USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY19 Final Performance Progress Report
Due date: August 31, 2021

Cover Page

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Fiscal Year:	2019
USDA-ARS Agreement ID:	59-0206-8-197
USDA-ARS Agreement Title:	Developing 6- and 2-rowed Malting Barley Cultivars with Reduced FHB and DON
FY19 USDA-ARS Award Amount:	$ 209,623
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:	FAR0028531
Project/Grant Reporting Period:	5/3/19 - 8/2/21
Reporting Period End Date:	8/2/2021

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	$ 209,623
	FY19 Total ARS Award Amount	**$ 209,623**

Richard O. Horsley 8/1/2021

Principal Investigator Date

* MGMT – FHB Management
FST – Food Safety & Toxicology
R – Research
S – Service (DON Testing Lab)
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 research project?**
   The overall goal of this project is to develop two-rowed malting barley cultivars with enhanced resistance to FHB and reduced DON accumulation. In FY19, our goals were: 1) continued development and screening of 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, 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 or objectives?** *(For each major goal/objective, address these three items below.)*

   a) What were the major activities?
   - Evaluated 1,190 experimental barley lines in 2019 in replicated yield trials at six locations in North Dakota.
   - Nearly 7,500 F_3 and F_4 head rows were grown in 2019 that included material that had at least one parent in its pedigree that had reduced DON accumulation.
   - Made 97 crosses in fall 2020 to incorporate improved agronomic performance, end-use quality, and reduced DON accumulation.
   - Seeded 969 experimental barley lines in spring 2020 in replicated yield trials at three locations in North Dakota.
   - Seeded about 6,300 F_3 and F_4 head rows in spring 2021 that included material that had at least one parent in its pedigree that had reduced DON accumulation.

   b) What were the significant results?
   - We grew the NABSEN trial in 2020 at our Casselton research site and submitted harvested grain samples to Dr. Paul Schwarz's lab for DON determination. We seeded the 2021 NABSEN trial at our Osnabrock, ND research site.
   - The two-rowed lines 2ND36638, 2ND36642, 2ND37111, 2ND37130, and 2ND37568 were submitted to the AMBA's Pilot Scale evaluation system in fall 2020. Each of these lines were in their first year of Pilot Scale evaluation. Lines found satisfactory in Pilot Scale evaluation are eligible for Plant Scale evaluation. DON levels of all five lines was less than that of AAC Synergy, one of the most widely grown cultivars in ND. Additionally, ND36642 and 2ND37568 had lower DON accumulation of ND Genesis, an NDSU release that is also widely grown in ND.

   c) List key outcomes or other achievements.
   The two-rowed line 2ND32529 continues to be evaluated in the AMBA Plant Scale evaluation program. Cultivars found satisfactory in this final stage of evaluation are eligible for addition to the AMBA Recommended list of Malting Varieties. DON accumulation of 2ND32529 is intermediate to that of AAC Synergy and ND Genesis.

3. Was this research impacted by the COVID-19 pandemic (i.e. university shutdowns and/or restrictions, reduced or lack of support personnel, etc.)? If yes, please explain how this research was impacted or is continuing to be impacted.

In 2020 we made the following adjustments due to COVID-19:

- Planted our second FHB nursery in Fargo instead of Osnabrock, ND research site.
- The yield trials typically grown in Osnabrock were moved to our Prosper, ND research site.
- We did not plant yield trials at our Minot, Nesson Valley, or Williston research sites in western ND.
- Our head rows were planted at our Casselton, ND research site instead of Osnabrock.

No adjustments were made in 2021

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

Makenson Maisonneuve, an MS student from Haiti, is conducting research to update our genomic selection model for DON accumulation.

5. 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. Most 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 **FY19 award period (5/3/19 - 8/2/21)**. 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 FY19 award period?**
   ☐Yes ☒No ☐ Not Applicable
   If yes, how many? Click to enter number here.

2. **Did any graduate students in your research program supported by funding from your USWBSI grant earn their Ph.D. degree during the FY19 award period?**
   ☐Yes ☐No ☒ Not Applicable
   If yes, how many? Click to enter number here.

3. **Have any post docs who worked for you during the FY19 award period and were supported by funding from your USWBSI grant taken faculty positions with universities?**
   ☐Yes ☐No ☒ Not Applicable
   If yes, how many? Click to enter number here.

4. **Have any post docs who worked for you during the FY19 award period and were supported by funding from your USWBSI grant gone on to take positions with private ag-related companies or federal agencies?**
   ☐Yes ☐No ☒ Not Applicable
   If yes, how many? Click to enter number here.

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 **FY19 award period (5/3/19 - 8/2/21)**. 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**	**FHB Rating** (0-9)	**Year Released**
Nothing to report.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year
Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year
Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year
Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year
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Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year
Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year

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

Publications, Conference Papers, and Presentations

Instructions: Refer to the FPR_Instructions for detailed more instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY19 grant award. Only citations for publications published (submitted or accepted) or presentations presented during the **award period (5/3/19 - 8/2/21**) should be included. If you did not publish/submit or present anything, state 'Nothing to Report' directly above the Journal publications section.

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

> Z.J. Winn, R. Acharya, J. Lyerly, G. Brown-Guedira, C. Cowger, C. Griffey, J. Fitzgerald, R.E. Mason and J.P. Murphy. 2020. "Mapping of Fusarium Head Blight Resistance in NC13-20076 Soft Red Winter Wheat." In: S. Canty, A. Hoffstetter, and R. Dill-Macky (Eds.), *Proceedings of the 2020 National Fusarium Head Blight Forum (*p. 12.), Virtual; December 7-11. Online: https://scabusa.org/pdfs/NFHBF20_Proceedings.pdf.
> Status: Abstract Published and Poster Presented
> Acknowledgement of Federal Support: YES (Abstract and Poster)

Journal publications.

Murillo, D.A., S.A. Gezan, A.M. Heilman, T.C. Walk, J.S. Aparicio, and R.D. Horsley. 2021. FielDHub: A Shiny app for design of experiments in life sciences. JOSS 6(61):3122, https://doi.org/10.21105/joss.03122.
Status: Published
Acknowledgement of Federal Support: NO

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

Nothing to report.

Other publications, conference papers and presentations.

Nothing to report.