USDA-ARS
U.S. Wheat and Barley Scab Initiative
FY20 Annual Performance Progress Report
Due date: August 31, 2021

Cover Page

Principle Investigator (PI):	Juliet Marshall
Institution:	University of Idaho
E-mail:	jmarshall@uidaho.edu
Phone:	208-529-8376 Ext. 115
Fiscal Year:	2020
USDA-ARS Agreement ID:	59-0206-0-175
USDA-ARS Agreement Title:	Integrated Management Tools to Reduce FHB Impact in the Intermountain West and the PNW
FY20 USDA-ARS Award Amount:	$ 140,728
Recipient Organization:	Regents of the University of Idaho Office of Sponsored Programs 875 Perimeter Drive MS 3020 Moscow, ID 83844-3020
DUNS Number:	075746271
EIN:	82-6000945
Recipient Identifying Number or Account Number:	AN4786
Project/Grant Reporting Period:	6/1/20 - 5/31/21
Reporting Period End Date:	5/31/2021

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
BAR-CP	Determining FHB Susceptibility in Barley Cultivars in the Western US	$ 50,409
VDHR-SPR	Determining FHB Susceptibility in Wheat Cultivars in the Western US	$ 61,999
MGMT	Efficacy of a New Fungicide for FHB and DON Management in Idaho Integrated Management Studies	$ 18,535
PBG	FgMutantDB Migration to USWBSI Servers and Added Functionality	$ 9,785
	FY20 Total ARS Award Amount	**$ 140,728**

Juliet M. Marshall

8/31/2021

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

FY20 Annual Performance Progress Report
PI: Marshall, Juliet
USDA-ARS Agreement #: 59-0206-0-175
Reporting Period: 6/1/20 - 5/31/21

Project 1: *Determining FHB Susceptibility in Barley Cultivars in the Western US*

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

Increasing risks associated with FHB and DON in Idaho barley production prompted research in screening varieties to FHB-causing fungi. In 2015, fields of barley showed signs of the disease and many spring wheat fields tested at >5 ppm DON, even after appropriate treatments with fungicides. Large production areas north of Idaho Falls had barley rejected due to high levels of DON. In 2018, 40,000 bu of barley was rejected from one producer alone near Rupert, Idaho. The majority of the barley varieties that are available to growers in the area are susceptible to FHB and growers need variety information for FHB management. Breeders need information on advanced lines and breeding material to release selections with reduced vulnerability to FHB damage and DON accumulation. Testing under the unique conditions in the irrigated production regions of the Intermountain West was performed to develop appropriate management practices to reduce FHB and DON. The goals and objectives of this project were to: 1) determine the degree of susceptibility that exists in currently grown spring and winter barley varieties and advanced lines to local *Fusarium graminearum* isolates, 2) provide DON data to local breeders and growers to increase the ability to select the best varieties for breeding and production.

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?

An assessment of released barley cultivars and advanced lines from entries in the University of Idaho Extension Variety trials (EVT) was conducted in on-station FHB nurseries at the Aberdeen Research and Extension Center and at a second location in Kimberly, ID at the Kimberly R&E Center. The second location was added to increase the chances of having a (warmer) conducive environment for FHB development for both spring and winter lines. Winter checks were Caledonia (resistant). Spring resistant and susceptible checks were: 1) six-row resistant checks were Chevron and Quest; 2) the susceptible cultivars were PI383933 and Stander; 3) the two-rowed susceptible check was ICB111809; and 4) the 2-row resistant check was Clho4196. Experimental units consisted of two-row plots with two replications using a randomized complete block design. Plots were 5-foot long rows planted with a Hege 1000 headrow planter. Special irrigation systems were designed and installed to provide an environment conducive for FHB infection while the irrigation needs of the crop was provided separately with standard solid-set irrigation equipment. Autoclaved corn was inoculated with *F. graminearum* and allowed to grow for three weeks before drying. Corn spawn was spread in the field approximately three weeks prior to anthesis (wheat) or head emergence (barley) of the earliest lines at 30 grams

