USDA-ARS
U.S. Wheat and Barley Scab Initiative
FY17 Final Performance Report – NCE for FY18
Due date: July 12, 2019

Cover Page

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Fiscal Year:	2017 (NCE for FY18)
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.
FY17 USDA-ARS Award Amount:	$ 185,193
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:	5/3/18 - 5/2/19
Reporting Period End Date:	05/02/19

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
BAR-CP	Developing 6- and 2-rowed Malting Barley Cultivars with Reduced FHB and DON.	$ 185,193
	FY17 Total ARS Award Amount	$ 185,193

Kirk O. Horsley 7/5/2019

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 Reduced FHB and DON.*

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

The overall goal of this project is to develop two- and six-rowed malting barley cultivars with enhanced resistance to FHB and reduced DON accumulation. In FY17, our goals were: 1) continued development and screening of two- and six-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, and 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? *Address items 1-4) below for each goal or objective.*

1) major activities

- Made 95 crosses to incorporate improved agronomic performance, end-use quality, and reduced DON accumulation.
- Evaluated 1,375 experimental barley lines in replicated yield trials at six locations in North Dakota.
- Nearly 14,000 F_3 and F_4 head rows were grown 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

- We grew the NABSEN trial at our Osnabrock research site and submitted harvested grain samples to Dr. Paul Schwarz's lab for DON determination.
- The two-rowed lines 2ND34634, 2ND34697, and 2ND34954 were submitted to the AMBA's Pilot Scale evaluation system. Lines found satisfactory in Pilot Scale evaluation are eligible for Plant Scale evaluation. DON levels of these lines were similar to that of ND Genesis.
- The six-rowed lines ND32920, ND34318, ND35204, ND35207, and ND35210 were submitted to AMBA Pilot Scale evaluation. All five lines had DON levels less than Tradition.

4) key outcomes or other achievements

- The two-rowed lines 2ND32529, 2ND32657, and 2ND32829 were advanced to AMBA Plant Scale evaluation. This is the final testing done before a line is considered for release. The lines 2ND32529 and 2ND32829 had DON levels similar to less than ND Genesis.

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

- José Rivera, a PhD student from Puerto Rico, is conducting research to validate genomic selection for traits related to agronomic performance, malt quality, and disease resistance in two-rowed barley germplasm developed by the NDSU barley breeding program.
- Brian Kisely, an M.S. student from South Dakota, is conducting research to validate marker assisted selection for traits related to agronomic performance, malt quality, and disease resistance in two-rowed barley germplasm developed by the NDSU barley breeding program.

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 data for NDSU lines tested in replicated yield trials are uploaded to T3.

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY17-NCE 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 FY17-NCE 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 FY17-NCE period?**

   No

   If yes, how many?

3. **Have any post docs who worked for you during the FY17-NCE 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 FY17-NCE 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 FY17-NCE period. All columns must be completed for each listed germplasm/cultivar. Use the key below the table for Grain Class abbreviations.

NOTE: 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**

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

Instructions: Refer to the FY17-NCE_FPR-Instructions for detailed instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY17-NCE grant period. Only include citations for publications submitted or presentations given during your award period (5/3/18 - 5/2/19). If you did not have any publications or presentations, state 'Nothing to Report' directly above the Journal publications section.

NOTE: Directly below each reference/citation, you must indicate the Status (i.e. published, submitted, etc.) and whether acknowledgement of Federal support was indicated in publication/ presentation. See example below for a poster presented at the FHB Forum:

> Conley, E.J., and J.A. Anderson. 2018. Accuracy of Genome-Wide Prediction for Fusarium Head Blight Associated Traits in a Spring Wheat Breeding Program. In: Proceedings of the XXIV International Plant & Animal Genome Conference, San Diego, CA.
> Status: Abstract Published and Poster Presented
> Acknowledgement of Federal Support: YES (poster), NO (abstract)

Journal publications.

Daba, S., Horsley, R., Schwarz, P., Chao, S., Capettini, F., Mohammadi, M. (2018). Association and Genome Analyses to Propose Putative Candidate Genes for Malt Quality Traits. *Journal of the Science of Food and Agriculture*. Accepted: November 14, 2018.
Status: Published
Acknowledgement of Federal Support: NO

Huerta Zurita, R., Horsley, R., Schwarz, P. B. (2018). Is the Apparent Degree of Fermentation a Reliable Estimator of Fermentability? *Journal of the American Society of Brewing Chemists*. Accepted: October 2018
Status: Published
Acknowledgement of Federal Support: NO

Jin, Z., Gillespie, J., Barr, J., Wiersma, J. J., Sorrells, M. E., Zwinger, S., Gross, T., Cumming, J., Bergstrom, G. C., Brueggeman, R., Horsley, R. D., Schwarz, P. (2018). Malting of Fusarium Head Blight-Infected Rye (Secale cereale): Growth of Fusarium graminearum, Trichothecene Production, and the Impact on Malt Quality. *TOXINS, 10*(9).
Status: Published
Acknowledgement of Federal Support: YES

Wang, Y., Jin, Z., Barr, J., Gillespie, J., Simsek, S., Horsley, R., Schwarz, P. B. (2018). Micro-malting for the quality evaluation of rye (Secale cereale) genotypes. *Fermentation, 4*, 17 pages. Submitted: June 20, 2018. (Current Status: Published). https://www.mdpi.com/2311-5637/4/3/50 https://www.mdpi.com/2311-5637/4/3/50
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 an invited talk on organic barley production in North Dakota.
Status: Presented
Acknowledgement of Federal Support: NO

Presented an invited talk on barley breeding at the NDSU-NCI Barley and Malt Short Course, October 2017.
Status: Presented
Acknowledgement of Federal Support: NO

Presented an invited talk on barley breeding at the NCI Barley to Beer Conference, November 2018.
Status: Presented
Acknowledgement of Federal Support: NO

Presented an invited talk on application of new breeding technologies to the ND Wheat Commission County Representative meeting in Fargo, ND in December 2018.
Status: Presented
Acknowledgement of Federal Support: NO

Presented an invited talk on two-rowed barley varieties for the Midwest at the 2018 Prairie Plains Conference in Grand Forks, ND in December 2018.
Status: Presented
Acknowledgement of Federal Support: NO

Presented an invited talk on the Eastern Spring Barley Nursery grown in Michigan at the 2019 Great Lakes Hops and Barley Conference in Traverse City, MI in March 2019.
Status: Presented
Acknowledgement of Federal Support: NO