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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Fiscal Year:	2007
USDA-ARS Agreement ID:	59-0790-6-063
USDA-ARS Agreement Title:	A Rapid Assay System for Trangenes that Confer Resistance to DON and FHB.
FY07 ARS Award Amount:	$ 50,052

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Adjusted Award Amount
GET	A Rapid Assay System for Transgenes that Confer Resistance to DON and FHB.	$50,052
	Total Award Amount	**$ 50,052**

7/13/08

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: *A Rapid Assay System for Transgenes that Confer Resistance to DON and FHB.*

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

There is an urgent need in the field for germplasm and genes that can enhance resistance of wheat and barley to FHB and thereby prevent the accumulation of DON. Because transformation of wheat and barley is time- and resource-consuming, it is not possible to screen large numbers of transgenes genes for their activity against FHB in these systems. We have addressed this problem by developing a rapid and efficient gene assay system based on the recombinogenic plant *Physcomitrella patens*, which allows gene function to be rapidly and inexpensively assessed through the creation of gene knockout or overexpression lines. By exploiting this plant as a rapid assay system, we have been able to identify a number of genes that confer resistance to DON and to FHB. Genes that are effective in Physcomitrella have been passed on to our collaborators in the USWBSI program who can validate their performance in a transient assay for efficacy against FHB in wheat. Cumulatively, these linked assays constitute a research and development pipeline for gene discovery and deployment of novel anti-FHB genes in wheat.

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:
We have characterized a collection of genes for efficacy against DON and FHB in Physcomitrella. These genes define independent pathways for conferring resistance to FHB and DON and identify multiple targets for improving FHB-resistance in wheat through classical or molecular approaches. Wheat versions of these genes are also effective against FHB in Physcomitrella. Constructs designed to suppress the activity of these anti-FHB genes in wheat have been developed and are being assayed for efficacy against FHB in whole wheat plants. These studies allow highly performing anti-FHB genes to be selected for introduction into transgenic wheat plants.

Impact:
These developments constitute a research and development pipeline for screening genes for DON and FHB resistance. They provide a collection of genes that can be targeted for improvement by molecular or marker-assisted methods or through gene transfer. They also establish the R&D pipeline for the discovery and deployment of additional genes as these are uncovered from ongoing screens.

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 scientific community has access to the anti-FHB genes that we have validated in Physcomitrella, along with an indication of their utility for improving crop plants. The scientific and agricultural communities can design better, more rational and robust strategies for improving FHB resistance based on the results of our mechanistic studies in Physcomitrella. These communities will also benefit from the establishment of a dedicated route-to-deployment for anti-FHB genes into wheat.

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.

Publications:

Saidasan, H. and Lawton, M. (2007) In Proceedings of the 2007 National Fusarium Head Blight Forum (Eds, Canty, S. M., Clarke, A., Ellis, D. and Van Sanford, D.) University of Kentucky, Kansas City, MO, pp. 58.

Lawton, M and Saidasan, H. (2008). Physcomitrella Pathogenesis. In The Moss, Physcomitrella, C, Knight, D. Cove and P.-F. Perroud, Eds. Annual Plant Reviews, Wiley-Blackwell, Oxford. *In press*

Presentations:

Genes that confer resistance to Fusarium. Second Annual Rutgers Mini-Symposium: Cultivating Traditions, Current Strengths and Future Frontiers, Feb January 7-8, 2008, Poster Presentation.

Genes that confer resistance to Fusarium. National Fusarium Head Blight Forum, Kansas City, MO, Dec 2-4, 2007. Invited Speaker.

Genes that confer resistance to Fusarium. National Fusarium Head Blight Forum, Kansas City, MO, Dec 2-4, 2007. Poster Presentation.

Gene networks that control disease susceptibility in *Physcomitrella patens*, Dept. Chemistry, University of Sao Paulo, SP, Brazil, Dec 12, 2007. Invited Speaker.

Mechanisms of moss deconstruction: Microbial Infection of *Physcomitrella*, Moss 2007, Korea University, Seoul, Korea, August 2007. Invited Presentation.

Physcomitrella patens: a model genetic system for understanding susceptibility to Fusarium Head Blight. 5th Tripartite Symposium in Biotechnology and BioEnergy, New Brunswick, NJ. April 9-12, 2007. Poster presentation.