

**USDA-ARS/  
U.S. Wheat and Barley Scab Initiative  
FY08 Preliminary Final Performance Report (April 09 – April 10)  
No Cost Extension for FY09 and FY10  
July 15, 2010**

**Cover Page**

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<b>Fiscal Year:</b>	2008
<b>USDA-ARS Agreement ID:</b>	59-0790-6-057
<b>USDA-ARS Agreement Title:</b>	Engineering Barley with Antifungal Gene Gastrodianin to Enhance Resistance to Scab Disease.
<b>FY08 ARS Award Amount:</b>	\$ 12,819

**USWBSI Individual Project(s)**

<b>USWBSI Research Area*</b>	<b>Project Title</b>	<b>ARS Adjusted Award Amount</b>
FY08-DA-012	Transformation and Field Testing of Transgenic Barley Lines.	\$ 12,819
	<b>Total Award Amount</b>	<b>\$ 12,819</b>

*Tilahun Abebe*

Principal Investigator

July 12, 2010

Date

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\* 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:** *Transformation and Field Testing 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?**

Enhancing resistance to *Fusarium* head blight (FHB) can improve yield and quality of barley. We have developed barley lines expressing antifungal *gastrodianin* gene from the Chinese herb *Gastrodia elata*. Gastrodianin inhibits the growth of many fungi, including *Fusarium graminearum*. To achieve maximum protection, expression of *gastrodianin* was targeted to the husk and epidermis of the kernel using the spike-specific *Lem2* promoter isolated from Morex 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 all three sections (repeat sections for each major accomplishment):**

**Accomplishment:**

In FY08, transgenic Golden Promise barley lines were tested for resistance to FHB in a greenhouse screen conducted by Dr. Ruth Dill-Macky at the University of Minnesota, St. Paul. Resistance was assessed on T2 plants from seven transformation events. The greenhouse screen revealed that line 58D5 had the lowest FHB severity (24%) compared with the wild type Golden Promise (55.9%) or Golden Promise transformed with *gfp* only (43.5%).

Furthermore, to verify the reduced susceptibility of 58D5 to FHB is real, more greenhouse tests are planned for 2010/11. Field tests are currently underway in collaboration with Dr. Lynn Dahleen, USDA-ARS, Fargo, ND and Dr. Ruth Dill-Macky, University of Minnesota, St. Paul, MN. Golden Promise is not suitable for screening resistance under field conditions. Dr. Lynn Dahleen has crossed the transgenic Golden Promise lines with Conlon. Improved lines in Conlon background are used for the field test.

**Impact:**

The greenhouse test indicates that at least one transgenic line is resistant to FHB. Transgenic Golden Promise lines were crossed with Conlon for field testing. Field testing is underway. If the field tests showed results comparable to the greenhouse screening, *gastrodianin* will be an excellent choice to combat FHB of barley.

**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 LS, Dill-Macky R, Shah J, Muehlbauer G, Skadsen RW, Manoharan M, Tilahun A, Jurgenson J. 2009. Transgenic field trials for fhb resistance and related research in wheat and barley. In: Ouellet T and Leger D (eds). Proceedings of the 6<sup>th</sup> Canadian Workshop on Fusarium Head Blight, November 1-4, 2009, Ottawa, ON, Canada, p. 38.
- NG EH, Abebe T, Skadsen RW, Jurgenson JE. 2008. Engineering barley with *gastrodianin* for resistance to scab disease. Poster presented at the American Phytopathological Society centennial meeting, July 26-30, 2008, Minneapolis, MN.
- Abebe T, Ng EH, Skadsen R and Jurgenson JE. 2008. Progress in engineering barley with *gastrodian* for resistance to scab disease. Presentation given at the Barley Coordinated project Meeting, Ft. Collins, CO, June 3, 2008.
- Ng EH, Abebe T, Jurgenson JE and Skadsen RW. 2007. Engineering barley with *gastrodianin* for improved resistance to *Fusarium* head blight. Proceedings of the National Fusarium Head Blight Forum, 2-4 December, 2007, Kansas City, MO, p. 54-57.