

**USDA-ARS**  
**U.S. Wheat and Barley Scab Initiative**  
**FY20 Annual Performance Progress Report**  
**Due date: August 31, 2021**

**Cover Page**

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<b>Fiscal Year:</b>	2020
<b>USDA-ARS Agreement ID:</b>	59-0206-0-141
<b>USDA-ARS Agreement Title:</b>	Integrated Management of FHB and DON in Barley in New England
<b>FY20 USDA-ARS Award Amount:</b>	\$ 27,334
<b>Recipient Organization:</b>	University of Vermont and State Agricultural College Sponsored Project Administration 217 Waterman Building 85 South Prospect St. Burlington VT 05405
<b>DUNS Number:</b>	66811191
<b>EIN:</b>	03-0179440
<b>Recipient Identifying Number or Account Number:</b>	AWD00000204
<b>Project/Grant Reporting Period:</b>	6/1/20 - 5/31/21
<b>Reporting Period End Date:</b>	5/31/2021

**USWBSI Individual Project(s)**

USWBSI Research Category*	Project Title	ARS Award Amount
MGMT	Integrated Management of FHB and DON in Barley in New England	\$ 27,334
<b>FY20 Total ARS Award Amount</b>		<b>\$ 27,334</b>

**Heather Darby**

Principal Investigator

Digitally signed by Heather Darby  
 DN: cn=Heather Darby, o=University  
 of Vermont, ou=Extension,  
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 Date: 2021.09.02 08:11:17 -04'00'  
 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

**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 29 winter barley cultivars was established on September 20, 2019. These varieties were evaluated for yield, quality, and DON concentrations. The spring barley variety trial evaluating 26 varieties was established on April 17, 2020. The spring barley varieties were evaluated for yield, quality, and DON concentrations.

Objective 2: A field experiment was established in Vermont on April 9, 2020 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 2020, 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.

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**Table 1 – Application dates and rates for fungicides applied to malting barley, Alburgh, VT 2020.**

Treatments	Pre-heading application	Heading Application	Post-heading Application	Application Rate
Control	-	6/17 & 6/23	6/23 & 6/28	water
Prosaro	-	6/17 & 6/23	6/23 & 6/28	6.5 fl oz ac <sup>-1</sup> + 0.125% Induce ac <sup>-1</sup>
Caramba	-	6/17 & 6/23	6/23 & 6/28	14 fl oz ac <sup>-1</sup> + 0.125% Induce ac <sup>-1</sup>
Miravis Ace	6/12 & 6/16	6/17 & 6/23	6/23 & 6/28	13.7 fl oz ac <sup>-1</sup> + 0.125% Induce ac <sup>-1</sup>
Miravis Ace + Prosaro	-	6/17 & 6/23 (M.A.)	6/23 & 6/28 ( P )	same as individual applications
Miravis Ace + Caramba	-	6/17 & 6/23 (M.A.)	6/23 & 6/28 ( C )	same as individual applications
Champ ION	-	6/17 & 6/23	6/23 & 6/28	1.5 lbs ac <sup>-1</sup>
Fusarium	-	6/18 & 6/24		100,000 spores ml <sup>-1</sup>

**b) What were the significant results?**

Objective 1: Winter barley yields ranged from 3177 to 5631 lbs ac<sup>-1</sup>, with a trial average of 4482 lbs ac<sup>-1</sup>. DON concentrations ranged from 0.00 to 0.50 ppm. Spring barley yields ranged from 2904 to 4830 lbs ac<sup>-1</sup>, with a trial average of 4244 lbs ac<sup>-1</sup>, 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. 2020 was a very good year for barley quality. In both trials, yields differed significantly between trials although DON concentrations did not and were uniformly low across grains trials at the Alburgh site.

Objective 2: All grains trials including the fungicide trial had DON levels well below the 1 ppm threshold determined by the FDA. However, fungicide treatments did have a significant impact on the incidence of Fusarium head blight and on DON concentrations. Compared to the other fungicide treatments, the Miravis Ace® applied at heading had the lowest DON concentrations (0.03 ppm). This was statistically similar to all other conventional fungicide treatment timings and combinations, as well as the negative control (plots that were not inoculated with *Fusarium*), all of which tested below 0.20 ppm for DON. The Champ ION treatments were significantly higher than the conventional treatments (between 0.22 and 0.28 ppm). The positive control plots (inoculated with *Fusarium*, but not treated with fungicides) had the highest DON concentrations at 0.33 ppm. 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 250 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 250 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 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.**

The most significant impact of the COVID-19 pandemic on this research involved the dissemination of research results. Although there were logistical challenges involved in the field work, the team was able to work around these to complete the research field work. Some of the primary avenues for distributing our research results are at conferences, field days, and other in-person events. These were cancelled for over a year. We increased our blog postings and other social media communications to reach more people through this avenue and held online conferences, webinars and other events.

