

**USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY07 Final Performance Report (approx. May 07 – April 08)
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Cover Page

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USDA-ARS Agreement ID:	59-0790-4-125
USDA-ARS Agreement Title:	Uniform Trial to Evaluate Efficacy of Fungicides and Biologicals Against Fusarium Head Blight.
FY07 ARS Award Amount:	\$ 14,634

USWBSI Individual Project(s)

USWBSI Research Area *	Project Title	ARS Adjusted Award Amount
CBCC	Evaluation of Integrated Management Strategies for Fusarium Head Blight.	\$9,756
CBCC	Uniform Trial to Evaluate Efficacy of Fungicides and Biologicals against Scab.	\$ 4,878
	Total Award Amount	\$ 14,634

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: *Evaluation of Integrated Management Strategies for Fusarium Head Blight.*

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

The severity of Fusarium head blight (FHB) epidemics in the United States has caused enormous yield and quality losses in both wheat and barley over the last decade. The development of this disease is dependent on host genetics, a range of favorable environmental conditions, the prevalence of the causal fungus and the survival and spread of the causal fungus. Control of this disease has been difficult because of the complex nature of the host/pathogen interaction. Management of FHB and the associated mycotoxin DON have not been achieved by any single control measure. An integrated approach is critical to attaining the best possible control of FHB in any given environment.

As a result of a workshop sponsored by the Chemical, Biological and Cultural Control Research Area in 2006, a protocol for a multi-state project focusing on integrated management strategies for FHB was developed. The research portion of this project would involve multi-state trials evaluating crop sequence, variety selection and fungicide application as an integrated management program for FHB. Timely dissemination of the research results is also a priority of this project.

The University of Missouri cooperated in this multi-state project following the protocol developed by a subcommittee from the workshop participants during the 2006-2007 season.

**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 data from the Missouri trial does indicate a significant difference in DON levels with varieties and with crop sequence. As expected more susceptible varieties tended to have higher levels of scabby kernels and higher DON levels than varieties with more resistance to FHB. However, all varieties had lower DON levels when planted in soybean residue rather than corn residue. Fungicide application did not seem to have an impact on yield or DON level regardless of variety or crop sequence. The plan is to repeat the trial in 2007-2008 to see if results are reproducible and to obtain a second year's data on the integrated management of FHB.

Impact:

The purpose of the Integrated Management Strategies for Fusarium Head Blight Project is to provide growers with data on the value of utilizing multiple management options to reduce both FHB and DON levels in grain crops. Compilation of data from similar trials from all locations provides valuable information on which practices and/or combination of practices may reduce the incidence and severity of FHB and may then impact the DON levels in harvested grain. For Missouri one key point would be the value of crop sequence or rotation in reducing FHB and DON in winter wheat.

(Form FPR07)

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?:

The uniform trial data is compiled across all locations participating in the trial and this information is presented at the National Scab Forum, is published in the National Scab Forum proceedings and is available through the U.S. Wheat and Barley Scab Initiative web site as well as through individual state reports and web sites. Growers and agribusiness personnel in Missouri and academic and agricultural professionals throughout the United States have access to this information. Again, from the first year of this study one important trend was the lower incidence of FHB and lower DON levels in wheat planted into soybean residue as compared to wheat planted into corn residue. The importance of crop rotation in managing FHB may have been overlooked in recent years.

Project 2: *Uniform Trial to Evaluate Efficacy of Fungicides and Biologicals against Scab.*

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

Scab or Fusarium head blight (FHB) continues to be a problem on soft red winter wheat grown in Missouri. Although a state wide epidemic has not occurred for several years, each year there are areas within the state that have weather conditions favorable for disease development as the winter wheat crop is flowering. Producers in these areas see a direct impact from yield reduction and may see an indirect impact due to DON levels or quality issues when the grain is marketed. High levels of FHB in the crop or of DON in the grain also cause significant problems for elevators accepting the grain and processors trying to use the grain. One management option would be the use of fungicides or biological control agents to minimize FHB infection. The Uniform Scab Fungicide Trial was set up to identify safe fungicides that are effective against FHB. A second uniform trial to evaluate the efficacy of biological control agents against FHB has also been established. Given sets of fungicides and biological control agents are evaluated for consistency of performance across a wide range of wheat classes and varieties, barley classes and environments. For the fungicide portion of the uniform trial, the emphasis is on new fungicide chemistries, new combinations of products, more precise application timing and application techniques. In the biologicals portion of the uniform trial, the emphasis has shifted to biologicals available in formulations that would be practical for on-farm use. The identification of safe fungicides or the development of safe, easy to use biological control agents which effectively control FHB would benefit producers, agribusinesses and ultimately consumers.

The set of fungicides and biological control agents for the Uniform Scab Trials were evaluated on two soft red winter wheat varieties in Missouri during the 2006-2007 season. The field work for this trial has been completed. Samples were submitted for DON analysis and data was analyzed for the annual trial report.

