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

Cover Page

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Fiscal Year:	2020
USDA-ARS Agreement ID:	59-0206-0-179
USDA-ARS Agreement Title:	Developing Integrative Approaches to Tackle Fusarium Head Blight of Wheat and Barley
FY20 USDA-ARS Award Amount:	$ 82,615
Recipient Organization:	University of Maryland Office of the Comptroller Contract and Grant Accounting RM 4101, Chesapeake Bldg College Pard, MD 20742-3141
DUNS Number:	790934285
EIN:	52-6002033
Recipient Identifying Number or Account Number:	5252552
Project/Grant Reporting Period:	5/15/20 - 5/14/21
Reporting Period End Date:	5/14/2021

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
MGMT	Analyzing Commercial Wheat and Barley Cultivars for FHB Reaction in MD/DE	$ 14,935
MGMT	Evaluation of Fungicide Performance for FHB Management on SRW Wheat and Barley Varieties	$ 36,337
GDER	Wheat Variants Deficient in a FHB Susceptibility Factor	$ 31,343
	FY20 Total ARS Award Amount	**$ 82,615**

7/29/2021

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

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Project 1: *Analyzing Commercial Wheat and Barley Cultivars for FHB Reaction in MD/DE*

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

Evaluation of Fusarium head blight (FHB) reaction in popular local varieties of wheat and barley is critical for management of scab by growers. The major goal of this project is to conduct misted nursery to assess variety response to FHB in Maryland (MD) and Delaware (DE) cultivars. Specific objectives of the research project are:

1) Conduct misted nursery for local wheat and barley varieties from Maryland and Delaware.
2) Make the results available to the growers in a timely manner so that they can use them in making planting decisions in the growing season.
3) Organize field day to make growers aware of the importance of planting resistant varieties in management of FHB.

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?

1) Misted nursery was conducted for testing FHB response of eighty local wheat and barley varieties from Maryland and Delware. The experiments were conducted in 3 replications. Data on FHB severity and index was collected and statistically analyzed. DON data on some entries/reps is still awaited.
2) The results on FHB severity and index were collected and provided to the farmers in July, as soon as the data was completed and statistically analyzed. Samples for DON analyses were sent to the assigned lab, but that data was not available to include in the factsheet for use by farmers due to Covid-19.
3) 3. Field day could not be organized due to the Covid-19 restrictions in place at the appropriate time.

b) What were the significant results?

Evaluation of resistance levels of local cultivars based on visual symptoms and DON content was performed. Some DON analysis results are still awaited.

c) List key outcomes or other achievements.

Factsheet on the visual symptom evaluation for varieties was prepared and disseminated to the farmers.

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.

Yes, the research was significantly hampered by Covid-19. We were asked to grind our samples this year by ourselves for DON analysis, so it took a while to prepare samples. Secondly, we could not conduct field day for farmers because of Covid-19 severe restrictions in place at that time.

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

Two graduate students and three undergraduate students were involved in the project, who got trained for corn inoculum preparation, phenotypic data collection and evaluation.

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

A Factsheet with results on FHB severity and index was disseminated to extension agents, growers and other stakeholders in the state. The Factsheet will be updated once the entire data is received.

Project 2: *Evaluation of Fungicide Performance for FHB Management on SRW Wheat and Barley Varieties*

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

This project addresses the following goals in the USWBSI Action Plan: Goal # 1) Develop integrated management strategies for FHB and mycotoxins that are robust to conditions experienced in production fields of wheat and barley and Goal # 2) Help develop and validate the next generation of management tools for FHB and mycotoxin control.

Specific objectives of the project are:

1) Evaluate the combined effect of fungicide treatment and genetic resistance on FHB and DON in SRW wheat varieties and barley, with emphasis on Miravis Ace:
2) Compare the efficacy of Miravis Ace when applied at heading or at anthesis to that of standard anthesis application of Prosaro® or Caramba®.

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?

1) Field evaluation of efficacy of Miravis-Ace® and a standard fungicide with different genetic resistance levels of wheat and barley cultivars was performed.
2) Field evaluation of efficacy of Miravis-Ace and standard fungicides and controls was performed on susceptible wheat and barley cultivars.

b) What were the significant results?

1) Miravis-Ace performed better in resistant varieties than the susceptible cultivars in controlling visual FHB symptoms as well as DON.
2) Miravis-Ace was equally good in controlling FHB severity and DON content as standard FHB fungicides at anthesis.
3) Significant but lower level of control was obtained with application of Miravis-Ace at anthesis in terms of FHB severity. DON results are still awaited.

c) List key outcomes or other achievements.