per square meter. Barley plots were inoculated with a spore suspension of macroconidia of *F. graminearum* at head emergence. Barley symptom development has been more difficult to induce and has responded best after inoculation with both corn spawn and a total spore suspension of 100,000 conidia per mL. Plots were inoculated twice (50,000 conidia per mL) with conidial suspension starting at head emergence (Feekes GS 10.1, June 9) using a CO_2 backpack sprayer with three 8003 VS nozzles at a ground speed of 1 sec/ft at 40 psi. A second inoculation of each barley plot occurred one week after the first. A misting system with sprinkler nozzles every 20 feet was used for increasing humidity in the plant canopy. The misters ran for 3 minutes every 60 minutes between 6 AM and 9 AM as well as 5PM to 9 PM.
FHB was be assessed in each plot at about soft dough (Feekes 11.2). Scab readings were done 21 to 28 days after head emergence. Twenty spikes per plot were rated for percent disease severity. Percent incidence was determined by calculating the proportion of infected in the total number of assessed heads. FHB index is calculated using the formula: FHB Index = (% severity x % incidence) /100. On-site weather stations were used to collect temperature and humidity data. Plots were harvested using Wintersteiger Classic small plot combine and weighed for yield and test weight. Samples will be submitted to the USWBSI-funded DON testing laboratories in St. Paul, MN for DON analysis. The specific objectives were to screen currently grown varieties to determine degree of susceptibility and assess risk of DON under intermountain west irrigated production conditions, and to select for increased resistance in breeding lines of barley to improve FHB resistance and reduce DON in newly released varieties.

b) What were the significant results?

FHB formed in the spring nursery, and ratings were performed to distinguish the level of genetic tolerance or susceptibility of screened varieties in the EVT as well as those advanced lines from breeders. Disease development in barley was better than in previous years, and significant differences developed in both FHB and DON levels in harvested grain. One variety of feed barley was identified with surprisingly high levels of DON that occurred over multiple years.

c) List key outcomes or other achievements.

The results of these studies were and will be presented numerous times at the local, national and international level. Consultants and breeding companies in the area have used this data to improve variety recommendations, and growers now regularly spray to reduce FHB and DON in susceptible spring cultivars. Growers are now aware of the varieties that are less likely to get FHB and suffer high DON, and spray those varieties they know are vulnerable, especially when following corn in their crop rotations.

We provided results of the screening additional advanced lines to participating breeders from Montana.

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.

There were significant impacts associated with the COVID pandemic including a reduction in the number of people we were able to hire (students and grad students) to perform the work or provide training opportunities, the inability to collaborate with our USDA colleagues and having to perform work for them due to travel and in-person work restrictions. Travel to the plots became difficult as there were restrictions of one person per car during the earlier period of time in the pandemic (until June 2020). Many fewer grower meetings and professional meetings were held and almost no in-person presentations were given. While in-person meetings were significantly reduced, field visits were continued due to reduced risk associated with outdoor activities. In addition, increased costs were associated with pre-grinding samples for DON testing due to USDA restriction in MN

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

Additional staff were trained in rating methods, including graduate students. I have a PhD student that has been working on this project (previously as a technician), whose responsibilities have been to develop inoculum, organize inoculations, analyze data and assist in preparing reports. The PhD project will incorporate weather data to assist in the development of predictive models that are specific to the intermountain West irrigated environment. I also have a postdoctoral fellow training to supervise the nursery following the graduation of the PhD student.

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

As I have a 60% extension appointment (100% cereals), I am responsible for presenting appropriate research to the growers and industry professionals. I regularly present the FHB research results at almost every extension meeting, incorporating it into presentations as well as into my annual Small Grain Report, which is widely distributed in Idaho and available online. Every year, I encourage my PhD student and pst-doc to present at the Idaho Association of Plant Protection, to develop papers and to present at the USWBSI annual meeting and the regional and national American Phytopathological Society meetings.