**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 Uniform Trials to evaluate efficacy of fungicides and biological control agents against FHB were conducted in Missouri during the 2006-2007 season. Planting went well and the stands were good last fall. During the winter months there were two major ice storms which covered both trials with about two inches of ice. Weather was also a major factor from March to early April. The last three weeks of March temperatures were unusually warm resulting in the second warmest three weeks in March since 1889. Then from April 4 to April 7, the temperatures plummeted and record lows were set for most of those days. The abrupt change from three weeks of very warm weather which encouraged wheat green up and growth to night time temperatures of 17 or 18 degrees F resulted in extensive low temperature damage to wheat. Damage ranged from plants that were killed by low temperatures to plants that had stem damage especially to the main stem but managed to

survive to plants that had poor head development and fill to plants that showed little or no negative effects from the low temperatures. The Uniform Fungicide Trial was conducted on the two varieties Roane and Truman. Roane sustained moderated low temperature damage and Truman sustained little low temperature damage. In the Uniform Biological Trial the varieties were Elkhart and Roane. Again Roane did not show major damage from the low temperature but the Elkhart was severely affected. In the Elkhart stands were thin and uneven. Weather conditions during flowering were conducive to the development of FHB. Fungicide treatments were applied at the appropriate timings. Biological control agents were applied under ideal conditions for growth of the biological control agents and for development of FHB. This year all of the biologicals were supplied in sufficient quantity so no additional increase of biological inoculum was necessary. Furthermore all of the biological control agents were applied with ease; the formulations didn't clog spray nozzles or cause any other application problems

Unfortunately, weather conditions from flowering on were not favorable for the development of FHB. Both incidence and severity of FHB were low when those ratings were taken in the field. Scabby kernel counts were also low. All three varieties did have more blank kernels and shriveled or shrunken kernels than normal. It is difficult to distinguish between kernels damaged by low temperatures and kernels with scab in visual ratings. The DON levels were mostly below detectable levels for all treatments in both trials indicating that kernel damage was more likely the result of adverse environmental conditions than to FHB. But the strength of the Uniform Fungicide and Biological Trials has been and continues to be in the replication of the same sets of treatments across a number of locations. Although results in one location in a given year may not be statistically significant, across all locations there should be significant results that provide valuable information for all wheat and barley producing areas of the U. S.

Impact:

The purpose of the Uniform Fungicide Trial and the Uniform Biological Control Agent Trial is to provide growers with data on the efficacy of these materials that will help them in making management decisions related to FHB. Compilation of uniform trial data from all locations provides valuable information on which fungicides or biological control agents reduce the incidence and/or severity of FHB, which may impact the DON levels in harvested grain and application timings and techniques that provide the best results.

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?:

The uniform trial data is compiled across all locations participating in the trials and this information is presented at the National Scab Forum, is published in the National Scab Forum proceedings and is available through the U.S. Wheat and Barley Scab Initiative web site. Growers and agribusiness personnel in Missouri as well as academic and agricultural professionals throughout the United States have access to this information.

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.

Presentations:

Crop Injury Diagnostic Clinic, Field Crop Disease Session, July 2007, Columbia, MO

Crop Management Conference, Field Crop Disease Update, December 2007, Columbia, MO

Pesticide Applicator Training Recertification Sessions, Field Crop Disease Update, January 2008, multiple locations throughout Missouri

Wheat Diseases, MFA Training, February 2008, Columbia, MO

Training Session for Missouri Seed Improvement Association Wheat Inspectors, June 2007, Columbia, MO

Wheat Tour, May 2008, Lamar, MO

Teleconference phone calls with Extension field staff during the spring and summer of 2007

Proceedings:

Paul, P., L. Madden, M. McMullen, D. Hershman, L. Sweets, S. Wegulo W. Bockus, S. Halley and K. Ruden. 2007. An integrated approach to managing FHB and DON in wheat: uniform trials 2007. Proceedings of the 2007 National Fusarium Head Blight Forum. December 2-4, 2007. Kansas City, Missouri. pp. 117-122.

Paul, P., L. Madden, M. McMullen, D. Hershman, D. Brown-Rytlewski, L. Sweets, E. Adee, C. Bradley, B. Padgett and K. Rudeen. 2007. Fungicide effects on FHB and DON in wheat across multiple locations and wheat classes: uniform fungicide trials 2007. Proceedings of the 2007 National Fusarium Head Blight Forum. December 2-4, 2007. Kansas City, Missouri. pp.123-127.

Yuen, G. L., C.C. Jochum, K. R. Ruden, J. Morgan, B. H. Bleakley and L. E. Sweets. 2007. Results from the 2007 standardized evaluation of biological agents for the control of Fusarium head blight on wheat and barley. Proceedings of the 2007 National Fusarium Head Blight Forum. December 2-4, 2007. Kansas City, Missouri. pp. 153-157.

Extension Publications:

Manuals:

Bradley, K. W., L. E. Sweets, W. C. Bailey, J. A. Kendig, and J. A. Wrather. 2007. 2007 Missouri pest management guide. University of Missouri Extension publication M171.

Newsletter Articles:

Sweets, L. E. Foliage diseases of winter wheat and their management. Integrated Pest and Crop Management Newsletter 17(7).

Sweets, L. E. Foliar fungicides labeled for use on winter wheat. Integrated Pest and Crop Management Newsletter 17(7).

Sweets, L. E. Wheat diseases. Integrated Pest and Crop Management Newsletter 17(8).

Sweets, L. E. Fusarium head blight or scab of wheat. Integrated Pest and Crop Management Newsletter 17(9).

Sweets, L. E. Evaluate winter wheat seed quality prior to planting. Integrated Pest and Crop Management Newsletter 17(13).

Sweets, L. E. Seed treatment fungicides labeled for use on winter wheat. Integrated Pest and Crop Management Newsletter 17(13).