USDA-ARS
U.S. Wheat and Barley Scab Initiative
FY19 Performance Report
Due date: July 24, 2020

Cover Page

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Fiscal Year:	2019
USDA-ARS Agreement ID:	59-0206-9-121
USDA-ARS Agreement Title:	Development of Montana Adapted FHB Resistant Winter Wheat Varieties
FY19 USDA-ARS Award Amount:	$ 26,866
Recipient Organization:	Montana State University Office of Sponsored Programs Montana State University PO Box 172470 Bozeman, MT 59717-2470
DUNS Number:	625447982
EIN:	81-6010045
Recipient Identifying Number or Account Number:	W7936
Project/Grant Reporting Period:	5/6/19 - 5/5/20
Reporting Period End Date:	5/5/2020

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
HWW-CP	Development of Montana Adapted FHB Resistant Winter Wheat Varieties	$ 26,866
	FY19 Total ARS Award Amount	**$ 26,866**

Jason Cook

7/22/2020

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: *Development of Montana Adapted FHB Resistant Winter Wheat Varieties*

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

- Use marker assisted backcrossing (MAB) to incorporate *Fhb1* and Fhb5A into Montana adapted winter wheat germplasm, and make conventional breeding populations by crossing winter wheat lines with native fusarium head blight (FHB) resistance to Montana adapted winter wheat germplasm.

- Screen publically released varieties and elite Montana adapted experimental lines for FHB resistance.

2. What was accomplished under these goals or objectives? *(For each major goal/objective, address items a-b) below.)*

a) What were the major activities?

Major activities include using MAB to integrate known FHB resistance genes into Montana adapted winter wheat germplasm. Secondly, crosses were made between FHB resistant winter wheat lines and susceptible Montana adapted winter wheat germplasm for conventional breeding. Lastly, experimental lines were phenotyped in FHB screening nurseries for FHB resistance.

b) What were the significant results?

Fifteen MT experimental lines were submitted to the 2019 FHB hard red winter wheat uniform screening nursery. Infection levels at all uniform screening nurseries were very high due to abnormally high precipitation and optimum temperatures. Site managers advised we should not rely on the 2019 data for assessing FHB resistance. Using multiyear regional FHB resistance and agronomic data, MT1793 (Decade – Fhb1) was advanced for further testing in MT and ND. Experimental line MT1793 will be considered for public release to growers after the 2020 growing season.

We also established a new mist irrigated FHB screening nursery at the Southern Ag Research Center (SARC) located near Huntley, MT. The nursery contained 45 experimental lines and had good FHB infection levels where means (range) for FHB Severity was 13.6 (0.8 - 28.8), FHB Incidence was 66.6 (11.1 - 91.1) and FHB Index was 10.1 (0.1 - 26.3). Unfortunately, the SARC nursery was hailed out before it could be harvested and assessed for DON levels. The same experimental entries were included in another FHB screening nursery located in Minot, ND. Unfortunately no FHB was observed at the Minot, ND test location, however valuable agronomic data was obtained. From these nurseries, six experimental entries were advanced for further evaluation.

Lastly, MAB is being used to incorporate *Fhb1* and *Fhb5A* into Montana adapted winter wheat lines with an emphasis on developing varieties resistant to both FHB and wheat

stem sawfly. A total of 420 lines were planted in the field for evaluation and seed increase during the 2020 growing season. We are also using MAB to incorporate an *Fhb1 + Sr2* positive allele linkage group into our germplasm with the goal of maintaining both positive alleles in the winter wheat breeding program.

c) List key outcomes or other achievements.

Key outcomes from our breeding efforts include acquiring FHB resistance information on Montana adapted elite lines that carry *Fhb1* and native resistance from Emerson. Based on multiple years of data the *Fhb1* gene did not negatively impact yield and agronomic performance relative to the recurrent parents. Six experimental lines with FHB resistance were advanced in the breeding pipeline for additional testing in the 2020 yield trials. An additional set of 45 lines derived from FHB resistance sources are being evaluated in yield trials located in Minot, ND, Huntley, MT, and Bozeman, MT during the 2020 growing season. The Huntley, MT site is located at the SARC, and is our first mist irrigated FHB winter wheat nursery in MT. A total of 420 MAB lines carrying *Fhb1* and *Fhb5A* have been planted for field evaluation and seed increase in 2020. The Montana winter wheat breeding program has breeding material carrying resistance to FHB present in all stages of the breeding pipeline.

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

No

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

None

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

We now have enough FHB data where we can provide FHB resistance ratings to Montana adapted varieties. Ratings and our work with the USWBSI have been communicated to Montana wheat producers and stakeholders through the use of periodicals, field days and social media. Our efforts to develop Montana adapted FHB resistant winter wheat varieties has received positive responses from the Montana wheat growing community.

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY19 award period (5/6/19 - 5/5/20). 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?**
   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 FY19 award period?**
   No

   If yes, how many?

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?**
   No

   If yes, how many?

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?**
   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 FY19 award 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**
None				

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 FY19-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 (5/6/19 - 5/5/20**) 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:

De Wolf, E., D. Shah, P. Paul, L. Madden, S. Crawford, D. Hane, S. Canty, R. Dill-Macky, D. Van Sanford, K. Imhoff and D. Miller. 2019. "Impact of Prediction Tools for Fusarium Head Blight in the US, 2009-2019." In: S. Canty, A. Hoffstetter, H. Campbell and R. Dill-Macky (Eds.), *Proceedings of the 2019 National Fusarium Head Blight Forum* (p. 12), Milwaukee, WI; December 8-10. University of Kentucky, Lexington, KY.
Status: Abstract Published and Poster Presented
Acknowledgement of Federal Support: YES (Abstract and Poster)

Nothing to report.

Journal publications.

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

Other publications, conference papers and presentations.