Project 2: *Determining FHB Susceptibility in Wheat Cultivars in the Western US*

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

As in barley, increasing risks associated with FHB and DON in Idaho wheat production prompted research in screening varieties to FHB-causing fungi. In fact, the risk of disease and DON contamination in wheat is much greater than barley. FHB damage in spring grain continues to increase in southern and eastern Idaho. Several years in a row, fields of spring wheat showed signs of the disease and many spring wheat fields tested at >5 ppm DON, even after appropriate treatments with fungicides. Growers now regularly incorporate fungicide treatments for FHB suppression as standard practices for susceptible varieties. The majority of the wheat varieties that are available to growers in the area are susceptible to FHB. Growers need information on FHB susceptibility of the varieties that currently are being grown and those newly released. Breeders need information on advanced lines and breeding material to release selections with reduced vulnerability to FHB damage and DON accumulation. The project goals and objectives for this proposal were to: 1) determine the degree of susceptibility that exists in currently grown varieties and advanced lines to local *Fusarium graminearum* isolates, including screening cultivars in the winter variety trials; 2) provide DON data to local breeders and growers to increase the ability to select the best varieties for breeding and production. Providing the data and increasing awareness of variety reaction to FHB determines need for potential fungicide applications and other integrated pest management recommendations.

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?**

   An assessment of released wheat cultivars and advanced lines from entries in the University of Idaho Extension Variety trials was conducted in on-station FHB nurseries at the Aberdeen Research and Extension Center and at a second location in Kimberly, ID at the Kimberly R&E Center. The second location was added to increase the chances of having a (warmer) conducive environment for FHB development in spring lines while providing the first screening of the winter wheat cultivars in the EVT. Experiments tested existing varieties and advanced cultivars and were evaluated after inoculation and misting. Caledonia soft white winter line was included as a resistant check in the winter trial. Resistant and susceptible spring checks included: Jefferson hard red spring (susceptible check), and Rollag hard red spring (resistant check). Experimental units consisted of two-row plots with two replications using a randomized complete block design. Plots were 5-foot long rows planted with a Hege 1000 headrow planter. Special

irrigation systems were designed and installed to provide an environment conducive for FHB infection while simultaneously meeting the irrigation needs of the crop.

Autoclaved corn was inoculated with *F. graminearum* and allowed to grow for three weeks before drying. Corn spawn was spread in the field approximately three weeks prior to anthesis of the earliest lines at 30 grams per square meter. An irrigation system with sprinkler nozzles every 20 feet is used both for irrigation. A supplementary misting system with nozzles every 10 feet provided additional moisture to increase likelihood of infection every day Monday through Sunday (A misting system with sprinkler nozzles every 20 feet was used for increasing humidity in the plant canopy. The misters ran for 3 minutes every 60 minutes between 6 AM and 9 AM as well as 5PM to 9 PM.

FHB was assessed in each plot at about soft dough (Feekes 11.2). Scab readings were done 21 days after flowering (at least 24 days post-heading). Twenty spikes per plot were rated for percent disease severity. Percent incidence was determined by calculating the proportion of infected and the total number of assessed heads. FHB index is calculated using the formula: FHB Index = (% severity x % incidence) /100. On-site weather stations were used to collect temperature and humidity data. Plots were harvested using Wintersteiger Classic small plot combine and weighed for yield and test weight. Harvested samples will be assessed for FDK prior to testing for DON. Samples will be submitted to the USWBSI-funded DON testing laboratories in St. Paul, MN for DON analysis.

b) What were the significant results?

Significant differences in disease levels in both the spring wheat nursery and the expanded winter wheat nursery in Kimberly, allowing ratings to distinguish the level of genetic tolerance or susceptibility of currently produced varieties. Significant differences in DON levels in harvested grain were determined with the cooperation of the USWBSI supported lab at UMN in St. Paul.

c) List key outcomes or other achievements.

The results of the previous FHB experiments and this study was presented numerous times at the local, national and international level. Consultants and breeding companies in the area have used this data to improve variety recommendations, and growers now regularly spray to reduce FHB and DON in susceptible and moderately susceptible spring wheat cultivars. Growers are now aware of the varieties that are less likely to get FHB and suffer high DON, and spray those varieties they know are vulnerable, especially when following corn in their crop rotations.

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.

