USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY15 Final Performance Report
Due date: July 15, 2016

Cover Page

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Fiscal Year:	2015
USDA-ARS Agreement ID:	59-0206-4-009
USDA-ARS Agreement Title:	Developing 6- and 2-rowed Malting Barley Cultivars with Enhanced FHB Resistance and Reduced DON Accumulation.
FY15 USDA-ARS Award Amount:	$ 185,705
Recipient Organization:	North Dakota State University Office of Grant & Contract Accouting NDSU Dept 3130, PO Box 6050 Fargo, ND 58108-0650
DUNS Number:	80-388-2299
EIN:	45-6002439
Recipient Identifying Number or Account Number:	FAR0022042
Project/Grant Reporting Period:	05/03/15-05/02/16
Reporting Period End Date:	05/02/16

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
BAR-CP	Developing 6- and 2-rowed Malting Barley Cultivars with Enhanced FHB Resistance and Reduced DON Accumulation.	$ 185,705
	FY15 Total ARS Award Amount	**$ 185,705**

Principal Investigator Date

* MGMT – FHB Management
FST – Food Safety & Toxicology
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
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: *Developing 6- and 2-rowed Malting Barley Cultivars with Enhanced FHB Resistance and Reduced DON Accumulation.*

1. What are the major goals and objectives of the project?

The overall goal of this project is to develop six- and two-rowed malting barley cultivars with enhanced resistance to FHB and reduced DON accumulation. In FY2015, our goals were: 1) continued development and screening of six- and two-rowed barley lines in our breeding program for reduced FHB and DON, 2) growing the North American Barley Scab Evaluation Nursery (NABSEN) at our Osnabrock, ND research site, 3) collect FHB and DON data on cultivars and advanced breeding lines that can be used by growers for making decisions on what cultivar(s) to grow.

2. What was accomplished under these goals?

1) major activities
- Made over 200 crosses to incorporate improved agronomic performance, end-use quality, and reduced DON accumulation.
- Evaluated over 1,500 experimental barley lines in replicated yield trials at up to seven locations in North Dakota.
- Grew over 24,000 F4 head rows that included material that had at least one parent in its pedigree that had reduced DON accumulation.

2) specific objectives
- We identified breeding lines with reduced DON accumulation that were submitted to the American Malting Barley Association's (AMBA) Pilot Scale evaluation program.
- We grew the NABSEN trial at our Osnabrock research site and submitted harvested grain samples to Dr. Paul Schwarz's lab for DON determination.

3) significant results
The two-rowed line 2ND28065 was approved for advancement to the AMBA's Plant Scale evaluation program in 2016. This is the last step of testing that needs to be satisfied before a line is added to the AMBA's List of Recommended Malting Barley Varieties. 2ND28065 accumulates about 22% less DON than ND Genesis. Additionally, 2ND28065 has a 4% yield advantage over ND Genesis.

4) key outcomes or other achievements
- Released the two-rowed variety ND Genesis in December 2015. This variety is considered a replacement for Pinnacle two-rowed barley. ND Genesis accumulates about 20% less DON than Pinnacle. We received seed requests of over 60,000 bu, but we only had 9,000 bu for distribution.
- ND Genesis was added to the AMBA's List of Recommended Malting Barley Varieties.

3. What opportunities for training and professional development has the project provided?

- Renata Jung, a Ph.D. student from Brazil, completed her PhD. Her dissertation research used a subset of the NDSB Barley CAP lines to identify SNP markers that can be used for marker-assisted selection for agronomic, disease resistance, and malt quality traits.
- José Rivera, an M.S. student from Puerto Rico, is conducting research using the Robust x Stander mapping population to identify genes controlling malt quality and agronomic performance in Midwest six-rowed barley.
- Dr. Geovana Entringer, Ms. Claudia Paiva, and Ricardo Sayd are visiting scientists from Brazil working on the barley breeding program. They are receiving training on conventional breeding and utilization of data from biparental and association mapping to identify SNPs for marker-assisted selection and genomic selection.

