USDA-ARS
U.S. Wheat and Barley Scab Initiative
FY20 Annual Performance Progress Report
Due date: August 31, 2021

Cover Page

Principle Investigator (PI):	Thomas Baldwin
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Fiscal Year:	2020
USDA-ARS Agreement ID:	59-0206-0-163
USDA-ARS Agreement Title:	FHB Management in Barley: QTL Deployment and Phenotyping
FY20 USDA-ARS Award Amount:	$ 30,755
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:	FAR0031979
Project/Grant Reporting Period:	6/12/20 - 6/11/21
Reporting Period End Date:	6/11/2021

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
BAR-CP	Coordination of NABSEN and Collaborative Screening of Western US Barley Germplasm.	$ 20,215
BAR-CP	Identification, Characterization, & Development of Widely-adapted FHB-resistant Germplasm	$ 2,444
BAR-CP	Genomics Selection for FHB Resistance and Malting Quality in Spring Malting Barley	$ 5,456
BAR-CP	Development of 2-rowed FHB Resistance Germplasm and Cultivars	$ 2,640
	FY20 Total ARS Award Amount	**$ 30,755**

Thomas T. Baldwin 8/31/2021

Principal Investigator Date

* MGMT – FHB Management
FST – Food Safety & Toxicology
R- Research
S – Service (DON Testing Labs)
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

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Project 1: *Coordination of NABSEN and Collaborative Screening of Western US Barley Germplasm.*

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

   Major goals and objectives of this research project is to promote collaboration between North American barley breeding programs to advance and distribute elite barley germplasm with resistance to Fusarium head blight.

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?**
   Our project coordinated the assessment of advanced breeding lines and managed the FHB misted/inoculated nurseries in Fargo and Langdon, ND. These activities include coordinating, receiving, distributing lines from the University of Minnesota, Busch Ag, USDA-ARS Canadian breeding Group and NDSU breeding programs.

   b) **What were the significant results?**
   Our project evaluated a total of 45 advanced breeding lines planted in short rows and with 3 replications in Fargo and Langdon, ND misted nurseries. The misted nurseries were inoculated with infected FHB corn spawn to ensure good infection. Heading date, FHB incidence and severity notes were collected along with DON accumulation. Five lines were equal to or less then the resistant 2-rowed variety; Conlon which had 9.8 ppm DON.

   c) **List key outcomes or other achievements.**
   NABSEN trials continue to inform breeding programs of the progress of their advanced lines in developing the highest levels of FHB resistance. Advanced lines with FHB resistance will be used as parents to make crosses to other breeding lines to ensure incorporation of FHB resistances.

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.**

   Members of my team were directly affected by COVID-19 and field ratings in Fargo and Langdon had to be delayed. However, rating was still accomplished effectively later in the season. Travel restrictions was also an issue and limited travel to Langdon for more attentive management. Additionally, we agreed to plant additional barley breeding

materials from the North Dakota and other Universities for assessment in our misted nurseries in Fargo and Langdon. As a result, the size of our Fargo and Langdon misting nurseries were increased to provide testing for their materials. Cost of travel was also increased due to the requirement to travel in separate vehicles to limit the spread of potential COVID cases.

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

In NDSU, two undergraduate student workers were trained in preparation for planting, scoring, maintaining hill plots, and harvesting

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

The NABSEN report for 2020 has been submitted to all NABSEN collaborators in February of 2021 and later to USWBSI*. This information can be excessed online. The data is also uploaded to the T3 data base.

*Later reporting to USWBSI was due to a miscommunication that was resolved.

Project 2: *Identification, Characterization, & Development of Widely-adapted FHB-resistant Germplasm*

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

   The major goal of this project is to broaden the adaptability of Aberdeen Idaho barley germplasm by production elite spring germplasm with broad spectrum disease resistance and investigate fungal biomass estimated qPCR as a screening tool for selection of low-DON lines. Seed increases of recombinant inbred lines or Double haploid lines will be conducted in 2020, for field testing in 2021 in Fargo and Langdon, ND.

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?**
   Major activities include communicating and establishing protocols for screening procedures in 2021. Recombinant inbred lines and double haploid lines where increased in Idaho field in 2020 with assistance from our program.

   b) **What were the significant results?**
   Lines were increased for 2021 field trials.

   c) **List key outcomes or other achievements.**
   Increased lines for 2021 field trials and coordination of field trails for 2021 was the only outcome for this project this year.

