USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY12 Final Performance Report
July 16, 2013

Cover Page

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Fiscal Year:	FY12
USDA-ARS Agreement ID:	59-0206-1-112
USDA-ARS Agreement Title:	A Rapid Assay System for Transgenes that Confer Resistance to DON and FHB.
FY12 USDA-ARS Award Amount:	No Cost Extension (NCE)

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
BAR-CP	High Efficiency Method for Generating FHB-Resistant Barley: Removing Bottlenecks in the Pipeline for Deploying FHB Resistance Genes.	NCE
	Total ARS Award Amount	**NCE**

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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: *High Efficiency Method for Generating FHB-Resistant Barley: Removing Bottlenecks in the Pipeline for Deploying FHB Resistance Genes.*

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

   There is a great need for new sources of resistance to FHB, given the difficulty of identifying FHB resistance genes in existing collection of wheat and barley germplasm. We previously used *Physcomitrella patens*, whose genome is highly amenable to site-specific modification to identify both endogenous and foreign genes whose modification leads to a change in susceptibility to FHB. This system was used to identify genes that decrease susceptibility(in effect, enhancing resistance) to the mycotoxin DON and to infection with FHB. Genes identified in this screen appear to operate through distinct molecular pathways, suggesting the possibility of multiple approaches for enhancing FHB resistance in field crops. To test the effect of the corresponding wheat or barley genes, we have introduced the appropriate coding sequences in either overexpression or RNAi suppressor vectors that can be introduced and expressed in transgenic barley. Introduction of these constructs into transgenic crops will allow the efficacy of these gene manipulations to be assayed in the context of other FHB-resistance factors and under field conditions of the disease.

   This project addresses the GDER goal to efficiently identify candidate genes for resistance against FHB and reduced DON accumulation through high-throughput functional screening assays and Objectives 4 and 6 of the Barley Coordinated Project to develop barley varieties with enhanced resistance to FHB and to evaluate promising transgenes in adapted genetic backgrounds.

2. **List the most important accomplishment and its impact (i.e. how is it being used) to minimize the threat of Fusarium head blight or to reduce mycotoxins. Complete both sections (repeat sections for each major accomplishment):**

   Accomplishment:

   Genes identified in *Physcomitrella patens* as effective against FHB reveal a number of approaches for interfering with the pathology of the disease. Genes identified in our screen are predicted to play a role in regulating cell death, ER stress and the unfolded protein response and induced immunity. These studies suggest that conserved pathways may be targeted by the pathogen and that approaches that are effective in other model systems may also be so in wheat and barley. This opens up the use of wild-type and mutant genes from other pathosystems to be assayed in wheat and barley. To test this notion, we have constructed vectors that will be used by our collaborators in the project to create transgenic lines that overexpress components of induced immune signaling or that are suppressed for components that contribute to disease susceptibility so that these can be tested for altered sensitivity to FHB.

Impact:

These studies will directly test whether resistance to FHB can be conferred by overexpressing signaling components of the induced immune response or by suppressing components required for disease susceptibility. Assay of transgenic plants expressing these gene constructs will also test the validity of the rapid assay system for selecting and screening genes that are effective in barley and indicate which disease resistance/ susceptibility mechanisms are conserved. If effective, then transgenic barley plants can be used to introduce resistance into field varieties via conventional breeding programs.

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