

USDA-ARS | U.S. Wheat and Barley Scab Initiative
FY21 FINAL Performance Progress Report

Due date: July 26, 2023

Cover Page

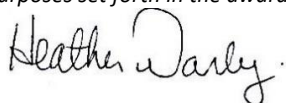
USDA-ARS Agreement ID:	59-0206-0-141
USDA-ARS Agreement Title:	Integrated Management of FHB and DON in Barley in New England
Principle Investigator (PI):	Heather Darby
Institution:	University of Vermont
Institution UEI:	Z94KLERAG5V9
Fiscal Year:	2021
FY21 USDA-ARS Award Amount:	\$28,898
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Period of Performance:	6/1/21 - 5/31/23
Reporting Period End Date:	5/31/2023

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
MGMT-IM	Integrated Management of FHB and DON in Barley in New England	\$28,898
FY21 Total ARS Award Amount		\$28,898

I am submitting this report as a: FINAL Report

I certify to the best of my knowledge and belief that this report is correct and complete for performance of activities for the purposes set forth in the award documents.



Principal Investigator Signature

July 22, 2023 _____
Date Report Submitted

† BAR-CP – Barley Coordinated Project
 DUR-CP – Durum Coordinated Project
 EC-HQ – Executive Committee-Headquarters
 FST-R – Food Safety & Toxicology (Research)
 FST-S – Food Safety & Toxicology (Service)
 GDER – Gene Discovery & Engineering Resistance
 HWW-CP – Hard Winter Wheat Coordinated Project

MGMT – FHB Management
 MGMT-IM – FHB Management – Integrated Management Coordinated Project
 PBG – Pathogen Biology & Genetics
 TSCI – Transformational Science
 VDHR – Variety Development & Uniform Nurseries
 NWW – Northern Soft Winter Wheat Region
 SPR – Spring Wheat Region
 SWW – Southern Soft Red Winter Wheat Region

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?

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 or objectives? (For each major goal/objective, address these three items below.)

a) What were the major activities?

Objective 1: Winter and spring malting barley variety trials were conducted in Alburgh, Vermont. A trial to evaluate 27 winter barley cultivars was established on September 18, 2020. These varieties were evaluated for yield, quality, and DON concentrations. The spring barley variety trial evaluating 25 varieties was established on April 09, 2021. The spring barley varieties were evaluated for yield, quality, and DON concentrations.

Objective 2: A field experiment was established in Vermont 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. In 2021, fungicides were trialed individually and in combinations. The organic fungicide Champ ION was applied in three timing combinations: at heading, post-heading and at both heading and post-heading. The six-row cultivar (Robust) was approximately a week ahead of the two-row cultivar (ND Genesis) resulting in separate applications of each treatment at the appropriate timing for each cultivar.

Table 1 – Application dates and rates for fungicides applied to malting barley, Alburgh, VT 2021.

Treatments	Early application	Heading application	4-6 days after heading	Application rate
	Feekes 10.3	Feekes 10.5	Feekes 10.5	
Control		15 & 16 June		Water
Caramba		15 & 16 June		14 fl oz ac ⁻¹ +.125% Induce ac ⁻¹
Prosaro		15 & 16 June		6.5 fl oz ac ⁻¹ +.125% Induce ac ⁻¹
Champion		15 & 16 June	20-Jun	1.5 lbs ac ⁻¹
Regalia		15 & 16 June		65 fl oz ac ⁻¹ +.125% Induce ac ⁻¹
Miravis Ace	8 & 9 June	15 & 16 June		13.7 fl oz ac ⁻¹ + .125% Induce ac ⁻¹
Miravis Ace + Prosaro		15 & 16 June	20-Jun	
Miravis Ace + Caramba		15 & 16 June	20-Jun	
<i>Fusarium graminearum</i>		15 & 16 June		100,000 spores/ml

b) What were the significant results?

Objective 1: In 2021, winter barley yields ranged from 2284 to 6022 lbs ac⁻¹, with a trial average of 4057 lbs ac⁻¹. DON concentrations ranged from 0.00 to 0.50 ppm. Spring barley yields ranged from 2531 to 4339 lbs ac⁻¹, with a trial average of 3365 lbs ac⁻¹, and DON levels from 0.00 to 0.52 ppm. These results indicate the importance of variety selection especially for those that may confer some tolerance to FHB. 2021 was a very good year for barley quality. In both trials, yields differed significantly between varieties although DON concentrations did not.