4. How have the results been disseminated to communities of interest?

Results are disseminated via articles in peer-reviewed journals and popular press, field day presentations, and presentations to stakeholder groups at local and regional meetings. All phenotype and genotype for NDSU lines tested in replicated yield trials is being uploaded to T3.

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY15 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 FY15 award period?** No

   If yes, how many?

2. **Did any graduate students in your research program supported by funding from your USWBSI grant earn their Ph.D. degree during the FY15 award period?** Yes

   If yes, how many? 1

3. **Have any post docs who worked for you during the FY15 award period and were supported by funding from your USWBSI grant taken faculty positions with universities?** No

   If yes, how many?

4. **Have any post docs who worked for you during the FY15 award period and were supported by funding from your USWBSI grant gone on to take positions with private ag-related companies or federal agencies?** No

   If yes, how many?

Release of Germplasm/Cultivars

Instructions: In the table below, list all germplasm and/or cultivars released with full or partial support through the USWBSI during the FY15 award period. All columns must be completed for each listed germplasm/cultivar. Use the key below the table for Grain Class abbreviations. *Leave blank if you have nothing to report or if your grant did NOT include any VDHR-related projects.*

Name of Germplasm/Cultivar	**Grain Class**	**FHB Resistance** (S, MS, MR, R, where R represents your most resistant check)	**FHB Rating** (0-9)	**Year Released**
ND Genesis	BAR	MR	3	2015

Add rows if needed.

NOTE: List the associated release notice or publication under the appropriate sub-section in the 'Publications' section of the FPR.

Abbreviations for Grain Classes

Barley - BAR
Durum - DUR
Hard Red Winter - HRW
Hard White Winter - HWW
Hard Red Spring - HRS
Soft Red Winter - SRW
Soft White Winter - SWW

Publications, Conference Papers, and Presentations

Refer to the FY15-FPR_Instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY15 grant. If you did not have any publications or presentations, state 'Nothing to Report' directly above the Journal publications section.

Journal publications.

Bianchini, A., R. Horsley, M. Jack, D. Ryu, S. Tittlemier, W.W. Wilson, H.K. Abbas, S. Abel, G. Harrison, J.D. Miller, W.T. Shier, and G. Weaver. 2015. DON occurrence in grains: a North American perspective. Cereal Foods World 60:32-56.
Status: Published
Acknowledgement of Federal Support: No

Books or other non-periodical, one-time publications.

Nothing to Report

Other publications, conference papers and presentations.

- Presented invited talks at field days held in Presque Isle, Me, Amherst, MA, and Alburgh, VT. These field days were organized by personnel at the University of Maine, University of Massachusetts-Amherst, and University of Vermont, respectively. Presentations included discussions on the levels of resistance to FHB and DON accumulation of different barley lines.
  Status: Presented
  Acknowledgement of Federal Support: Not applicable for these presentations.
- Presented an invited talk at the Hettinger Research Extension field day in July 2015. Presentation included discussions on the levels of resistance to FHB and DON accumulation of different barley lines.
  Status: Presented
  Acknowledgement of Federal Support: Not applicable for these presentations.
- Co-hosted the 2015 Craft brewer/maltster field class in July 2015. Presentation included discussions on the levels of resistance to FHB and DON accumulation of different barley lines.
- Presented an invited talk barley variety quality characteristics of Midwest barley varieties to a Mexican trade team hosted by the US Grains Council and the ND Barley Council in September 2015. Presentation included discussions on the levels of resistance to FHB and DON accumulation of different barley lines.
  Status: Presented
  Acknowledgement of Federal Support: Not applicable for these presentations.
- Presented an invited talk on barley breeding at the NDSU-NCI Barley and Malt Short Course, October 2015. Presentation included discussions on the levels of resistance to FHB and DON accumulation of different barley lines.
  Status: Presented
  Acknowledgement of Federal Support: Not applicable for these presentations.

- Presented an invited talk on adaptation of barley varieties for the eastern US at the 2016 Farmer-Brewer Weekend. Presentation included discussions on the levels of resistance to FHB and DON accumulation of different barley lines.
  Status: Presented
  Acknowledgement of Federal Support: Not applicable for these presentations.