USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY05 Final Performance Report (approx. May 05 – April 06)
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Cover Page

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Fiscal Year:	**2005**
FY05 ARS Agreement ID:	**NA**
Agreement Title:	**Effects of Post-Anthesis Moisture, Cultivar and Infection Timing on FHB and DON in Wheat.**
FY05 ARS Award Amount:	**$ 20,000**

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Adjusted Award Amount
EDM	Effects of Post-Anthesis Moisture, Cultivar and Infection Timing on FHB and DON in Wheat.	$ 20,000
	Total Award Amount	**$ 20,000**

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Principal Investigator Date

* BIO – Biotechnology
CBC – Chemical & Biological Control
EDM – Epidemiology & Disease Management
FSTU – Food Safety, Toxicology, & Utilization
GIE – Germplasm Introduction & Enhancement
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 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: We developed and carried out procedures to manipulate moisture duration and infection timing, and to assess disease, amount of fungus, and DON in various wheat head tissue types. The first year's data were obtained under mild disease pressure. These data are useful, but must be complemented by data from a heavier epidemic.

Duration of post-flowering moisture had only a weak effect on FHB incidence and severity, and had no significant effect on grain DON, except that treatments receiving the longest duration of mist (30 days post-flowering) had significantly less grain DON than those misted for shorter durations. This may indicate that duration of post-flowering moisture is not a determining factor in disease and DON levels, although the epidemic was mild and results may change with more disease. When heads from the plots misted for 30 days were separated into glume, rachis, and grain fractions, and DON levels were compared to fungal DNA assayed by real-time PCR, there was a much stronger correlation between fungal DNA and DON in grain ($R = 0.89$, $P < 0.0001$) than in glumes ($R = 0.44$, $P = 0.06$) or in rachis tissue ($R = 0.48$, $P = 0.04$). This suggests that by harvest time, grain DON levels were more closely related to fungal biomass in the grain than was the case in other head tissue types. One explanation for high DON levels in asymptomatic grain would be the translocation of DON from *Fusarium* growing outside the grain, but our results provided no evidence for that.

Regarding infection timing, inoculations occurring at or 10 days after flowering resulted in significant amounts of DON, while inoculations at 20 and 30 days post-flowering did not. Tombstone percentages and grain DON levels were correlated in this sample, and there was

no interaction of days of post-flowering misting with infection timing. These results suggest that infections occur within about two weeks after flowering, regardless of moisture duration. The results do not support the hypothesis that later infections play an important role in the phenomenon of asymptomatic grain with high DON levels. DON levels in heads infected at or within 10 days of flowering were significantly higher in chaff and rachis tissues than in grain.

Mean grain DON levels dropped during the month following flowering, and then remained low through harvest. These data were obtained only from plots misted for 30 days, which were also the treatments that produced the lowest DON levels at harvest.

Impact: Data from multiple seasons with different levels of epidemic intensity are essential to draw conclusions about the relationships we are investigating. The final impact of our research will be a more detailed understanding of the conditions that lead to elevated DON levels. This knowledge will allow researchers and extension workers to better advise growers and millers when to anticipate and prepare for problems with DON, and when DON management measures should be prioritized. For example, if we better understand the conditions that lead to high DON levels at harvest, DON management could be improved with timely and accurate recommendations of special measures such as early harvest, drying grain after harvest, etc.

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?:

Our research is part of an increased focus among FHB researchers on understanding the conditions that lead to high DON levels. When these conditions are understood in detail, extension workers and growers will be able to better forecast DON problems and take action to minimize DON.

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.

Cowger, C. 2005. "Effects of moisture, cultivar, and infection timing on FHB severity and DON in wheat." In: Canty, S. M., Boring, T., Wardwell, J., Siler, L., and Ward, R. W. (Eds.), Proceedings of the National Fusarium Head Blight Forum; 2005 Dec 11-13; Milwaukee, WI. East Lansing: Michigan State University. p. 115.