USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY13 Preliminary Final Performance Report
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Cover Page

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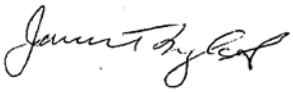
Fiscal Year:	FY13
USDA-ARS Agreement ID:	59-0206-2-089
USDA-ARS Agreement Title:	Effects of Defense Peptides on Fusarium Head Blight.
FY13 USDA-ARS Award Amount:	$ 27,698

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
PBG	Effects of Defense Peptides on Fusarium Head Blight.	$ 27,698
	FY13 Total ARS Award Amount	**$ 27,698**



7/11/14

Principal Investigator Date

* MGMT – FHB Management
FSTU – Food Safety, Toxicology, & Utilization of Mycotoxin-contaminated Grain
GDER – Gene Discovery & Engineering Resistance
PBG – Pathogen Biology & Genetics
BAR-CP – Barley Coordinated Project
DUR-CP – Durum Coordinated Project
HWW-CP – Hard Winter Wheat Coordinated Project
VDHR – Variety Development & Uniform Nurseries – Sub categories are below:
SPR – Spring Wheat Region
NWW – Northern Soft Winter Wheat Region
SWW – Southern Soft Red Winter Wheat Region

Project 1: *Effects of Defense Peptides on Fusarium Head Blight.*

1. What major problem or issue is being resolved relevant to Fusarium head blight (scab) and how are you resolving it?

In this project, we are testing the concept that antifungal peptides can be used to suppress infection of wheat by sexually-produced ascospores of *Gibberella zeae* or macroconidia of the asexual pathogen form, *Fusarium graminearum*. Previous work in the Leslie laboratory showed that pheromone mating peptides produced by *G. zeae* inhibit infectious ascospores. Initial work in this project confirmed this inhibitory potential and expanded its effect to infectious macroconidia. Subsequent project work conducted under laboratory conditions showed that mating peptides protected wheat heads in point inoculation experiments, i.e. pathogen inoculum and mating peptides placed together in the floral tube (stigmatic channel).

During FY 12 we found that the pheromone mating peptides attached to a protein carrier, CKX (cytokinin oxidase/dehydrogenase) and produced via fermentation in a yeast did not protect wheat as we had expected, based on our experience with other plant diseases. Consequently, we decided to focus on synthesized free peptides (without attached CKX) in follow-up field experiments during FY 13.

During the past year (May 2013 – May 2014), we conducted two greenhouse trials to evaluate the ability of mating peptides in the free form (not attached to a protein carrier) to protect wheat from infection and scab development. Two mating peptides, Pnc and Pgz, were synthesized commercially. Each of these had been shown in previous in vitro experiments to inhibit germination and development of infective G. zeae ascospores. In the greenhouse experiments, each of these peptides was tested individually at a 20µM concentration, which was shown to be inhibitory to the pathogen in previous studies. In each trial, peptides Pnc and Pgz were sprayed onto to florets until run-off. Immediately after application, florets were spray-inoculated with ascospores (10,000 spores/ml) of G. zeae. A control treatment was included in which plants were sprayed to run-off with deionized water prior to ascospore inoculation. Inoculated plants of all treatments were placed immediately into a humidity chamber, and were examined 2 weeks later for scab symptoms. In trials 1 and 2, scab incidence in the control treatment was 100 and 84%, respectively. In each trial, the scab incidence for florets treated with Pnc or Pgz did not differ significantly from the respective control treatment.

The reason for a lack of significant scab control by mating peptides sprayed onto florets is not clear. It is possible that peptide concentrations following application were depleted by run-off or degradation. Thus,the lack of scab control from sprayed peptides might be related to an insufficient contact of the peptides with the pathogen on the surface of the florets. It is likely that a higher peptide concentration in the spray or a longer period of contact between peptides and pathogen is necessary to limit infection, tissue colonization and disease. Such longer-term inhibition could be better achieved in plants that have been transformed to produce a consistent supply of peptides, such as Pnc or Pgz, over time.

In order to develop mating peptides in a tool for scab control, it will be important to evaluate the stability of the peptides when applied to plant surface. Then it may be necessary to identify measures to improve peptide dispersal and stability. It would also be beneficial to determine whether the mating peptides that inhibit G. zeae are limited in their activity to this pathogen, or whether they have broader inhibitory potential against other ascomycetous pathogens of importance on wheat, such as Pyrenophora. Determination of the inhibitory range of mating peptides inhibition will contribute to assessment of priorities in developing transgenic wheat for disease resistance.

2. List the most important accomplishments and their impact (i.e. how are they being used) to minimize the threat of Fusarium Head Blight or to reduce mycotoxins. Complete both sections; repeat sections for each major accomplishment:

Accomplishment:

We have determined that inhibitory mating peptides, when applied to the surface of wheat florets, do not effectively limit infection by G. zeae and subsequent scab development.

Impact:

Results of these experiments suggest a need to develop transgenic wheat for effective production and delivery of inhibitory mating peptides within susceptible plant tissues.

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 FY13 grant. Please reference each item using an accepted journal format. If you need more space, continue the list on the next page.

None this year.