USDA-ARS
U.S. Wheat and Barley Scab Initiative
FY19 Performance Report
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Cover Page

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Fiscal Year:	2019
USDA-ARS Agreement ID:	N/A
USDA-ARS Agreement Title:	Improvement and Adoption of FHB Management Techniques
FY19 USDA-ARS Award Amount:	$ 34,421

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
MGMT	Integrated Management of Winter Barley in Mid-Atlantic USA	$ 15,742
MGMT	Educating Soft Winter Wheat Producers on MR Varieties as the Foundation of FHB Management	$ 18,679
	FY19 Total ARS Award Amount	**$ 34,421**

Christina Cowger

7/24/20

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

Project 1: *Integrated Management of Winter Barley in Mid-Atlantic USA*

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

The first objective is to provide data to enhance the selection of Mid-Atlantic barleys with FHB resistance.

The second objective is to better understand profitability of integrating cultivar resistance and fungicide applications for scab reduction in Mid-Atlantic winter barley crops.

2. What was accomplished under these goals or objectives? *(For each major goal/objective, address items a-b) below.)*

a) What were the major activities?

Starting in 2014-15, several Mid-Atlantic barley nurseries were screened annually for FHB resistance: the Uniform Winter Barley Yield Trial, Uniform Winter Malting Barley Nursery, Uniform Barley Winterhardiness Nursery, and the ARS Barley Elite Yield Trial. A total of about 105 checks and experimental lines are screened each year for FHB resistance in a replicated, inoculated, misted trial. Both two- and six-row barleys are accepted in all the nurseries. The P.I. provides symptom, test weight, and DON data to Dr. David Marshall and the Virginia Tech team to provide data, which include disease symptoms and DON. Some of these data were included in a peer-reviewed manuscript that was published in 2019.

In 2016-17, we concluded a 3-year integrated management experiment. In a split-plot design, main plots consisted of four barley cultivars widely grown in the Mid-Atlantic region and having different levels of FHB resistance. Three levels of spray treatment with Prosaro® ("on-time," "late," and an unsprayed check) were the sub-plots. We published the results in the above-mentioned manuscript.

In 2017-18, 2018-19, and 2019-20, we conducted the first three years of a multi-year integrated management experiment using three winter barley cultivars with different levels of resistance to FHB: Violetta (MR), Thoroughbred (MR/MS), and Flavia (S). Inoculation was with Fusarium-infected corn spawn applied in three batches at one-week intervals. We used the six standard CP-IM fungicide treatments for Objective 1, plus four additional fungicide treatments, and all standard data were collected.

The treatments will allow comparisons of the efficacy of Miravis Ace® to that of Prosaro and Caramba®, and of three fungicide timings (spikes half emerged, spikes just fully emerged, and 6 days after spikes fully emerged). They will also allow estimation of the mean benefits of fungicide application, cultivar resistance, and the combination of the two in terms of yield, test weight, and DON reduction.

b) What were the significant results?

The first three-year integrated management experiment was concluded, and a peer-reviewed article is now published.

c) List key outcomes or other achievements.

Conclusions from the first winter barley integrated management experiment:

VARIETY RESISTANCE: Across the three years, DON ranked the cultivars Endeavor < Nomini = Thoroughbred < Atlantic.

FUNGICIDE TIMING: Neither visual disease symptoms nor deoxynivalenol (DON) gave any reason to prefer one of the fungicide timings over the other.

FUNGICIDE + RESISTANCE: Relative to the unsprayed treatment of the susceptible cultivar Atlantic, the percent DON reduction provided by the moderately resistant cultivar Endeavor was 70% (Fig. 1). The percent DON reduction from a fungicide application on Atlantic was 35%, averaging the two spray timings together. The combination of Endeavor's moderate resistance and a fungicide, again averaging the two timings, resulted in a 75% DON reduction compared to unsprayed Atlantic.

The second barley integrated management experiment has so far shown that Miravis Ace is as effective as Prosaro or Caramba when applied at early full heading or 6 days later. However, efficacy of all three products was lower when applied at 50% barley spike emergence.

3. Was this research impacted by the COVID-19 pandemic (i.e. university shutdowns, reduced or lack of support personnel, etc.)? If yes, please explain how this research was impacted or is continuing to be impacted.

The field research was not affected by the pandemic.

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

The project has helped train two technicians in management of FHB field experiments, including inoculum production and application, establishment of effective mist irrigation programs, disease assessment techniques, and sample processing for test weight and DON analysis.

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

We have presented the results at field days in North Carolina which draw hundreds of growers and crop consultants and county agents; presented a poster at the Joint Crops meeting which draws hundreds of farmers and crop advisors from the Mid-Atlantic region; and published a peer-reviewed article in *Plant Disease*.

Project 2: *Educating Soft Winter Wheat Producers on MR Varieties as the Foundation of FHB Management*

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

   Communicate about FHB management with producers and crop advisors who are not being reached or convinced to change their FHB management by current extension programs. The geographic / market class focus is on the soft winter wheat region, which was demonstrated by the producer survey to have special problems with MR variety adoption. Projects are aimed at strengthening the message and enhancing adoption of variety resistance, particularly in soft winter wheat.

2. **What was accomplished under these goals or objectives?** *(For each major goal/objective, address items a-b) below.)*

   a) What were the major activities?

   Two webinars on managing FHB in wheat were presented on Feb. 11 and Feb 18, 2019, through the American Society of Agronomy.

   b) What were the significant results?

   The webinars had over 900 registrants each, and 231 to 343 live participants each. Hundreds of others viewed the webinars on their own schedules.

   c) List key outcomes or other achievements.

   There were many positive evaluations of the material presented, and numerous questions were answered either during the webinars or afterward by email.

3. **Was this research impacted by the COVID-19 pandemic (i.e. university shutdowns, reduced or lack of support personnel, etc.)? If yes, please explain how this research was impacted or is continuing to be impacted.**

   Our presentation could not be given at the April 2020 meeting of the International Association of Operative Millers due to the meeting's COVID-19-related cancellation. However, we have been invited to prepare an article for the IAOM newsletter.

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

   PIs have gained experience in webinar development and presentation.

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

See webinars, above under significant results.

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY19 award period (N/A). 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 FY19 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 FY19 award period?**
   No.
   If yes, how many?

3. **Have any post docs who worked for you during the FY19 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 FY19 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 FY19 award period. 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** (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 FY19-FPR_Instructions for detailed more instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY19 grant award. Only citations for publications published (submitted or accepted) or presentations presented during the **award period (N/A**) 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:

De Wolf, E., D. Shah, P. Paul, L. Madden, S. Crawford, D. Hane, S. Canty, R. Dill-Macky, D. Van Sanford, K. Imhoff and D. Miller. 2019. "Impact of Prediction Tools for Fusarium Head Blight in the US, 2009-2019." In: S. Canty, A. Hoffstetter, H. Campbell and R. Dill-Macky (Eds.), *Proceedings of the 2019 National Fusarium Head Blight Forum*, Milwaukee, WI; December 8-10. University of Kentucky, Lexington, KY. p. 12.
Status: Abstract Published and Poster Presented
Acknowledgement of Federal Support: YES (Abstract and Poster)

Journal publications.

Cowger, C., Smith, J., Boos, D., Bradley, C. A., Ransom, J., and Bergstrom, G. C. 2020. Managing a destructive, episodic crop disease: a national survey of wheat and barley growers' experience with Fusarium head blight. Plant Dis. 104:634-648.
Status: Published
Acknowledgement of Federal Support: YES

Cowger, C., Arellano, C., Marshall, D., and Fitzgerald, J. 2019. Managing Fusarium head blight in winter barley with cultivar resistance and fungicide. Plant Dis. 103:1858-1864.
Status: Published
Acknowledgement of Federal Support: YES

McKee, G., **Cowger, C.**, Dill-Macky, R., Friskop, A., Gautam, P., Ransom, J., and Wilson, W. 2019. Disease management and estimated effects on DON (deoxynivalenol) contamination in *Fusarium* infested barley. Agriculture 9:155.
Status: Published
Acknowledgement of Federal Support: YES

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

Other publications, conference papers and presentations.

Cowger, Christina. 2019. "Comparison of Miravis Ace, Prosaro and Caramba for management of DON in winter barley." In: S. Canty, A. Hoffstetter, H. Campbell and R. Dill-Macky (Eds.), *Proceedings of the 2019 National Fusarium Head Blight Forum* (p. 5), Milwaukee, WI; December 8-10. University of Kentucky, Lexington, KY.
Status: Abstract Published and Poster Presented
Acknowledgement of Federal Support: YES (Abstract and Poster)

Paul, P.A., S.J. Ng, and 25 other co-authors. 2019. "Fusarium head blight management coordinated project: Integrated management trials 2018-2019. In S. Canty, A. Hoffstetter, H. Campbell and R. Dill-Mackey (Eds.), *Proceedings of the 2019 National Fusarium Head Blight Forum* (p. 20), Milwaukee, WI; December 8-10. University of Kentucky, Lexington, KY.
Status: Abstract Published and Poster Presented
Acknowledgement of Federal Support: YES (Abstract and Poster)

Paul, P.A., S.J. Ng, and 25 other co-authors. 2019. "Fusarium head blight management coordinated project: Uniform fungicide trials 2018-2019." In S. Canty, A. Hoffstetter, H. Campbell and R. Dill-Mackey (Eds.), *Proceedings of the 2019 National Fusarium Head Blight Forum* (p. 25), Milwaukee, WI; December 8-10. University of Kentucky, Lexington, KY.
Status: Abstract Published and Poster Presented
Acknowledgement of Federal Support: YES (Abstract and Poster)