USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY09 Final Performance Report
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Cover Page

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Fiscal Year:	2009
USDA-ARS Agreement ID:	NA
USDA-ARS Agreement Title:	Field Testing of Transgenic Barley and Development of New Lines with Improved Enzymes.
FY09- USDA-ARS Award Amount:	$ 33,074

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Adjusted Award Amount
BAR-CP	Transformation and Field Testing of Transgenic Barley Lines.	$ 13,074
GDER	Development and Testing of Improved Enzymes for Transgenic Control of FHB.	$ 20,000
	Total Award Amount	**$ 33,074**

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 Winter Wheat Region
SWW – Southern Sinter Wheat Region

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?**

   Resistance to FHB is limited in barley, so transgenic lines have been developed expressing genes that might reduce FHB and DON. This project evaluated transgenic lines in replicated field trials to get an accurate assessment of the potential of the transgenes. In 2009, 48 lines were tested for the third year in the FHB nursery. Several transgenic lines in other labs were developed in the cultivar Golden Promise, which cannot be field tested in North Dakota because of lack of adaptation. These lines were crossed twice to the adapted cultivar Conlon so they can be tested in 2010 field trials.

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: Two transgenic Conlon barley lines were identified as consistently having 25-34% less DON than wild type Conlon after three years of testing.

   Impact: These lines are being crossed with the new cultivars from the MN and ND breeding programs to see if the resistance provided by the transgenes is additive to the resistance being bred in by traditional methods.

Project 2: *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?**

   Additional strategies are needed to reduce DON contamination in FHB-infected barley. Co-PI Ivan Rayment has applied protein engineering to the trichothecene 3-*O*-acetylase (Tri101) from *F. sporotrichioides* and *F. graminearum* to improve the function and stability of the enzyme, and inserted the improved genes into plasmids for *Agrobacterium*-mediated transformation. We are using these plasmids to transform 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: The main accomplishment in 2009 was initiating *Agrobacterium*-mediated transformation methods in my lab. As with any new method of this complexity, there are a number of difficulties to overcome to get the system working properly. At this point, we have learned how to prevent *Agrobacterium* overgrowth on our barley callus and determined optimal co-cultivation times in our conditions. This has led to transformed callus, but the antibiotics for selection have limited green plant regeneration. Tests of media components are underway to improve regeneration rates.

   Impact: Once we have the *Agrobacterium* methods optimized for our conditions, we will have an efficient method to test new genes in barley for their effects on FHB and DON.

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.

1. Dahleen, L.S., R. Dill-Macky and S.M. Neate. 2008 FHB analysis of transgenic barley lines. National Fusarium Head Blight Forum Proceedings. p. 106. 2008.

2. Dill-Macky, R., A.M. Elakkad, K.J. Wennberg, N.E. Tumer, R. Di, J. Shah, and L.S. Dahleen. Testing transgenic spring wheat and barley lines for reaction to Fusarium head blight: 2008 field nursery report. National Fusarium Head Blight Forum Proceedings. p. 107. 2008.

3. Dahleen, L., Dill-Macky R., Shah, J., Muehlbauer, G., Skadsen, R., Manoharan, M., Abebe, T., and Jurgenson, J. Transgenic field trials for FHB resistance and related research in wheat and barley. In: Ouellet, T. and Leger, D. (eds.). Proceedings of the 6th Canadian Workshop on Fusarium Head Blight. Nov. 1-4, 2009. Ottawa, ON, Canada. P. 38. 2009.

4. Dill-Macky, R., Wennberg, K.J., Scanlan, T.C., Muehlbauer, G.J., Shin, S., Shah, D., Kaur, J. and Dahleen, L.S. Testing transgenic spring wheat and barley lines for reaction to Fusarium head blight: 2009 field nursery report. In: S. Canty, A. Clark, J. Mundell, E. Walton, D. Ellis and D. Van Sanford (eds.), Proceedings of the National Fusarium Head Blight Forum; 2009 Dec 7-9; Orlando FL. Lexington, KY: University of Kentucky pp. 189. 2009