

USDA-ARS | U.S. Wheat and Barley Scab Initiative  
**FY21 FINAL Performance Progress Report**

**Due date:** July 26, 2023

**Cover Page**

<b>USDA-ARS Agreement ID:</b>	59-0206-0-128
<b>USDA-ARS Agreement Title:</b>	Fusarium Head Blight Resistance for Montana Spring Wheat
<b>Principle Investigator (PI):</b>	Jason Cook
<b>Institution:</b>	Montana State University
<b>Institution UEI:</b>	EJ3UF7TK8RT5
<b>Fiscal Year:</b>	2021
<b>FY21 USDA-ARS Award Amount:</b>	\$19,380
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<b>Period of Performance:</b>	5/6/21 - 5/5/23
<b>Reporting Period End Date:</b>	5/5/2023

**USWBSI Individual Project(s)**

USWBSI Research Category*	Project Title	ARS Award Amount
VDHR-SPR	Fusarium Head Blight Resistance for Montana Spring Wheat	\$19,380
<b>FY21 Total ARS Award Amount</b>		<b>\$19,380</b>

I am submitting this report as a:  FINAL Report

*I certify to the best of my knowledge and belief that this report is correct and complete for performance of activities for the purposes set forth in the award documents.*

\_\_\_\_\_  
Principal Investigator Signature

7/25/2023  
Date Report Submitted

† BAR-CP – Barley Coordinated Project  
 DUR-CP – Durum Coordinated Project  
 EC-HQ – Executive Committee-Headquarters  
 FST-R – Food Safety & Toxicology (Research)  
 FST-S – Food Safety & Toxicology (Service)  
 GDER – Gene Discovery & Engineering Resistance  
 HWW-CP – Hard Winter Wheat Coordinated Project

MGMT – FHB Management  
 MGMT-IM – FHB Management – Integrated Management Coordinated Project  
 PBG – Pathogen Biology & Genetics  
 TSCI – Transformational Science  
 VDHR – Variety Development & Uniform Nurseries  
 NWW – Northern Soft Winter Wheat Region  
 SPR – Spring Wheat Region  
 SWW – Southern Soft Red Winter Wheat Region

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

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### 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 selection (MAS) 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 2022 field season. Experimental lines found to have FHB resistance will be advance in breeding pipeline and used as parents in the crossing block.

Deployment of FHB resistant spring wheat varieties adapted to Montana will help protect Montana's spring wheat grain producers and end-users from FHB infection 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. A single seed descent program was used to generate head rows at the F4 generation. 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 screening nursery located in Sidney, MT. The second activity was a marker assisted selection (MAS) program used to identify lines with major FHB resistance genes.

#### b) What were the significant results?

In 2022, our growing conditions across the state varied from severe drought to high rainfall conditions. At Sidney, MT where our FHB screening nursery was located, we had optimum environmental conditions for excellent onset of disease from which we got excellent data. We had 109 entries in our screening nursery. Means for FHB Severity was 44.7% (12.3 – 68.1), FHB Incidence was 95.4% (50.0-100.0) and FHB Index was 43.3% (16.6 - 67.1). The mean for FDK was 47.4% (12.0-68.3) and DON was 20.3 ppm (7.3-44.9).

We also entered six elite experimental lines into the Uniform Regional Scab Nursery for FHB resistance evaluation during the 2022 growing season. Incidence of FHB was good across locations and allows us to compare how our lines perform compared to elite experimental lines from other states with higher incidence of FHB. Overall, our lines are still more susceptible to FHB than ND, MN and SD.

Lastly, we sent 50 lines to Juliet Marshall, University of Idaho, for screening in their FHB nursery. Mean disease severity was 31.8 (4.0-61.0), incidence was 25.8 (2.5-50.0) and the disease index was 9.0 (0.2-29.1). Juliet's team does not collect grain samples for FDK or DON analysis from this site, but the information they provide helps us know how the lines perform across diverse environments.

**c) List key outcomes or other achievements.**

Key outcomes for 2022 include getting excellent FHB resistance data from our screening nursery that helps us select lines with moderate resistance for variety release and use in our breeding crossing block. In January of 2023, we used multiyear data from our FHB screening nursery to help release experimental line MT1809 that is now named MT Dutton. [MT Dutton](#) has significantly better FHB resistance than most other varieties released from our breeding program and is comparable to MT Sidney. Also, using data from the screening nursery, we have expanded the number of parents with moderate FHB resistance in our crossing block. This increases the number of populations with FHB resistant parents in the breeding program and will improve our chances of identifying moderately FHB resistant lines. 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 statewide yield trials.

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

None

**4. 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 using 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.

## Publications, Conference Papers, and Presentations

Please include a listing of all your publications/presentations about your FHB work that were a result of funding from your FY21 grant award. Only citations for publications published (submitted or accepted) or presentations presented during the **award period** should be included.

**Did you publish/submit or present anything during this award period?**

- Yes, I've included the citation reference in listing(s) below.  
 No, I have nothing to report.

### Journal publications as a result of FY21 award

*List peer-reviewed articles or papers appearing in scientific, technical, or professional journals. Include any peer-reviewed publication in the periodically published proceedings of a scientific society, a conference, or the like.*

Identify for each publication: Author(s); title; journal; volume: year; page numbers; status of publication (published [include DOI#]; accepted, awaiting publication; submitted, under review; other); acknowledgement of federal support (yes/no).

### Books or other non-periodical, one-time publications as a result of FY21 award

*Report any book, monograph, dissertation, abstract, or the like published as or in a separate publication, rather than a periodical or series. Include any significant publication in the proceedings of a one-time conference or in the report of a one-time study, commission, or the like.*

Identify for each one-time publication: Author(s); title; editor; title of collection, if applicable; bibliographic information; year; type of publication (book, thesis, or dissertation, other); status of publication (published; accepted, awaiting publication; submitted, under review; other); acknowledgement of federal support (yes/no).

### Other publications, conference papers and presentations as a result of FY21 award

Identify any other publications, conference papers and/or presentations not reported above. Specify the status of the publication.