There were significant impacts associated with the COVID pandemic including a reduction in the number of people we were able to hire (students and grad students) to perform the work or provide training opportunities, the inability to collaborate with our USDA colleagues and having to perform work for them due to travel and in-person work restrictions. Travel to the plots became difficult as there were restrictions of one person per car during the earlier period of time in the pandemic (until June 2020). Many fewer grower meetings and professional meetings were held and almost no in-person presentations were given. While in-person meetings were significantly reduced, field visits were continued due to reduced risk associated with outdoor activities. In addition, increased costs were associated with pre-grinding samples for DON testing due to USDA restriction in MN

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

I have a PhD student that has been working on this project (previously as a technician), whose responsibilities have been to develop inoculum, organize inoculations, analyze data and assist in preparing reports. The PhD project will incorporate weather data to assist in the development of predictive models that are specific to the intermountain West irrigated environment. I also have a postdoctoral fellow training to supervise the nursery following the graduation of the PhD student. I have also been able to assist other young faculty in the PNW with the development of grower recommendations and Pest Alerts for their producer clientele (OR and WA).

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

As I have a 60% extension appointment (100% cereals), I am responsible for presenting appropriate research to the growers and industry professionals. I regularly present the FHB research results at almost every meeting, incorporating it into presentations as well as into my annual Small Grain Report, which is widely distributed in Idaho and available online. Every year, I encourage my PhD student and post-doc to present at the Idaho Association of Plant Protection, to develop papers and to present at the USWBSI annual meeting and the regional and national American Phytopathological Society meetings.

Project 3: *Efficacy of a New Fungicide for FHB and DON Management in Idaho Integrated Management Studies*

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

Depending on the year, FHB damage in spring grain continues to increase in southern and eastern Idaho. Fungicide management tools are being investigated in the irrigated western production region to reduce FHB pressure and DON contamination. Our goals are to participate in the MGMT CP to evaluate the integrated effects of fungicide treatment and genetic resistance on FHB and DON in hard red spring and hard white wheat grown in the Pacific Northwest and Intermountain West region, with emphasis on a new fungicide, Miravis Ace. We compared the efficacy of Miravis Ace® when applied at heading or at anthesis to that of standard anthesis application of Prosaro® or Caramba®. The objective was to generate data to further quantify the economic benefit of FHB/DON management strategies and to develop more robust "*best-management practices*" for FHB and DON. We also are generating data to validate and advance the development of FHB and DON risk prediction models. With the expansion of FHB into irrigated production areas of the PNW and intermountain West, and the limits of currently available fungicides, testing of the newly available fungicide Miravis Ace may provide increased choices for the producer. Our objectives for this proposal were to: 1) evaluate fungicide treatments of a new class of fungicides compared to standard applications and 2) test appropriate combinations of fungicides and host resistance for FHB and DON reduction.

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?

Two separate experiments were conducted in conjunction with the Management CP. The first was the Uniform Fungicide Trial, and the second was the Integrated Management Trial. Following standard protocol developed for the MGMT CP, we planted the first trial and applied fungicides according to seven different treatments. In the Integrated Management trial, four varieties (susceptible, moderately susceptible and moderately resistant) based on previous screening evaluations were combined with several different fungicide timing combinations to evaluate fungicide effectiveness at reducing FHB and DON.

Additional fungicide testing was completed for industry partners interested in specific fungicide combinations and application timing, increasing our ability to address management practices specific to Idaho conditions and grower practices.

b) What were the significant results?

Good disease formed in the spring nursery, with significant differences between varieties and fungicide treatments. The plots were rated and harvested (mid-September), and DON levels were determined in treatments. Disease and DON were significantly decreased with the higher levels of resistance in the lines used, and the optimal timing of fungicide application remains at or after 50% anthesis. Miravis Ace efficacy was comparable to all other fungicides when applied at or after 50% anthesis but was not effective when applied at flag leaf or at to head emergence. Our recommendations for optimal timing of fungicides has not changed. In our environment, due to the relatively lower disease pressure, one fungicide application on moderately susceptible to moderately resistant varieties is sufficient to reduce disease to within industry guidelines of less than 1 ppm DON.

c) List key outcomes or other achievements.

