

USDA-ARS
U.S. Wheat and Barley Scab Initiative
FY20 Annual Performance Progress Report
Due date: July 29, 2021

Cover Page

Principle Investigator (PI):	Jason Cook
Institution:	Montana State University
E-mail:	jason.cook3@montana.edu
Phone:	406-994-7201
Fiscal Year:	2020
USDA-ARS Agreement ID:	59-0206-0-128
USDA-ARS Agreement Title:	Fusarium Head Blight Resistance for Montana Spring Wheat
FY20 USDA-ARS Award Amount:	\$ 19,380
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:	4W8545
Project/Grant Reporting Period:	5/6/20 - 5/5/21
Reporting Period End Date:	5/5/2021

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
VDHR-SPR	Fusarium Head Blight Resistance for Montana Spring Wheat	\$ 19,380
FY20 Total ARS Award Amount		\$ 19,380



7/12/2021

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

Project 1: *Fusarium Head Blight Resistance for Montana Spring Wheat*

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

- 1.) Integrate FHB resistance genes from FHB resistant spring wheat germplasm into MSU's spring wheat breeding program using both conventional breeding and marker assisted backcrossing (MAB) to increase FHB resistant allele frequencies in the Montana spring wheat breeding program.
- 2.) Phenotype Montana adapted spring wheat experimental lines for FHB resistance during the 2020 field seasons. Experimental lines found to have FHB resistance will be considered for public release.
- 3.) Deployment of FHB resistant spring wheat varieties adapted to Montana will help protect Montana's spring wheat grain producers and end-users from FHB infections and unacceptable deoxynivalenol (DON) levels that would prevent the sale of FHB infected spring wheat.

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?

There were two major activities. First, several experimental lines and varieties resistant to FHB have been incorporated into the hard red spring wheat crossing block over the past several years. A single seed descent program was used to generate head rows at the F4 generation and were incorporated into the general spring wheat breeding pipeline. Lines were selected with appropriate height, heading date, grain protein content, and stem solidness for two years prior to advancement to replicated yield trials. Advanced lines with an FHB-resistant parent were entered into FHB inoculated nurseries in Sidney, MT and Aberdeen, ID. The second activity was a marker assisted backcrossing (MAB) program used to incorporate known FHB resistance genes into elite lines.

b) What were the significant results?

In January, 2020, we publically released our first moderately resistant hard red spring wheat variety adapted for Montana. The experimental line number is MT1716. The parental source for the FHB resistance is RB07, a variety released by Jim Anderson, University of Minnesota. Fusarium head blight resistance and agronomic performance data for MT1716 can be found by ([clicking here](#)).

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We entered seven lines into the Uniform Regional Scab Nursery for FHB resistance evaluation during the 2020 growing season. Several of the locations had high incidence of FHB, but the data was highly variable among locations, making it difficult to determine with confidence if our lines had moderate resistance to FHB. Overall, it does not appear our lines are as resistant to FHB as those from MN, ND and SD.

In 2020, we tested 45 experimental lines and six check varieties at our mist irrigated FHB screening nursery located at the Eastern Ag Research Center (EARC) in Sidney, MT. We had lower FHB infection levels this year than in 2019. The mean FHB Severity was 8.4% (1.1 – 25.0), FHB Incidence was 37.8% (15.6-78.9) and the FHB Index was 4.1% (0.1-9.0). The mean FDK was 7.7% (2.7-18.3) and DON was 3.44 ppm (0.7-10.1).

We also sent 32 lines to Juliet Marshall, University of Idaho, for screening in their FHB nursery. Disease severity was 59.0 (32.7-80.5), incidence was 68.4 (40-85) and the disease index was 26.7 (13.3-60.6). Juliet's team does not collect grain samples for FDK or DON analysis from this site, but may do so in the future if there is enough testing capacity for DON analysis.

c) List key outcomes or other achievements.

Key outcomes from our breeding efforts include our first public spring wheat variety release, MT1716, that has moderate FHB resistance and is adapted to Montana. Our FHB screening nursery is working well to identify experimental lines with moderate FHB resistance, which are either advanced in the breeding pipeline or are used as parents in our crossing blocks. In the future, we hope to expand our screening nursery testing capacity to evaluate more lines for FHB resistance. To date, it appears native FHB resistance genes are providing moderate FHB resistance in our most advanced experimental lines. Experimental lines with known FHB resistance genes are dropping out of the breeding pipeline due to poor performance in first year state wide yield trials.

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.

No

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

None

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

Fusarium head blight resistance 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. The topic of FHB is of special interest in eastern Montana. Dr. Frankie Crutcher, the plant pathologist at the Eastern Agricultural Research Center, has developed a screening nursery that serves as an excellent focal point for discussing this research. Our efforts to develop Montana adapted FHB resistant spring 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 FY20 award period (5/6/20 - 5/5/21). 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 FY20 award period?

Yes No

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 FY20 award period?

Yes No

If yes, how many? [Click to enter number here.](#)

3. Have any post docs who worked for you during the FY20 award period and were supported by funding from your USWBSI grant taken faculty positions with universities?

Yes No

If yes, how many? [Click to enter number here.](#)

4. Have any post docs who worked for you during the FY20 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

If yes, how many? [Click to enter number here.](#)

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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 FY20 award period (5/6/20 - 5/5/21). 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
MT1716	HRS - Hard Red Spring	MR - Moderately Resistant	4	2021
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
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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.

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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 (5/6/20 - 5/5/21)** 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.

None