Objective 2: In 2021, fungicide treatments did have a significant impact on the incidence of Fusarium head blight and on DON concentrations. The highest DON concentrations in the trial were in the organic Regalia treatment (applied at heading) at 0.93 ppm. The uninoculated control had the lowest DON concentrations at 0.17 ppm. Five treatments had DON concentrations statistically below those of the Fusarium only treatment that was inoculated but not treated with fungicide: Miravis Ace applied at heading, Miravis Ace applied post-heading, Miravis Ace at heading followed by Caramba post-heading, and Miravis Ace at heading followed by Prosaro post-heading. Significant effects on FHB incidence and severity were also noted but are not closely correlated to DON concentrations.

c) List key outcomes or other achievements.

Objective 1: Variety trial results were distributed to over 572 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: Fungicide trial results were distributed to over 572 stakeholders during the project period. As a result, 91% of attendees indicated an increased knowledge on Fusarium head blight management. 83% indicated improved knowledge on fungicide options and application timing to manage head blight. Twenty-two farmers have started to incorporate fungicide applications into their production plans.

3. What opportunities for training and professional development has the project provided?The project has allowed the PI and one student to attend the Forum each year.

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

These research results have been posted on our website (www.uvm.edu/extension/nwcrops). They were discussed at two in-person field days in July and September and at our virtual grains conference in March 2022 and 2023. There were a total of 572 participants.

Publications, Conference Papers, and Presentations

Please include a listing of all your publications/presentations about your FHB work that were a result of funding from your FY21 grant award. Only citations for publications published (submitted or accepted) or presentations presented during the **award period** should be included.

Did you publish/submit or present anything during this award period?

- Yes, I've included the citation reference in listing(s) below.
 No, I have nothing to report.

Journal publications as a result of FY21 award

List peer-reviewed articles or papers appearing in scientific, technical, or professional journals. Include any peer-reviewed publication in the periodically published proceedings of a scientific society, a conference, or the like.

Identify for each publication: Author(s); title; journal; volume; year; page numbers; status of publication (published [include DOI#]; accepted, awaiting publication; submitted, under review; other); acknowledgement of federal support (yes/no).

Books or other non-periodical, one-time publications as a result of FY21 award

Report any book, monograph, dissertation, abstract, or the like published as or in a separate publication, rather than a periodical or series. Include any significant publication in the proceedings of a one-time conference or in the report of a one-time study, commission, or the like.

Identify for each one-time publication: Author(s); title; editor; title of collection, if applicable; bibliographic information; year; type of publication (book, thesis, or dissertation, other); status of publication (published; accepted, awaiting publication; submitted, under review; other); acknowledgement of federal support (yes/no).

Other publications, conference papers and presentations as a result of FY21 award

Identify any other publications, conference papers and/or presentations not reported above. Specify the status of the publication.

Darby, H. and H. Emick. (2022). Evaluation of Organic Copper Fungicide plus Cultivar Resistance to reduce FHB and DON Infection of Barley in Vermont. *Proceedings of the 2022 National Fusarium Head Blight Forum*; Tampa, FL. December 4-6, 2022. Retrieved from: <https://scabusa.org/forum/2022/2022NFHBForumProceedings.pdf>
Status: Abstract Published and Paper Presented
Acknowledgement of Federal Support: YES (Abstract and Paper)

Darby, H. and H. Emick. (2021). Evaluation of Conventional and Organic Fungicide Applications plus Cultivar Resistance to reduce FHB and DON Infection of Barley in Vermont. *Proceedings of the 2020 National Fusarium Head Blight Forum*; Virtual. December 6-7, 2021. Retrieved from: <https://scabusa.org/forum/2021/2021NFHBForumProceedings.pdf>
Status: Abstract Published and Paper Presented
Acknowledgement of Federal Support: YES (Abstract and Paper)

Darby, H., Wilcox Warren, S. and H. Emick. 2021. Organic Spring Barley Variety Trial. University of Vermont Extension Northwest Crops and Soils Program. St. Albans, VT. https://www.uvm.edu/sites/default/files/Northwest-Crops-and-Soils-Program/2021%20Research%20Rpts/2021_Organic_Spring_Barley_VT.pdf (accessed 28 Feb 2022).

Status: Reports published online

Acknowledgement of Federal Support: YES

Darby, H., Emick, H. and J. Bruce. 2021. Winter Barley Variety Trial. University of Vermont Extension Northwest Crops and Soils Program. St. Albans, VT. https://www.uvm.edu/sites/default/files/Northwest-Crops-and-Soils-Program/2021%20Research%20Rpts/2021_WBVT_ReportFinal.pdf. (accessed 28 Feb 2022).

Status: Reports published online

Acknowledgement of Federal Support: YES