USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY14 Final Performance Report
July 15, 2015

Cover Page

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Fiscal Year:	FY14
USDA-ARS Agreement ID:	59-0200-3-002
USDA-ARS Agreement Title:	Management and Resistance Sources for Control of FHB in Barley.
FY14 USDA-ARS Award Amount:	$ 15,261

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
BAR-CP	Coordination of the NABSEN and Collaborative Screening of Western US Barley Germplasm.	$ 15,261
	FY14 Total ARS Award Amount	**$ 15,261**

Principal Investigator Date

* MGMT – FHB Management
FSTU – Food Safety, Toxicology, & Utilization of Mycotoxin-contaminated Grain
GDER – Gene Discovery & Engineering Resistance
PBG – Pathogen Biology & Genetics
EC-HQ – Executive Committee-Headquarters
BAR-CP – Barley Coordinated Project
DUR-CP – Durum Coordinated Project
HWW-CP – Hard Winter Wheat Coordinated Project
WES-CP – Western 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: *Coordination of the NABSEN and Collaborative Screening of Western US Barley Germplasm.*

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

Barley production in the Midwestern United States has declined over the past twenty years with production moving further west as Scab influences producer' in the Midwest to grow other more reliable crops. However, as corn production moves west the Scab problem has followed threatening production in the western states as well. This project is aimed at helping to resolve these issues by assisting the Upper Midwestern and Western breeding programs development of genetically resistant barley varieties. Adequate genetic resistance in combination with fungicide use and cultural practices can mitigate the effects of the disease. The main objective of this project was to coordinate the North American Scab Evaluation Nursery (NABSEN) screening of elite barley germplasm in uniform established FHB nurseries in the Upper Midwestern United States and Canada.

Mist-irrigated and naturally irrigated nurseries were planted at six sites (Fargo, Langdon, and Casselton, ND; St. Paul and Crookston MN, and Brandon, Manitoba) over the past two years to evaluate advanced barley lines from the North Dakota State University, University of Minnesota, Busch Ag, and the Agri-Food Canada breeding programs as well as two sites in North Dakota to screen materials from Washington State University, USDA-Aberdeen, Idaho, and MillerCoors breeding programs. We coordinated the NABSEN by received and redistributed all the seed, establishing two of the mist irrigated nurseries at Fargo and Langdon, ND, producing the corn spawn inoculum to supplement with *Fusarium graminearum* spores for three nurseries (Fargo, Langdon and Osnabrock, ND) and received collated and prepared the final NABSEN reports. The FHB nurseries have been continually established and evaluated for more than 15 years with all the NABSEN nurseries containing the same sets of elite breeding germplasm with putative FHB resistances.

2. **List the most important accomplishments and their impact (i.e. how are they being used) to minimize the threat of Fusarium Head Blight or to reduce mycotoxins. Complete both sections; repeat sections for each major accomplishment:**

<u>Accomplishment:</u>

In 2014 the NABSEN contained 44 elite breeding lines, 4 resistant and 2 susceptible controls, Chevron, Quest and ND 20493(resistant six-row checks), Robust and Stander (susceptible six-row checks), and Conlon (resistant two-row check). Short rows with three replications were planted at each of seven locations (Fargo, Langdon, Casselton, and Osnabrock, ND; St. Paul and Crookston MN, and Brandon, Manitoba), however the Brandon location was lost due to flooding. FHB severity was recorded at Fargo, Langdon, St. Paul, and Crookston; all of these locations were under mist irrigation except. DON levels were recorded from all six locations in the US. Disease levels in 2014 were low in the Crookston, Casselton and Osnabrock unmisted nurseries thus no FHB incidence or severity data were recorded from these nurseries. FHB disease levels were low at Fargo, Langdon

