

USDA-ARS
U.S. Wheat and Barley Scab Initiative
FY17 Final Performance Report
Due date: July 31, 2018

Cover Page

Principle Investigator (PI):	Phil Bruckner
Institution:	Montana State University
E-mail:	bruckner@montana.edu
Phone:	406-994-5127
Fiscal Year:	2017
USDA-ARS Agreement ID:	59-0206-5-002
USDA-ARS Agreement Title:	Montana Winter Wheat Fusarium Head Blight Resistance.
FY17 USDA-ARS Award Amount:	\$ 15,849
Recipient Organization:	Montana State University Office of Sponsored Programs Montana State University PO Box 172470 Bozeman, MT 59717-2470
DUNS Number:	625447982
EIN:	816010045
Recipient Identifying Number or Account Number:	W5478
Project/Grant Reporting Period:	5/6/17 - 5/5/18
Reporting Period End Date:	05/05/18

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
HWW-CP	Montana Winter Wheat Fusarium Head Blight Resistance.	\$ 15,849
	FY17 Total ARS Award Amount	\$ 15,849

Phil Bruckner

7/26/18

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

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Project 1: *Montana Winter Wheat Fusarium Head Blight Resistance.*

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

- a. 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 fusarium head blight (FHB) resistance to Montana adapted winter wheat germplasm.
- b. Phenotype publically released varieties and elite Montana adapted experimental lines for FHB resistance.

2. What was accomplished under these goals? *Address items 1-4) below for each goal or objective.*

1) Major Activities:

Major activities funded by this grant 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 double-haploid (DH) line development and conventional breeding. Lastly, lines developed from the breeding program were phenotypically screened in the field for FHB resistance.

2) Specific Objectives:

Advanced Montana winter wheat lines were evaluated during the 2017 growing season in a replicated FHB screening nursery in Minot, ND for FHB resistance. Additionally, 15 Montana adapted winter wheat lines were entered into the FHB hard winter wheat uniform screening nursery for FHB screening. MAB was used to incorporate *Fhb1* and *Fhb5A* resistance genes from the Minnesota hard red spring wheat line MN-11394-6 into Montana adapted winter wheat lines. Conventional crosses were also made between FHB susceptible elite Montana adapted winter wheat varieties and FHB resistance winter wheat lines.

3) Significant Results:

Fifteen elite MT experimental lines, which include 13 DH lines developed by UWBSI that were derived from MAB *Fhb1* into Decade and Jerry were submitted to the 2017 FHB hard winter wheat uniform screening nursery. Useful FHB resistance information was obtained from the Manhattan, Kansas nursery. Experimental MT lines carrying the *Fhb1* gene had an FHB index (% killed spikelets) ranging from 1.9% to 7.9% in comparison to Flourish (FHB susceptible check) that had a FHB index of 16.9%. The experimental lines also had lower DON levels ranging between 8.1 ppm – 13.8 ppm in comparison to the susceptible checks Overley (26.8 ppm) and Flourish (26.5 ppm). No FHB was observed at the Minot, ND test location, however valuable agronomic performance data was obtained. Using the 2017 FHB resistance and agronomic data, three experimental lines were advanced for further testing in 2018. The experimental lines are named MT1793 (Decade – *Fhb1*), MT1796 (Decade – *Fhb1*), MT17103 (Jerry – *Fhb1*).

In 2017, F1 seed from crosses made between winter wheat lines carrying *Fhb1* and elite Montana winter wheat lines were sent to Heartland Plant Innovations for DH line production. In total, 551 DH lines were produced and are being evaluated during the 2018 growing season in Bozeman, MT for desirable agronomic attributes and seed increase. A subset of

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these DH lines will be advanced for 2019 yield trial evaluation. A set of 69 Emerson/Montana Elite DH lines were selected out of 659 DH lines evaluated in the field during the 2017 growing season are being grown in yield trials during the 2018 growing season. Conventional breeding populations were also made from crossing winter wheat germplasm with FHB resistance with Montana adapted varieties and are advancing through the breeding program. Lastly, MAB is being used to incorporate *Fhb1* and *Fhb5A* into Montana adapted lines with an emphasis on developing varieties resistant to both FHB and wheat stem sawfly. The first set of MAB derived lines carrying *Fhb1* and *Fhb5A* will be evaluated for agronomics and undergo seed increase during the 2019 growing season.

4) Key Outcomes or Other Achievements:

Key outcomes from this research project include acquiring FHB resistance information on Montana adapted elite lines that carry *Fhb1*. Overall, it appears the *Fhb1* gene reduces % spikelets killed by FHB and DON levels in a limited number of Montana adapted winter wheat backgrounds. Additionally, based on one year of data the *Fhb1* gene did not appear to negatively impact yield and agronomic performance relative to the recurrent parent. Three experimental lines that carry the *Fhb1* gene, have reduced FHB incidence and DON levels, and have adequate yield performance were advanced in the breeding pipeline and are being tested in 2018 yield trials. An additional set of 69 DH lines derived from Emerson (native FHB resistance)/Montana adapted lines are being evaluated in yield trials during the 2018 growing season. Selected DH-lines with superior agronomic performance will be screened for FHB resistance and further evaluated for yield performance in 2019. An additional subset of DH lines that carry the *Fhb1* gene will be selected from a set 531 DH lines for initial yield trial evaluation in 2019. New MAB lines carrying *Fhb1* and *Fhb5A* will be grown in 2019 for initial field evaluation and seed increase. The Montana winter wheat breeding program now has breeding material potentially carrying resistance to FHB present in nearly every stage of the breeding pipeline.

3. What opportunities for training and professional development has the project provided? None

4. 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 in periodicals and at field days. 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 FY17 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 FY17 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 FY17 award period? No**

If yes, how many?

3. **Have any post docs who worked for you during the FY17 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 FY17 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?

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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 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
None to report.				

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

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Publications, Conference Papers, and Presentations

Instructions: Refer to the FY17-FPR_Instructions for detailed instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY17 grant. Only include citations for publications submitted or presentations given during your award period (5/6/17 - 5/5/18). 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. 2017. 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)

Nothing to Report

Journal publications.

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

Other publications, conference papers and presentations.