USDA-ARS
U.S. Wheat and Barley Scab Initiative
FY18 Performance Report
Due date: July 12, 2019

Cover Page

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Fiscal Year:	2018
USDA-ARS Agreement ID:	59-0206-8-190
USDA-ARS Agreement Title:	Integrated Management of FHB and DON in Barley in New England.
FY18 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:	6/1/18 - 5/31/19
Reporting Period End Date:	05/31/19

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
	FY18 Total ARS Award Amount	$ 20,067

Heather Darby 7/12/2019
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 project?

Fusarium head blight (FHB) is currently the most significant disease impacting organic and conventional grain growers in New England, resulting in loss of yield, shriveled grain, and, most notably, mycotoxin contamination. 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? *Address items 1-4) below for each goal or objective.*

Objective 1.

1) major activities
Winter and spring malting barley variety trials were conducted in Alburgh, Vermont. A trial to evaluate 27 winter barley cultivars was established in September 2017. These varieties were evaluated for yield, quality, and DON concentrations. The spring barley variety trial evaluating 25 varieties was established in April 2018. The spring barley varieties were evaluated for yield, quality, and DON concentrations.

2) specific objectives
Evaluate spring and winter barley varieties in order to identify those that are suitable for malting and adapted to the Northeast.

3) significant results
Winter barley yields ranged from 904 to 3887 lbs ac^{-1}, with a trial average of 2485 lbs ac^{-1}. The DON concentrations ranged from 0.00 to 0.70 ppm. Spring barley yields ranged from 1462 to 3089 lbs ac^{-1}, with a trial average of 2395 lbs ac^{-1}, and DON levels from 0.20 to 0.67 ppm. These results indicate the importance of variety selection especially for those that may confer some tolerance to FHB. Although 2018 was a good year overall for growing barley with low DON levels and good yields, there were significant differences between varieties in both yield and DON concentrations in both variety trials.

4) key outcomes or other achievements
Variety trial results were distributed to over 400 stakeholders during the project period. Maltsters and brewers in Vermont have worked with grain growers to adopt new varieties that have performed well in terms of both agronomics and malting quality.

Objective 2.

1) major activities

A field experiment was established in Vermont on 24-Apr 2018 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. Three fungicides approved for use in organic systems were evaluated: Actinovate, ChampION, and Sonata.

Treatments	Heading application	4 days after heading application	Application rate
	date	date	
Control	15-Jun	19-Jun	Water
Actinovate	15-Jun	19-Jun	6 fl oz ac^{-1}
Caramba	15-Jun	19-Jun	14 fl oz ac^{-1} +.125% Induce ac^{-1}
ChampION	15-Jun	19-Jun	1.5 lbs ac^{-1}
Miravis Ace	15-Jun	19-Jun	13.7 fl oz ac^{-1}+ .125% Induce ac^{-1}
Sonata	15-Jun	19-Jun	2 qt. ac^{-1}
Fusarium graminearum	15-Jun		40,000 spores/ml

2) specific objectives

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

3) significant results

Fungicide treatments had a significant impact on DON concentrations. Compared to the other fungicide treatments, the Miravis Ace applied at 4 days after heading or at heading had the lowest DON concentrations (0.188 and 0.238 ppm, respectively). Essentially, applications of Miravis Ace at either timing were effective in reducing DON concentrations to levels comparable to barley with no fusarium exposure. Interestingly, Miravis Ace had significant and conflicting effects on yields and test weight. Miravis Ace, applied either at heading or at four days after heading, was correlated with decreased yields and test weight in the resistant variety, and higher yield and test weight in the susceptible variety.

4) 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 for 2019.

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

Nothing to report

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

July 26, 2018. 11th Annual Northwest Crops and Soils Field Day – There's Something Growing on Around Here, Borderview Research Farm, Alburgh, VT. 216 attendees.

November 12, 2018. Grower Meeting Peterson Malt – Malt Production and Planning. Peterson Malt, Ferrisburgh, VT 20 attendees.

March 28, 2019. The 15th Annual Grain Growers Conference- Stories of An Evolving Food System, Essex, VT. 113 attendees.

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY18 award period. 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 FY18 award period?** N/A

2. **Did any graduate students in your research program supported by funding from your USWBSI grant earn their Ph.D. degree during the FY18 award period?** N/A

3. **Have any post docs who worked for you during the FY18 award period and were supported by funding from your USWBSI grant taken faculty positions with universities?** N/A

4. **Have any post docs who worked for you during the FY18 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

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 FY18 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 FY18-FPR_Instructions for detailed instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY18 grant. Only include citations for publications submitted or presentations given during your award period (6/1/18 - 5/31/19). If you did not have any publications or presentations, state 'Nothing to Report' directly above the Journal publications section.

NOTE: Directly below each reference/citation, you must indicate the Status (i.e. published, submitted, etc.) and whether acknowledgement of Federal support was indicated in publication/ presentation. See example below for a poster presentation with an abstract:

> Conley, E.J., and J.A. Anderson. 2018. Accuracy of Genome-Wide Prediction for Fusarium Head Blight Associated Traits in a Spring Wheat Breeding Program. In: Proceedings of the XXIV International Plant & Animal Genome Conference, San Diego, CA.
> Status: Abstract Published and Poster Presented
> Acknowledgement of Federal Support: YES (poster), NO (abstract)

Journal publications.

N/A

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

N/A

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).
Status: Reports published online
Acknowledgement of Federal Support: YES