and St. Paul misted locations; while Crookston had moderate FHB severity. DON levels were high at Langdon and Fargo, ND while at Crookston and St. Paul, MN the levels of DON were moderate. Osnabrock dry land had low DON levels.
Plants were harvested and samples analyzed for DON in Dr. Paul Schwarz's lab at North Dakota State University. DON levels varied much between locations with the dryland locations having the lowest levels with a range from 0.02-2.9 ppm and misted nurseries ranged from 3.1 to 22.6 ppm. The Agriculture and Agri-Food Canada two-rowed line HB 625 had the lowest mist irrigated DON level (3.1 ppm), which was lower than Conlon the two-rowed standard with a mean DON level of 9.4. The University of Minnesota six-rowed line M161 had the lowest DON accumulation levels of all the six-rowed lines grown under irrigation (8.0 ppm), which was slightly higher than the six-row resistant standard ND20493, which had a mean DON level of 7.0. Seed was also redistributed and sent to Nanjing, China for testing. The 2014 NABSEN final report was submitted and posted.

We also screened 54 and 100 WSU and USDA-Aberdeen, Idaho cultivars and elite breeding lines for Dr. Kevin Murphy and Dr. Gongshe Hu, respectively. Thus, overall the NABSEN nurseries grown in the US in 2014 were a success and robust evaluation of the elite materials for Midwest and Western breeding programs was accomplished.

Impact:

Significant progress is being made toward developing FHB resistant barley cultivars. All North American barley breeders have access to the data collected in this project. The breeders are able to use the relative performance data to make decisions about continuing or dropping particular breeding lines. Breeders now have: 1) tests of the resistance stability of their breeding lines across a range of environments and disease pressures; 2) a measure of the resistance in their advanced lines compared to those of the other barley breeders in North America; 3) access to unique germplasm with resistance to FHB and DON accumulation. Record numbers of FHB resistant lines are being submitted for AMBA testing and these lines underwent evaluation in the NABSEN.

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY14 award period. The term "support" below includes any level of benefit to the student, ranging from full stipend plus tuition to the situation where the student's stipend was paid from other funds, but who learned how to rate scab in a misted nursery paid for by the USWBSI, and anything in between.

1. **Did any graduate students in your research program supported by funding from your USWBSI grant earn their MS degree during the FY14 award period?**
   None

   If yes, how many?
   N/A

2. **Did any graduate students in your research program supported by funding from your USWBSI grant earn their Ph.D. degree during the FY14 award period?**
   None

   If yes, how many?
   N/A

3. **Have any post docs who worked for you during the FY14 award period and were supported by funding from your USWBSI grant taken faculty positions with universities?**
   None
   If yes, how many?
   N/A

4. **Have any post docs who worked for you during the FY14 award period and were supported by funding from your USWBSI grant gone on to take positions with private ag-related companies or federal agencies?**
   None

   If yes, how many?
   N/A

Include below a list of all germplasm or cultivars released with full or partial support of the USWBSI during the FY14 award period. List the release notice or publication. Briefly describe the level of FHB resistance. *If not applicable because your grant did NOT include any VDHR-related projects, enter N/A below.*

The line ND-Genesis released in FY14 (See Dr. Richard Horsley's report) was evaluated in the NABSEN in previous years.

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 FY14 grant. Please reference each item using an accepted journal format. If you need more space, continue the list on the next page.

Friskop, Andrew, Robert Brueggeman, Marcia McMullen, Patrick Gross, Joel Ransom, Scott Halley, Pravin Gautam, Ruth Dill-Macky, Larry Osborne, Kay Ruden and Pierce A. Paul. 2014. "The Effectiveness of an Integrated Strategy to Manage Fusarium Head Blight in Barley Production using a Meta-Analysis Approach." In: S. Canty, A. Clark, N. Turcott and D. Van Sanford (Eds.), *Proceedings of the 2014 National Fusarium Head Blight Forum.* East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative. p. 15.

Gross, P.L., A. Friskop, J. Ransom and R. Brueggeman. 2014. "The Use of Integrated Management Strategies to Lower FHB DON in Barley." In: S. Canty, A. Clark, N. Turcott and D. Van Sanford (Eds.), *Proceedings of the 2014 National Fusarium Head Blight Forum.* East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative. p. 16.