Miravis-Ace provides FHB control at anthesis, and the level of control at 50% head emergence is lower, but significant. The preliminary results of the trials were shared with the growers and stakeholders in the state at Maryland Commodity Classic meeting. Fully analyzed results will be published in UMD Extension's Agronomy newsletter in August 2021.

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 was some delay in preparing samples due to requirement of grinding our samples, since with Covid-19 undergrad student help available in the process was limited.

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

Two graduate students and three undergraduate students were involved in the project, who got trained for corn inoculum preparation, phenotypic data collection and evaluation.

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

The preliminary results of the trials were shared with the growers and stakeholders in the state at Maryland Commodity Classic meeting. Fully analyzed results will be published in UMD Extension's Agronomy newsletter in August 2021.

Project 3: *Wheat Variants Deficient in a FHB Susceptibility Factor*

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

   The goal of this project is to identify native wheat gene variants that improve FHB resistance and reduce DON accumulation.

   The specific objectives of this project are to:
   1) Characterize the response to *Fusarium graminearum* in backcrossed progeny of Lpx3 variants.
   2) Develop wheat lines containing mutant combinations at more than one Lpx3 homeologous loci and characterize their response to *Fusarium graminearum*.

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?**
      1) Back-crosses were made with knock-out mutants, and the selfed progeny was selected for homozygous individuals
      2) Crosses between all the combinations of the A and B genome knock-out mutants were made, and backcrossed. Homozygous individuals were obtained for full null tetraploid mutant.

   b) **What were the significant results?**
      We have purified the background mutations in all 4 knock-out mutants as well as the combined full null mutant. Next, we are going to text the final genetic material in the Fall semester of 2021.

   c) **List key outcomes or other achievements.**
      Final genetic material with background cleared of mutations has been developed in all combinations. Next, the material will be tested for FHB severity and DON content.

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.**

   Due to pandemic, some interruptions in supplying and delivery of DNA extraction reagents, primers etc. were faced. This led to some delays in selecting homozygous individuals.

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

A PhD student has been involved in this project, and has been getting trained in FHB phenotyping, marker developments, PCRs, DNA extraction, sequence analysis, and basic wheat genetics.

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

The results were communicated as a talk and poster to the National FHB forum meeting, 2019.

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY20 award period (5/15/20 - 5/14/21). 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? 2

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.

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 (5/15/20 - 5/14/21). 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 (5/15/20 - 5/14/21**) 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.

Singh, L., Wight J.P., Crank, J., Thorne, L., Dong, Y., Rawat, N. (2020). Efficacy assessment of a new fungicide, Miravis Ace, for control of Fusarium head blight in wheat. Plant Health Progress. 21:365–368.
Status: Published
Acknowledgement of Federal Support: YES

Carpenter, N., Wright, E., Malla, S., Singh, L., Sanford, D.V., Clark, A., Harrison, S., Murphy, J.P., Costa, J., Chao, S., Brown-Guedira, G.L., Mc Master, N., Schmale, D.G., Griffey, C.A., Rawat, N. (2020). Identification and validation of Fusarium head blight resistance QTL in the US soft red winter wheat variety Jamestown. Crop Science. 60:2919–2930.
Status: Published
Acknowledgement of Federal Support: YES

Singh, L., Wight J.P., Crank, J., Thorne, L., Erwin, J.E., Dong, Y., Rawat, N. (2021). Evaluation of application timing of Miravis-Ace for control of Fusarium head blight and DON content in wheat. Plant Health Progress.
Status: Accepted
Acknowledgement of Federal Support: YES

Chhabra, B., Tiwari V.K., Gill, B.S., Dong, Y., Rawat, N. (2021). Discovery of a susceptibility factor for Fusarium head blight on chromosome 7A of wheat. Theoretical and Applied Genetics. DOI: 10.1007/s00122-021-03825-y.
Status: Published
Acknowledgement of Federal Support: YES

Steadham, J., Schulden, T., Kalia B., Gill, B.S., Bowden, L., Chhuneja, P., Erwin, J., Tiwari, V.K., Rawat, N. (2021). An approach for high-resolution genetic mapping of distant wild relatives of bread wheat. Theoretical and Applied Genetics. DOI: 10.1007/s00122-021-03851-w.
Status: Published
Acknowledgement of Federal Support: YES

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

Nothing to Report.

Other publications, conference papers and presentations.