The results of this study has been and will be presented numerous times at the local, national and international level. Consultants and breeding companies in the area have used previous data to improve fungicide application recommendations, and growers now regularly spray to reduce FHB and DON in susceptible and moderately susceptible spring wheat cultivars. Growers are now aware of the varieties that are less likely to get FHB and suffer high DON.

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.

There were significant impacts associated with the COVID pandemic including a reduction in the number of people we were able to hire (students and grad students) to perform the work or provide training opportunities, the inability to collaborate with our USDA colleagues and having to perform work for them due to travel and in-person work restrictions. Travel to the plots became difficult as there were restrictions of one person per car during the earlier period of time in the pandemic (until June 2020). Many fewer grower meetings and professional meetings were held and almost no in-person presentations were given. While in-person meetings were significantly reduced, field visits were continued due to reduced risk associated with outdoor activities. In addition, increased costs were associated with pre-grinding samples for DON testing due to USDA restriction in MN

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

I have a PhD student that has been working on this project (previously as a technician), whose responsibilities have been to develop inoculum, organize

inoculations, analyze data and assist in preparing reports. The PhD project will incorporate weather data to assist in the development of predictive models that are specific to the intermountain West irrigated environment. I also have a postdoctoral fellow training to supervise the nursery following the graduation of the PhD student.

I have also been able to assist other young faculty in the PNW with the development of grower recommendations and Pest Alerts for their producer clientele (OR and WA).

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

As I have a 60% extension appointment (100% cereals), I am responsible for presenting appropriate research to the growers and industry professionals. I regularly present the FHB research results at almost every meeting, incorporating it into presentations as well as into my annual Small Grain Report, which is widely distributed in Idaho and available online. Every year, I encourage my PhD student and post-doc to present at the Idaho Association of Plant Protection, to develop papers and to present at the USWBSI annual meeting and the regional and national American Phytopathological Society meetings.

Project 4: *FgMutantDB Migration to USWBSI Servers and Added Functionality*

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

   The major goals and objective of this research project is to preserve the FgMutantDB that stores the known locations of all the *Fusarium graminearum* mutants used in research program in the United States and globally. Advanced goals include added functionality to track and maintain collections of *F. graminearum* mutants.

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?**

   The curator of FgMutantDB, Dr. Thomas Baldwin, has been working closely with the USWBSI Systems administrator David Hane to import the database on the USWBSI servers.

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

   An up to date version of the FgMutantDB list of mutants was uploaded onto the USWBSI servers and a very early mysql schema has been developed. Imported data has been tested with raw data files from the original FgMutantDB, which remains active for users to add information. Unfortunately, the interactivity from the database is not creatable in mysql and have to be redesigned from scratch.

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

   Major outcomes of this achievement include importing an important resource that tracks mutants of *Fusarium graminearum* generated from USWBSI projects and other research initiatives onto the USWBSI servers for reference by USWBSI researchers. For many reasons' researchers can leave their stores of mutants behind with no way of keeping track of them. These mutants consist of a lot of time and funding to generate them. Keeping track of their locations and curation should be a priority

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.**

   The progress of this project was not affected directly by COVID-19. However, the researchers' time were limited by the increased demand of other projects directly affected by COVID-19

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

NDSU course in Advanced Mycology/Fungal Genetics utilized this database as a quick and simple way to track fungal mutants and develop their own database to integrate with other resources. One summer worker was trained on how to find newly released publications with newly developed *F. graminearum* mutants and relay that information to the researchers through FgMutantDB.

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

Information is shared with researchers on @FgmutantDB on twitter and through email communications.

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY20 award period (6/1/20 - 5/31/21). 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? 1

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.

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 (6/1/20 - 5/31/21). 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
N//a	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
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

NOTE: List the associated release notice or publication under the appropriate sub-section in the 'Publications' section of the FPR.

