USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY06 Final Performance Report (approx. May 06 – April 07)
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Cover Page

PI:	Jaehyuk Yu
Institution:	University of Wisconsin
Address:	Department of Food Microbiology and Toxicology Food Research Institute 1925 Willow Drive Madison, WI 53706
E-mail:	jyu1@wisc.edu
Phone:	608-262-4696
Fax:	608-263-1114
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USDA-ARS Agreement Title:	Functions of Two Regulators of G Protein Signaling *Fusarium graminearium*.
FY06 ARS Award Amount:	$ 37,594

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Award Amount
PGG	Regulators of G Protein Signaling in Fusarium graminearum.	$ 37,594
	Total Award Amount	**$ 37,594**

June 20, 2007___
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: *Regulators of G Protein Signaling in Fusarium graminearum.*

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

The filamentous fungus *Fusarium graminearum* is one of the most important pathogenic and toxigenic fungi that cause serious crop disease with the ability to produce various kinds of devastating mycotoxins. Fusarium head blight (FHB: scab) of barley and wheat caused by *F. graminearum* is significant and devastating disease in the US and Canada. Infection not only results in decreased yield but also reduced quality of grains by the contamination of grains with mycotoxins. As the goal of the U.S. Wheat and Barley Scab Initiative states, it is highly urgent to develop effective control measures that minimize the threat of FHB to the producers, processors, and consumers of wheat and barley.

Various approaches have been employed to develop practical ways to control FHB. As one supplementary approach for control of fungal disease and mycotoxin problems, we are focusing on understanding the roles of upstream signaling components that can be manipulated to disarm fungal pathogenicity, propagation and toxigenesis systems. Among those components, RGS proteins are known to play a key role in controlling levels of various G protein mediated signals.

The hypothesis of the project was that the *F. graminearum* RGS proteins play crucial roles in controlling a diverse array of biological processes including reproduction, pathogenicity, toxin production and stress response. To test this hypothesis we proposed to delete the three genes encoding additional RGS proteins in *F. graminearum* and examine the effects of deletion of these genes on pathogenicity, toxigenesis and other biology of *F. graminearum*.

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

Through analysis of the *F. graminearum* genome database, we identified three genes encoding three additional RGS proteins and designated them as Fg-*RGS3*, *4* and *5*. In order to investigate the functions of these important proteins, deletion cassettes were generated using Double-Joint PCR technique and individual deletion mutants were generated using a hygromycin resistance marker. The phenotypic changes caused by the absence of *RGS3*, 4, and 5 are currently being investigated in collaboration with Drs. Robert Proctor and Susan McCormick at USDA, Peoria IL. Important pathogen traits to be tested include pathogenicity, mycotoxin production, sexual and asexual reproduction, and stress response. If one or more of five *F. graminearum* RGS proteins (Fg-Rgs1 ~ Fg-Rgs5) is proven to be a good target to control fungal infection in plants, further attempt will be made to silence these genes employing double-stranded RNA (dsRNA) based RNA-interference.

Impact

Outcomes of this research will provide increased understanding of upstream control of pathogen biology that could lead to identification of innovative control strategies. One can envision targeted dsRNA expression in barley and/or wheat that could be used to inactivate one or more RGS proteins in *F. graminearum* upon infection. We believe that this project will have a great impact on wheat and barley protection and improvement as well as improvement of human and animal health.

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 G protein signaling and its tight regulation is essential for all eukaryotic organisms, not much has been known in *F. graminearum*. With the generation of *rgs3*, *rgs4* and *rgs5* deletion mutants coupled with previous accomplishments of constructing *rgs1* and *rgs2* deletion mutants, the *Fusarium* scientific community now has a collection of critical *rgs* mutants. These mutants provide important clues and bases for further investigation of crucial pathogen biology and genetics.

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.

Due to the nature of the project that requires intensive work and time, we expect that the first publication will be made sometime in 2008.