Timing on FHB and DON in Wheat.
FY06 ARS Award Amount:	\$ 28,913

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Award Amount
EEDF	Effects of Post-Anthesis Moisture, Cultivar, and Infection Timing on FHB and DON in Wheat.	\$ 28,913
	Total Award Amount	\$ 28,913

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

(Form – FPR06)

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 involves seven 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 are monitoring 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:

In 2005, FHB was at low levels in our plots, and duration of post-flowering moisture had only a weak effect on FHB incidence and severity, and no significant effect on grain DON. In 2006, levels of disease incidence and severity were substantially higher than in 2005. **In 2006, FHB incidence, FHB severity, and mean grain DON increased significantly as duration of post-flowering misting increased up to 20 days.** Grain DON at harvest was much higher in heads infected at flowering than in late-infected heads (means of 16 ppm vs. approx. 2 ppm, respectively). In heads infected 10 days after flowering, however, mean grain DON at harvest increased from 1 ppm with no post-flowering misting to 4 ppm with 30 days post-flowering misting. In a time-course study of infection during the grain-fill period, we found that increasing days of misting post-flowering increased the percentage of *Fusarium*-infected kernels at harvest. **Our 2006 data suggest that increasing numbers of moist days after flowering can significantly increase *Fusarium* infection, FHB severity, and DON in wheat heads. The combination of late infections and prolonged post-flowering moisture could account for the scenario of grain with few visual symptoms yet unacceptably high DON concentrations.** Assays of visually scabby kernels and kernel infection, which are still in progress, will help determine whether this is the case.

This information is important in order to increase the accuracy of FHB risk forecasting, to relate visual FHB symptoms to grain DON levels at harvest, and to 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. The use of multiple measures of symptoms, 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 can be important in determining DON levels in wheat grain at harvest. This knowledge will help researchers develop and refine DON risk forecasting models. Such models will help growers and millers reduce and manage DON risk and damage.

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USDA-ARS Agreement #: NA

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. 2006. **Cowger, C.** In: Canty, S. M., et al., (Eds.), Proceedings of the National Fusarium Head Blight Forum; 2006 Dec 9-12, Raleigh, NC. East Lansing: Michigan State University. (Conference Proceedings)