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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Fiscal Year:	2006
USDA-ARS Agreement ID:	59-0790-6-072
USDA-ARS Agreement Title:	Enhancing Biological Strategies to Control Fusarium Head Blight and Evaluation Biological Control Agents in Uniform Tests Against FHB.
FY06 ARS Award Amount:	$ 27,318

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Award Amount
CBCC	Enhancing Biological Strategies to Control Fusarium Head Blight.	$ 17,326
CBCC	Uniform Tests of Biological Control Agents Against Fusarium Head Blight.	$ 9,992
	Total Award Amount	**$ 27,318**

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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
PGG – Pathogen Genetics & Genomics
VDUN – Variety Development & Uniform Nurseries

Project 1: *Enhancing Biological Strategies to Control Fusarium Head Blight.*

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

The identification of effective chemical and biological controls for managing Fusarium head blight (FHB) remains a challenge. Biological agents, such as *Lysobacter enzymogenes* C3, with different modes of action, were shown to have promise but individually have have been inconsistent as to efficacy in the field. In this study, we explored the potentials of combining C3 with other biocontrol fungi and bacteria having different modes of action to control FHB. We also evaluated the effectiveness of the combining C3 and other inducers of host resistance with tebuconazole in controlling FHB. Field trials were conducted in Nebraska and South Dakota, in collaboration with scientists at South Dakota State University. C3 was tested as an inducer of resistance applied at head emergence. It was applied alone and in combination with known antibiotic-producing FHB biocontrol agents *Bacillus* strains 1BA and *B. subtilis* TrigoCor 1448 and with tebuconazole, which were applied at anthesis. C3 also was tested in combination with other elicitors of induced systemic resistance: *Pseudomonas fluorescns* WCS417 and autoclaved fungal biomass (AFB) preparations.

Microorganisms that have the ability to degrade DON are needed as biological control agents. While organisms with this trait have been reported in Europe, they are unavailable for study in the US and have not been evaluated for DON degradation in cereal grain. Therefore, efforts were made to isolate microorganisms from soil and seed that can degrade DON through a two stage enrichment and isolation procedure using media containing DON.

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:

Combining agents with different modes of action and with tebuconazole –
Because of low moisture conditions in Nebraska and South Dakota, disease levels were too low to provide good comparison of treatments. None of the treatments, including tebuconazole, reduced disease parameters to signficant levels compared to the control. Despite low disease incidence and severity, DON was detected in control and tebuconzole-treated plots.

Isolation of microorganisms to degrade DON –
Difficulties were encountered initially in extracting sufficient DON from cultures of Fusarium to enrich for DON degrading microorganisms. Once this was accomplished, attempts were made to isolate desired microorganisms from DON contaminated seed and from soil but were unsuccessful.

Impact:

While weather conditions prevented identification of effective biological treatments, detection of DON despite low disease pressure confirms the need to for methods to provide more effect control of the mycotoxin.

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 strategy of combining agents with different modes of action and with tebuconazole may have promise, but the potential of this strategy for improving field efficacy has yet to be demonstrated. Isolation of microorganism with the capability to degrade DON, while reported to be possible, is technically difficult and will require a more intensive search.

Project 2: *Uniform Tests of Biological Control Agents Against Fusarium Head Blight.*

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

The objectives of this project were to coordinate efforts involving multiple states in standardized comparisons of biological treatments for control of Fusarium head blight and to conduct a field test on winter wheat in Nebraska as part of the 2006 uniform biological control tests. Gary Yuen served as the coordinator of uniform tests conducted in 3 states (MO, NE, and SD), and conducted trials in one NE location. Three biological control agents (*Bacillus* 1BA, *B. subtilis* TrigoCor1448, and *Lysobacter enzymogenes* C3) were applied alone and in combination with tebuconazole. In addition, there was a non-treated control and a treatment with tebuconazole alone.

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:
Results from the Nebraska experiment was published in the report of the 2006 Uniform Biological Control Tests (see publications list). Disease incidence and severity were very low in Nebraska, as in the other test locations, due to low moisture conditions during flowering. None of the treatments, including tebuconazole, were significantly different from the control in any disease parameter.

Impact:
Nebraska continued to contribute data to the uniform biological control testing program. While results from the Nebraska experiment were inconclusive as to control efficacy they were consistent with other states.

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?:
While data from past Nebraska experiments suggest that combining biological agents with chemical fungicides might improve the consistency of control, biologicals and chemicals individually need to be improved before the efficacy of the combination can be ensured.

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.

Jochum, C.C., Osborne, L.E., and Yuen. G.Y. 2006 Fusarium head blight biological control with *Lysobacter enzymogenes* strain C3. Biological Control 39:336-344.

Yuen, G.Y, Jochum, C.C., Ruden, K.R., Sweets, L.E., Bleakley, B.H., and Draper, M.A. 2006. 2006 results from the standardized evaluation of biological agents for the control of Fusarium head blight. In: Canty, S.M., Clark, A., and Van Sanford, D. (Eds.), Proceedings of the 2006 National Fusarium Head Blight Forum; 2006 Dec. 10-12; Research Triangle Park, NC. Unversity of Kentucky. pp. 27-30.

Yuen, G.Y. and S.D. Schoneweis. 2007. Strategies for managing Fusarium head blight and deoxynivalenol accumulation in wheat. International Journal of Food Microbiology (in press).