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 (6/1/20 - 5/31/21**) 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:

Winn, Z.J., Acharya, R., Lyerly, J., Brown-Guedira, G., Cowger, C., Griffey, C., Fitzgerald, J., Mason R.E., and Murphy, J.P. (2020, Dec 7-11). Mapping of Fusarium Head Blight Resistance in NC13-20076 Soft Red Winter Wheat (p. 12). In: Canty, S., Hoffstetter, A. and Dill-Macky, R. (Eds.), *Proceedings of the 2020 National Fusarium Head Blight Forum*. https://scabusa.org/pdfs/NFHBF20_Proceedings.pdf.
Status: Abstract Published and Poster Presented
Acknowledgement of Federal Support: YES (Abstract and Poster)

Journal publications.

Nothing to Report

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

Nothing to Report

Other publications, conference papers and presentations.

Yimer, B., Baldwin, S.A., Baldwin, T.T., Dong, Y. and Marshall, J.M. 2020. Evaluation of winter wheat varieties and selections for FHB resistance in southeast Idaho. Abstract and Poster at USWBSI National Fusarium Head Blight Forum, Milwaukee, WI. Dec 8 – 9, 2020.
Status: Abstract Published and Poster Presented
Acknowledgement of Federal Support: YES (Abstract and Poster)

Baldwin, S.A., Yimer, B.A, Baldwin, T.T., Dong, Y. and Marshall, J.M. 2020. Determining Fusarium Head Blight Resistance in Spring Barley in Idaho. Abstract and Poster at USWBSI National Fusarium Head Blight Forum, Milwaukee, WI. Dec 8 – 9, 2020
Status: Abstract Published and Poster Presented
Acknowledgement of Federal Support: YES (Abstract and Poster)

Sidrat Abdullah, Eninka Mndowla, Suzette Arcibal Baldwin, Ellen Kress, Ruth Dill-Macky, Mark Earl Sorrells, Patrick Gross, Robert Brueggeman, Carl Griffey, Joshua Fitzgerald, Juliet Marshall, Kathy Klos, and Thomas Baldwin. 2020. Fusarium Head Blight Biomass in Spring Barley Comparing 2018 to 2019 in U.S. Nurseries. Abstract and Poster at USWBSI National Fusarium Head Blight Forum, Milwaukee, WI. Dec 8 – 9, 2020.
Status: Abstract Published and Poster Presented
Acknowledgement of Federal Support: YES (Abstract and Poster)

Jane Marian Luis, Sin Joe Ng, Gary Bergstrom, Kaitlyn Bissonnette, Kira Bowen, Carl Bradley, Emmanuel Byamukama, Martin Chilvers, Alyssa Collins, Christina Cowger, Heather Darby, Erick DeWolf, Ruth Dill Macky, Paul Esker, Andrew Friskop, Nathan Kleczewski, Alyssa Koehler, David Langston, Jr., Laurence Madden, Juliet Marshall, Hillary Mehl, Wanderson Moraes, Martin Nagekirk, Nidhi Rawat, Damon Smith, Darcy Telenko, Stephen Wegulo, Heather Young-Kelly and Pierce A Paul. 2020. Fusarium Head Blight Management Coordinated Project: Integrated Management Trials 2018-2020. Abstract and Poster at USWBSI National Fusarium Head Blight Forum, Milwaukee, WI. Dec 8 – 9, 2020.
Status: Abstract Published and Poster Presented
Acknowledgement of Federal Support: YES (Abstract and Poster)

Marshall, J.M. 2020. Going Down the Rabbit Hole: The Effect of Climate Change on FHB and Small Grains. USWBSI. Plenary Speaker. Dec 7, 2020. National Fusarium Head Blight Forum, Milwaukee, WI. Dec 8 – 9, 2020.
Status: Presentation
Acknowledgement of Federal Support: YES

Marshall, J.M. 2020. Cereal Seed Diseases, Pests and Solutions. Idaho, Eastern Oregon Seed Association. Annual Meeting. Invited presentation. Meeting held virtually, Dec 1, 2020. National Fusarium Head Blight Forum, Milwaukee, WI. Dec 8 – 9, 2020.
Status: Presentation
Acknowledgement of Federal Support: YES