

**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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<b>Fiscal Year:</b>	2007
<b>USDA-ARS Agreement ID:</b>	59-0790-5-076
<b>USDA-ARS Agreement Title:</b>	Effect of Inoculum Levels, Host Resistance, Fungicide and Weather on FHB.
<b>FY07 ARS Award Amount:</b>	\$ 34,297

**USWBSI Individual Project(s)**

<b>USWBSI Research Area *</b>	<b>Project Title</b>	<b>ARS Adjusted Award Amount</b>
EEDF	Effects of Growth Stage, Host Resistance, and Weather on DON and FHB Development.	\$24,939
HGG	Characterizing the FHB Resistance of 'Frontana' Wheat Using Unique RBCM Lines.	\$ 9,358
	<b>Total Award Amount</b>	<b>\$ 34,297</b>

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Principal Investigator

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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 Growth Stage, Host Resistance, and Weather on DON and FHB Development.**

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

Fusarium head blight (Scab), caused by *Fusarium graminearum*, is one of the important diseases of wheat worldwide. Although wheat cultivars moderately resistant to FHB is managed through fungicide applications and cultural practices, a reliable disease forecasting system is essential to predict FHB epidemics during the season for the wheat growers to know if their crop needed fungicide application.

### **2. What were the most significant accomplishments and impact?**

#### **Accomplishment:**

To determine effects of three wheat cultivars Glenn (FHB resistant), Steele-ND (moderately susceptible) and Trooper (susceptible) and crop growth stages on FHB severity and incidence, and DON content, field plots were artificially inoculated at Fargo, ND. Glenn has the lowest (20.6%) and Trooper has the highest FHB severity (28.12%). All three disease components: incidence (12.75%), severity (41%), and DON (2.45 ppm) were higher when the cultivars were inoculated at mid flowering stage. A positive correlation was observed between FHB severity and DON content in all three cultivars Glenn ( $r = 0.9865$ ), Steele-ND (0.9893), and Trooper (0.9844). It appeared that locally available *G. zea* inoculum could play a significant role in disease development, and infection at mid flowering growth stage could be a crucial in FHB incidence, severity, and DON production.

**Impact:** This project would ultimately speed up the efforts in the development of effective and précised forecaster, and would help wheat producers better manage disease. Incorporation of FHB severity data into the disease forecasting system would help in DON level prediction prior to harvesting.

### **3. A list of the publications, presentations, peer-reviewed articles, and non-peer reviewed articles.**

- Ali, S., and T. B. Adhikari. 2007. Effect of wheat genotypes and inoculation timings on Fusarium Head Blight of wheat in North Dakota. Page 24: in the Proceeding of the 2007 National Fusarium Head Blight Forum, December 2-4, 2007, The Westin Crown Center, Kansas City, MO.
- Paul, P. A., P. E. Lipps, E. De Wolf, G. Shaner, G. Buechley, T. Adhikari, S. Ali, J. Stein, L. Osborne, and L. V. Madden. 2007. A distributed lag analysis of the relationship between *Gibberella zea* inoculum density on wheat spikes and weather variables. *Phytopathology* 97:1608-1624.
- Paul, P. P., L. V. Madden, S. Wegulo, T. Adhikari, S. Ali, and E. DeWolf. 2007. Influence of SRWW, HRSW, and HRWW varieties on the relationship between FHB and DON. Page 128: in the Proceeding of the 2007 National Fusarium Head Blight Forum, December 2-4, 2007, The Westin Crown Center, Kansas City, MO.
- Nita, M, E. DeWolf, L. Madden, P. Paul, S. Shaner, T. Adhikari, S. Ali, J. Stein, and L. Osborne, and S. Wegulo. 2007. Mechanistic simulation models for Fusarium Head Blight and DON. Page 108: in the Proceeding of the 2007 National Fusarium Head Blight Forum, December 2-4, 2007, The Westin Crown Center, Kansas City, MO.

## **Project 2: Characterizing the FHB Resistance of 'Frontana' Wheat Using Unique RBCM Lines.**

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

Fusarium head blight (FHB) of small grains, is caused primarily by *Fusarium graminearum* Schwabe. Both yield and quality are severely affected by the fungal mycotoxins [(e. g., deoxynivalenol (DON)]. The Brazilian spring wheat cultivar, 'Frontana' represents a genetically different source of resistance and prevents initial fungal infection (Type I resistance) or accumulation of DON (Type V resistance). Unique reciprocal backcross monosomic (RBCM) lines have been developed from a cross between the resistant cultivar 'Frontana' and the susceptible cultivar 'Chris'. It would be advantageous to wheat breeding efforts if this mechanism was characterized and if the chromosomes carrying the genes involved in the Frontana type of resistance could be confirmed.

### **2. What were the most significant accomplishments and impact?**

#### **Accomplishment:**

An attached-leaf bioassay and real-time PCR analysis were used to determine resistance in the two parents 'Frontana' (resistant parent), 'Chris' (susceptible parent), 'Frontana' chromosome lines (FTN 3AS, FTN 6AS, and FTN 4DS), and Alsen using digital image analysis. After disease scoring, the inoculated leaf segments for each cultivar/line were used to quantify fungal biomass by real-time PCR assays. 'Frontana' and three lines (FTN 3AS, FTN 4DS, and FTN 6AS) exhibited smaller lesions than 'Alsen' and 'Chris'. Real-time PCR assay detected the highest FgDNA in 'Chris' (306.87 pg) and the lowest FgDNA in FTN 4DS line (0 pg). FgDNA in 'Frontana' and other two lines (FTN 3AS and FTN 6AS) ranged from 0.75 pg to 0.98 pg. Both leaf bioassay and real-time PCR analysis will provide accurate quantification of *F. graminearum* in wheat and can be useful to differentiate among susceptible and resistant wheat lines to early infection of FHB.

#### **Impact:**

The resistant line(s) identified in this study can be utilized in wheat breeding programs for the development of FHB-resistant wheat cultivars.

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**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.**

None.