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.**

   COVID made travel complex. Despite these barriers, my program traveled to Idaho to provide extra time and labor to complete harvesting of field increase lines for 2021 trials.

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

   No training was provided from my program for this project at this time.

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

   Email communications and material distribution has been accomplished in 2020 for field trials in 2021.

Project 3: *Genomics Selection for FHB Resistance and Malting Quality in Spring Malting Barley*

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

   The major goals and objectives of this research project is to evaluate the FHB resistance of malt quality advanced lines in a training population selected to represent the Aberdeen, ID spring malt barley breeding program

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?**
   Two replications of 248 lines from the Aberdeen, ID spring malt barley breeding program was planted, maintained, inoculated, scored, and harvested in two North Dakota FHB misted nurseries in Fargo and Langdon.

   b) **What were the significant results?**
   Significant results from this project includes adequate levels of FHB incidence in both nurseries to differentiate FHB reactions to lines in the training population.

   c) **List key outcomes or other achievements.**
   Key outcomes and achievements include reporting disease scoring and DON results from the Fargo and Langdon nurseries to the USDA-ARS breeders to use in their genomic selection program

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.**

   Members of my team were directly affected by COVID-19 and field ratings in Fargo and Langdon had to be delayed. However, rating was still accomplished effectively later in the season. Travel restrictions was also an issue and limited travel to Langdon for more attentive management. Additionally, we agreed to plant additional barley breeding materials from the North Dakota and other Universities for assessment in our misted nurseries in Fargo and Langdon. As a result, the size of our Fargo and Langdon misting nurseries were increased to provide testing for their materials. Cost of travel was also increased due to the requirement to travel in separate vehicles to limit the spread of potential COVID cases.

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

In NDSU, two undergraduate student workers were trained in preparation for planting, scoring, maintaining hill plots, and harvesting

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

Results were shared with USDA-ARS breeders in Aberdeen, ID in excel sheets via email communications.

Project 4: *Development of 2-rowed FHB Resistance Germplasm and Cultivars*

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

   The major goal of this project is to add FHB resistance data into the germplasm profile and breeding program that is essential for cultivar development for FHB resistance in the western germplasm.

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?**
   Major activities included screening 100 lines from Dr. Gongshe Hu's barley breeding program from Aberdeen, ID in two North Dakota misted FHB nurseries. The Fargo and Langdon, ND nurseries were planted, maintained, inoculated, scored, and harvested for these lines in a replicated fashion.

   b) **What were the significant results?**
   Evaluated lines from this breeding program have comparable levels of resistance to the 2-row resistant check Conlon. Sufficient FHB incidence was recorded in both nurseries in 2020 to evaluate both FHB severity and DON in the lines tested.

   c) **List key outcomes or other achievements.**
   Results of the two trials were reported back to the PIs in Aberdeen Idaho breeding program to inform the selection in their programs.

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.**

   Members of my team were directly affected by COVID-19 and field ratings in Fargo and Langdon had to be delayed. However, rating was still accomplished effectively later in the season. Travel restrictions was also an issue and limited travel to Langdon for more attentive management. Additionally, we agreed to plant additional barley breeding materials from the North Dakota and other Universities for assessment in our misted nurseries in Fargo and Langdon. As a result, the size of our Fargo and Langdon misting nurseries were increased to provide testing for their materials. Cost of travel was also increased due to the requirement to travel in separate vehicles to limit the spread of potential COVID cases.

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

In NDSU, two undergraduate student workers were trained in preparation for planting, scoring, maintaining hill plots, and harvesting

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

Results were shared with USDA-ARS breeders in Aberdeen, ID in excel sheets via email communications.

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY20 award period (6/12/20 - 6/11/21). 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 FY20 award period (6/12/20 - 6/11/21). 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
Not applicable to this project.	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
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
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
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 PR_Instructions for detailed more instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY20 grant award. Only citations for publications published (submitted or accepted) or presentations presented during the **award period (6/12/20 - 6/11/21**) 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.

None

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

None

Other publications, conference papers and presentations.

NABSEN Report 2020 completed in February 2021 and sent to all Cooperators. Online.
Status: Published
Acknowledgement of Federal Support: Yes