

**USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY11 Final Performance Report
July 13, 2012**

Cover Page

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Fiscal Year:	FY11
USDA-ARS Agreement ID:	NA
USDA-ARS Agreement Title:	Transgenic Barley for FHB Resistance.
FY11 USDA-ARS Award Amount:	\$ 50,063

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
BAR-CP	Field Tests of Transgenic Barley Lines.	\$ 6,790
BAR-CP	High Efficiency Method for Generating FHB-Resistant Barley: Removing Bottlenecks in the Pipeline for Deploying FHB Resistance Genes.	\$ 21,125
GDER	Development and Testing of Improved Enzymes for Transgenic Control of FHB.	\$ 22,148
	Total ARS Award Amount	\$ 50,063

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: *Field Tests of Transgenic Barley Lines.***1. What major problem or issue is being resolved relevant to Fusarium head blight (scab) and how are you resolving it?**

Transgenic approaches have the potential to increase resistance to FHB and reduce DON in barley. We are conducting replicated field trials of transgenic barley lines developed by multiple labs supported by the USWBSI. Collaborator lines are in the cultivar Golden Promise, so we crossed their lines three times to the adapted cultivar Conlon and developed homozygous lines for field testing in 2012.

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:**

Eighteen barley lines were tested in the North Dakota FHB transgenic nursery in the summer of 2011, and tested for DON content after harvest. Twelve of the lines showed significantly less DON than the resistant control CI4196, and several lines showed less DON than Conlon.

Impact:

Multiple years of testing confirmed that two transgenic lines show approximately 40% less DON than wild type Conlon. These lines are being backcrossed to Quest and ND20448 to see if the transgene effects are additive to the genes bred into barley using traditional methods.

Project 2: *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?**

Multiple candidate genes that may reduce FHB and/or DON have been identified through USWBSI-funded research, using Physcomitrella and VIGS in wheat. We are using transgenic approaches to insert and express these genes in barley. Homozygous lines are being developed and will be tested in the ND and MN transgenic FHB nurseries.

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:

Four constructs were received from collaborator Steve Scofield (ARS). Putative transgenic plants have been obtained from three of the four constructs and work continues with the fourth gene.

Impact:

Production of initial transgenic plants gives us materials to develop homozygous lines expressing the transgenes. As the lines are developed, they will be entered in the transgenic FHB nurseries to test the effects of each gene on FHB levels and DON contamination.

Project 3: *Development and Testing of Improved Enzymes for Transgenic Control of FHB.***1. What major problem or issue is being resolved relevant to Fusarium head blight (scab) and how are you resolving it?**

Research has shown that Tri101 from *F. graminearum* could be altered to improve activity and stability. Collaborator Ivan Rayment has provided us with constructs containing the wild-type and improved *Tri101* genes. We are inserting the genes into barley to test effects on DON contamination in FHB-infected barley.

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:**

Several transgenic plants containing the wild-type and mutant genes were generated. Unfortunately, the expression levels were not sufficient to provide protein for analyses.

Impact:

Lack of gene expression caused us to develop a new mutant gene with codon usage optimized for cereal expression. Transformation experiments using a construct containing this new gene are underway.

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.

Dahleen, L.S., W. Morgan, S. Mittal, P. Bregitzer, R.H. Brown, and N.S. Hill. Quantitative trait loci (QTL) for *Fusarium* ELISA compared to QTL for Fusarium head blight resistance and deoxynivalenol content in barley. *Plant Breeding* 131:237-243. 2012. (From previously funded research)

Dahleen, L.S., R. Brueggeman, T. Abebe, and R. Skadsen. 2011. Field tests of transgenic barley lines in North Dakota. In: S. Canty, A. Clark, A. Anderson-Scully, D. Ellis, and D. Van Sanford (eds), *Proceedings of the 2011 National Fusarium Head Blight Forum* (p. 82). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative.

Syverson, R.L., A.M. Elakkad, **L.S. Dahleen**, V.J. Nalam, G. Klossner, J. Shah, and R. Dill-Macky. 2011. Testing transgenic wheat and barley lines for reaction to Fusarium head blight: 2011 field nursery report. In: S. Canty, A. Clark, A. Anderson-Scully, D. Ellis, and D. Van Sanford (eds), *Proceedings of the 2011 National Fusarium Head Blight Forum* (p. 97). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative.