USDA-ARS
U.S. Wheat and Barley Scab Initiative
FY19 Final Performance Report
Due date: August 7, 2020

Cover Page

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Fiscal Year:	2019
USDA-ARS Agreement ID:	59-0206-8-190
USDA-ARS Agreement Title:	Integrated Management of FHB and DON in Barley in New England
FY19 USDA-ARS Award Amount:	$ 20,067
Recipient Organization:	University of Vermont and State Agricultural College Sponsored Project Administration 217 Waterman Building 85 South Prospect St. Burlington VT 05405
DUNS Number:	66811191
EIN:	03-0179440
Recipient Identifying Number or Account Number:	000033652
Project/Grant Reporting Period:	6/1/19 - 5/31/20
Reporting Period End Date:	5/31/2020

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
MGMT	Integrated Management of FHB and DON in Barley in New England	$ 20,067
	FY19 Total ARS Award Amount	**$ 20,067**

Heather Darby 7/30/2020

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

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Project 1: *Integrated Management of FHB and DON in Barley in New England*

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

New England farmers need more information on agronomic practices for preventing or controlling *Fusarium* infection in order to produce high quality malting barley. This project evaluated integrated management strategies with the goal of minimizing the loss of yield and quality from FHB.

The project objectives were:
1) Evaluate spring and winter barley varieties in order to identify those that are suitable for malting and adapted to the Northeast.
2) Evaluate the efficacy of using fungicides to control *Fusarium* head blight infection of spring malting barley.

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

Obj. 1. Evaluate spring and winter barley varieties in order to identify those that are suitable for malting and adapted to the Northeast.

a) What were the major activities?

Winter and spring malting barley variety trials were conducted in Alburgh, Vermont. A trial to evaluate 17 winter barley cultivars was established in September 2018. These varieties were evaluated for winter survival. The spring barley variety trial evaluating 28 varieties was established in April 2019. The spring barley varieties were evaluated for yield, quality, and DON concentrations.

b) What were the significant results?

Winter barley received significant winter injury and the stand was too poor to evaluate for harvest. Despite a challenging beginning to the growing season with cold weather delaying planting and suppressing germination, 2019 was overall a fairly good year for growing spring barley. The average yield for the trial was 3553 lbs ac^{-1}, higher than the grand mean yield from 2011-2017 spring barley variety trials at Borderview Research Farm of 2289 lbs ac^{-1}. In terms of quality parameters, the test weight, crude protein, plumpness, germination, DON concentrations, and falling number were all very good, with almost all barley varieties meeting or exceeding industry standards.

c) List key outcomes or other achievements.

Variety trial results were distributed to over 400 stakeholders during the project period. Maltsters, distillers, and brewers in Vermont have worked collaboratively with UVM and grain growers to test and adopt new varieties that have performed well in terms of both agronomics and end-use quality.

Obj. 2. Evaluate the efficacy of using fungicides to control Fusarium head blight infection of spring malting barley.

a) What were the major activities?

A field experiment was established in Vermont on 30-Apr 2019 to investigate the effects of cultivar resistance, fungicide efficacy, application timing on FHB and DON infection in spring malting barley. The experimental design was a randomized complete block, with a split-plot arrangement of cultivar as the whole-plot and fungicide+timing treatments as the sub-plots. The fungicide+timing treatments are listed in Table 1 and the application rates listed in Table 2. The fungicide approved for use in organic systems was ChampION.

Table 1. Treatment application dates.

Variety and treatment	Application
Conlon 10.3 Feekes Miravis Ace	22-Jun
Conlon Inoculated with *Fusarium*	24-Jun
Conlon Heading Applications	24-Jun
Conlon Post-heading Applications	29-Jun
Robust 10.3 Feekes Miravis Ace	27-Jun
Robust Heading Applications	29-Jun
Robust Inoculated with *Fusarium*	29-Jun
Robust Post-Heading Applications	2-Jul

Table 2. Treatments-application rates.

Treatments	Application rate
Control	Water
Caramba	14 fl oz ac^{-1}
ChampION	1.5 lbs ac^{-1}
Miravis Ace	13.7 fl oz ac^{-1}
Prosaro	6.5 fl oz ac^{-1}
Fusarium graminearum	40,000 spores/ml

b) What were the significant results?

Fungicide treatments had a significant impact on yield and DON concentrations. Compared to the other fungicide treatments, the Miravis Ace® applied at 5 days after heading or at heading had the lowest DON concentrations (0.10 ppm). Essentially, applications of Miravis Ace at either timing were effective in reducing DON concentrations to levels comparable to barley with no *Fusarium* exposure. Interestingly, barley treated with Miravis Ace also had significantly higher yields compared to barley treated with Caramba® or ChampION.

c) List key outcomes or other achievements.

Fungicide trial results were distributed to over 400 stakeholders during the project period. As a result, farmers have started to incorporate fungicide application into their production plans.

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.

No, the research was not impacted by the pandemic.; however some of our outreach plans were limited due to the ongoing situation.

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

N/A

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

July 24, 2019. 11th Annual Northwest Crops and Soils Field Day – Borderview Research Farm, Alburgh, VT. 285 attendees.

November 10, 2019. Grower Meeting Peterson Malt – Peterson Malt, Ferrisburgh, VT 35 attendees.

March 12, 2020. The 16th Annual Grain Growers Conference- Going with the grain, Essex, VT. 85 attendees.

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the award period (6/1/19 - 5/31/20). 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?**
   N/A

   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?**
   N/A

   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?**
   N/A

   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?**
   N/A

   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 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 'USWBSI_Performance-Report_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 (6/1/19 - 5/31/20**) 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.

Journal publications.

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

Other publications, conference papers and presentations.

Darby, H. and E. Cummings. 2018. Evaluation of Fungicide Applications Plus Cultivar Resistance to Reduce FHB and DON Infection of Barley in New England. Proceedings of the 2019 National Fusarium Head Bligh Forum. Dec 2-4, 2018. St. Louis, MO.
Status: Paper
Acknowledgement of Federal Support: YES

Darby, H., H. Emick and H. Jean. 2019. 2018 Organic Spring Barley Variety Trial. University of Vermont Extension Northwest Crops and Soils Program, St. Albans, VT. Available online at: https://www.uvm.edu/sites/default/files/media/2018_Spring_Barley_VT_Report.pdf (accessed 11 Jul. 2019).
Status: Reports published online
Acknowledgement of Federal Support: YES

Darby, H., H. Emick and H. Jean. 2019. 2018 Organic Winter Malting Barley Variety Trial. University of Vermont Extension Northwest Crops and Soils Program, St. Albans, VT. Available online at: https://www.uvm.edu/sites/default/files/media/2018_organic_WBVT.pdf (accessed 11 Jul. 2019).
Status: Reports published online
Acknowledgement of Federal Support: YES

Darby, H., E. Cummings and H. Emick. 2019. The Efficacy of Spraying Fungicides to Control Fusarium Head Blight Infection in Spring Malting Barley. University of Vermont Extension Northwest Crops and Soils Program, St. Albans, VT. Available online at: https://www.uvm.edu/sites/default/files/media/2018_Spring_Barley_Fungicide.pdf (accessed 11 Jul. 2019).
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Darby, H. and H. Emick. 2019. Evaluation of Fungicide Applications Plus Cultivar Resistance to Reduce FHB and DON Infection of Barley in New England. Proceedings of the 2019 National Fusarium Head Bligh Forum. Dec 8-10, 2019. Milwaukee, WI.
Status: Paper
Acknowledgement of Federal Support: YES

Darby, H., H. Emick and H. Jean. 2020. 2019 Organic Spring Barley Variety Trial. University of Vermont Extension Northwest Crops and Soils Program, St. Albans, VT. Available online at: https://www.uvm.edu/sites/default/files/Northwest-Crops-and-Soils-Program/2019_SpringBarleyVT_Report.pdf (accessed 11 Jul. 2020).
Status: Reports published online
Acknowledgement of Federal Support: YES

Darby, H., H. Emick, J. Bruce, and H. Jean. 2020. 2019 Organic Winter Malting Barley Variety Trial. University of Vermont Extension Northwest Crops and Soils Program, St. Albans, VT. Available online at: https://www.uvm.edu/sites/default/files/media/2019_Winter_Barley_Variety_Trial.pdf (accessed 11 Jul. 2020).
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