Mittal, I., Alam, S., Chhabra, B., Shulaev, E., Mohan, V., Rawat, N., Shah, J. (2020). Targeting wheat genes associated with susceptibility to Fusarium graminearum for enhancing FHB resistance. In: S. Canty, A. Hoffstetter, Dill-Macky, R. (Eds.), Proceedings of the 2020 National Fusarium Head Blight Forum, Virtual. p.69.
Status: Abstract Published and Poster Presented
Acknowledgement of Federal Support: YES

Luis, J.M., Ng S.J., Bergstrom, G., Bissonnette, K., Bowen, K., Bradley, C., Byamukama, E., Chilvers, M., Collins, A., Cowger, C., Darby, H., DeWolf, E., Dill-Macky, R., Esker, P., Friskop, A., Kleczewski, N., Koehler., A., Langston, D.B., Madden, L., Marshall, J., Mehl, H., Moraes, W., Nagelkirk, M., Rawat, N., Smith, D., Telenko, D., Wegulo, S., Young-Kelly H., Paul, P.A. (2020). Fusarium Head Blight Management Coordinated Project: Integrated Management Trials- Wheat 2018-2020. In: S. Canty, A. Hoffstetter, Dill-Macky, R. (Eds.), Proceedings of the 2020 National Fusarium Head Blight Forum, Virtual. p. 38-42.
Status: Abstract Published and Poster Presented
Acknowledgement of Federal Support: YES

Luis, J.M., Ng S.J., Bergstrom, G., Bissonnette, K., Bowen, K., Bradley, C., Byamukama, E., Chilvers, M., Collins, A., Cowger, C., Darby, H., DeWolf, E., Dill-Macky, R., Esker, P., Friskop, A., Kleczewski, N., Koehler., A., Langston, D.B., Madden, L., Marshall, J., Mehl, H., Moraes, W., Nagelkirk, M., Rawat, N., Smith, D., Telenko, D., Wegulo, S., Young-Kelly

H., Paul, P.A. (2020). Fusarium Head Blight Management Coordinated Project: Integrated Management Trials- Barley 2018-2020. In: S. Canty, A. Hoffstetter, Dill-Macky, R. (Eds.), Proceedings of the 2020 National Fusarium Head Blight Forum, Virtual. p. 43-48.
Status: Abstract Published and Poster Presented
Acknowledgement of Federal Support: YES

Shah, J., Alam, S., Chabra, B., Mohan, V., Shulaev, E., Nagarajan, A., Gill, J., Rawat, N., Tyagi, N., Lee, H., and H. N. Trick (2019). Targeting Pathogenicity Mechanisms to Promote FHB-Resistance in Wheat. In: S. Canty, A. Hoffstetter, H. Campbell, and R. Dill-Macky (Eds.), Proceedings of the 2019 National Fusarium Head Blight Forum, Milwaukee, WI. p. 56.
Status: Abstract Published and Poster Presented
Acknowledgement of Federal Support: YES

Paul, P., Ng, S.J., Bergstrom, G., Bissonnette, K., Bradley, C., Byamukama, E., Chilvers, M.I., Collins, A., Cowger, C., Darby, H.M., DeWolfe, E., Dill-Macky, R., Esker, P., Friskop, A., Kleczewski, N., Koehler, A., Madden, L.V., Marshall, J., Mehl, H., Moraes, W., Nagelkirk, M., Rawat, N, Smith, D., Telenko, D., Wegulo, S., Young-Kelly, H.M. (2019). Fusarium head blight management coordinated project: Uniform fungicide trials 2018-2019. Proceedings of the 2019 National Fusarium Head Blight Forum, Milwaukee, WI. p. 20-24.
Status: Abstract Published and Poster Presented
Acknowledgement of Federal Support: YES

Paul, P., Ng, S.J., Bergstrom, G., Bissonnette, K., Bradley, C., Byamukama, E., Chilvers, M.I., Collins, A., Cowger, C., Darby, H.M., DeWolfe, E., Dill-Macky, R., Esker, P., Friskop, A., Kleczewski, N., Koehler, A., Madden, L.V., Marshall, J., Mehl, H., Moraes, W., Nagelkirk, M., Rawat, N., Smith, D., Telenko, D., Wegulo, S., Young-Kelly, H.M. (2019). Fusarium head blight management coordinated project: Uniform fungicide trials 2018-2019. Proceedings of the 2019 National Fusarium Head Blight Forum, Milwaukee, WI. p. 25-29.
Status: Abstract Published and Poster Presented
Acknowledgement of Federal Support: YES