USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY16 Final Performance Report
Due date: July 28, 2017

Cover Page

Principle Investigator (PI):	Phil Bruckner
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Fiscal Year:	2016
USDA-ARS Agreement ID:	59-0206-5-002
USDA-ARS Agreement Title:	Montana Winter Wheat Fusarium Head Blight Resistance.
FY16 USDA-ARS Award Amount:	$ 15,880
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:	5/6/16 - 5/5/17
Reporting Period End Date:	05/05/17

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
HWW-CP	Montana Winter Wheat Fusarium Head Blight Resistance.	$ 15,880
	FY16 Total ARS Award Amount	**$ 15,880**

Phil L. Bruckner 7/28/17

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 native 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 were to screen advanced Montana adapted winter wheat breeding lines for FHB resistance. Additionally, MAB was used to integrate known FHB resistance genes into Montana adapted winter wheat germplasm, and crosses were made between winter wheat lines with native FHB resistance and susceptible Montana adapted winter wheat germplasm.

2) Specific Objectives:

Advanced Montana winter wheat lines were evaluated during the 2016 growing season in a replicated FHB screening nursery in Minot, ND for FHB resistance. In addition to the Minot, ND FHB screening nursery, 15 Montana adapted winter wheat lines were entered into the FHB uniform screening nursery for additional FHB screening. Lastly, 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 elite Montana adapted winter wheat varieties and the winter wheat variety Emerson that has been reported to have native FHB resistance.

3) Significant Results:

Natural FHB infection was observed at the Minot, ND screening nursery with an average incidence (%) of 17.3% and severity (%) of 46.7% across the entire screening nursery. DON accumulation was measured from each plot with the majority of the plots having <0.5 ppm. Emerson and Overland were included in the Minot nursery and both have been reported to be moderately resistant to FHB. Elite Montana adapted lines MTS1407 and MT1488 had FHB incidence (%) of 10% and 11.7%, respectively and were not significantly different ($P \leq 0.05$) from Emerson (6.3%) and Overland (5.5%). The Montana MTS1407 and MT1488 had significantly higher severity (%), 41.9% and 58.7% respectively, then Overland (17.5%). However, the severity (%) for Emerson was 52.2%. Elite line MT1488 was also included in the 2016 FHB uniform screening nursery and in Manhattan, Kansas where it had an index (%) of 5.8% versus 2.3% for Emerson. Elite line MT1488 is being further evaluated in 2017.

In 2016, F1 seed from four crosses made between Emerson and elite Montana winter wheat lines were sent to Heartland Plant Innovations and was used to make DH lines. In total, 659 DH lines were made from the four populations and are being evaluated during the 2017 growing season in Bozeman, MT for good agronomic attributes and to increase seed for 2018 yield trials. Additional conventional breeding populations were made from crossing

winter wheat germplasm with known Fhb resistance with Montana adapted varieties and are advancing through the breeding program. Lastly, MAB is being used to incorporate FHB1 and FHB5A into additional Montana adapted lines with an emphasis on developing varieties resistant to both FHB and wheat stem sawfly. The first set of MAB derived lines will be ready for field testing during the 2019 growing season.

4) Key Outcomes or Other Achievements:

Key outcomes from this research project include acquiring additional FHB resistance information on Montana adapted elite lines. Overall, it appears there is little FHB resistance in Montana adapted winter wheat lines. It is possible MT1488 may have moderate FHB resistance, however additional testing needs to be done to confirm resistance levels. After phenotyping elite Montana winter wheat lines this past year it is apparent FHB resistant Montana winter wheat lines will need to be developed from using conventional and MAB breeding methods using parents that have known FHB resistance genes. In 2017, 17 DH lines provided by UWBSI that were derived from MAB FHB1 into Decade and Jerry are being evaluated for FHB resistance. Additionally, 659 DH lines derived from Emerson/Montana adapted lines are being observed and increased in Bozeman in 2017, and will be evaluated for FHB resistance in 2018. MAB lines will be available for field testing in 2019. The DH lines and lines developed from MAB appear to hold the most promise for identifying elite Montana adapted winter wheat lines that have FHB resistance.

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. We will rate all widely grown winter wheat varieties in Montana as susceptible to FHB. It has been communicated to Montana wheat producers and stakeholders in periodicals and field days that we are now part of USWBSI and working on developing FHB resistant winter wheat varieties, which has garnered a positive response. Lastly, Montana State University-Extension is also providing timely Ag Alert information (http://www.mtagalert.org/index.cfm?srch=getdata) during the growing season to warn Montana wheat producers when environmental conditions are appropriate for FHB infection, how to recognize FHB, and ways to manage the disease.

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY16 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 FY16 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 FY16 award period?** No

   If yes, how many?

3. **Have any post docs who worked for you during the FY16 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 FY16 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 FY16 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**

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 FY16-FPR_Instructions for detailed instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY16 grant. Only include citations for publications submitted or presentations given during your award period (5/6/16 - 5/5/17). 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. 2016. 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.