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

Nothing to report.

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

These research results have been posted on our website. They were discussed at our virtual grains conference in March 2021 (126 participants) and virtual grain week in May of 2021 (124 participants).

## Training of Next Generation Scientists

**Instructions:** Please answer the following questions as it pertains to the FY20 award period (6/1/20 - 5/31/21). 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 FY19 award period?**

Yes     No     Not Applicable

**If yes, how many?** [Click to enter number here.](#)

- 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?**

Yes     No     Not Applicable

**If yes, how many?** [Click to enter number here.](#)

- 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?**

Yes     No     Not Applicable

**If yes, how many?** [Click to enter number here.](#)

- 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?**

Yes     No     Not Applicable

**If yes, how many?** [Click to enter number here.](#)



## 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 (6/1/20 - 5/31/21)** 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:

Winn, Z.J., Acharya, R., Lyerly, J., Brown-Guedira, G., Cowger, C., Griffey, C., Fitzgerald, J., Mason R.E., and Murphy, J.P. (2020, Dec 7-11). Mapping of Fusarium Head Blight Resistance in NC13-20076 Soft Red Winter Wheat (p. 12). In: Canty, S., Hoffstetter, A. and Dill-Macky, R. (Eds.), *Proceedings of the 2020 National Fusarium Head Blight Forum*. [https://scabusa.org/pdfs/NFHBF20\\_Proceedings.pdf](https://scabusa.org/pdfs/NFHBF20_Proceedings.pdf).

Status: Abstract Published and Poster Presented

Acknowledgement of Federal Support: YES (Abstract and Poster)

### Journal publications.

N/A

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

N/A

### Other publications, conference papers and presentations.

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., Madden, L., Marshall, J., Mehl, H., Moraes, W., Nagelkirk, M., Rawat, N., Smith, D., Telenko, D., Wegulo, S., Young-Kelly, H., and Paul, P.A. (2020, Dec. 7-11). Fusarium head blight management coordinated project: Integrated management trials 2018-2020 (pp. 38-43). In: Canty, S., Hoffstetter, A. and Dill-Macky, R. (Eds.), *Proceedings of the 2020 National Fusarium Head Blight Forum*. [https://scabusa.org/pdfs/NFHBF20\\_Proceedings.pdf](https://scabusa.org/pdfs/NFHBF20_Proceedings.pdf).

Status: Published

Acknowledgement of Federal Support: Yes

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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., Madden, L., Marshall, J., Mehl, H., Moraes, W., Nagelkirk, M., Rawat, N., Smith, D., Telenko, D., Wegulo, S., Young-Kelly, H., and Paul, P.A. (2020, Dec. 7-11). Fusarium head blight management coordinated project: Uniform fungicide trials 2018-2020 (pp. 44-48). In: Canty, S., Hoffstetter, A. and Dill-Macky, R. (Eds.), *Proceedings of the 2020 National Fusarium Head Blight Forum*. [https://scabusa.org/pdfs/NFHBF20\\_Proceedings.pdf](https://scabusa.org/pdfs/NFHBF20_Proceedings.pdf).

Status: Published

Acknowledgement of Federal Support: Yes

Darby, H. and H. Emick. (2020, Dec 7-11). Evaluation of Organic Copper Fungicide Applications plus Cultivar Resistance to reduce FHB and DON Infection of Barley in Vermont (p. 31). In: S. Canty, A. Hoffstetter, and R. Dill-Macky (Eds.), *Proceedings of the 2020 National Fusarium Head Blight Forum*. [https://scabusa.org/pdfs/NFHBF20\\_Proceedings.pdf](https://scabusa.org/pdfs/NFHBF20_Proceedings.pdf).

Status: Abstract Published and Paper Presented

Acknowledgement of Federal Support: YES (Abstract and Paper)

Darby, H., H. Emick, H. Blair and R. Malone. 2021. 2020 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/2020%20Research%20Reports/2020\\_Organic\\_Spring\\_Barley\\_VT.pdf](https://www.uvm.edu/sites/default/files/Northwest-Crops-and-Soils-Program/2020%20Research%20Reports/2020_Organic_Spring_Barley_VT.pdf)

Status: Reports published online

Acknowledgement of Federal Support: YES

Darby, H., H. Emick, H. Blair and R. Malone. 2020. 2020 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/Northwest-Crops-and-Soils-Program/2020%20Research%20Reports/2020\\_Organic\\_Winter\\_Barley\\_VT.pdf](https://www.uvm.edu/sites/default/files/Northwest-Crops-and-Soils-Program/2020%20Research%20Reports/2020_Organic_Winter_Barley_VT.pdf)

Status: Reports published online

Acknowledgement of Federal Support: YES

Darby, H., H. Emick, and R. Malone. 2021. 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/Northwest-Crops-and-Soils-Program/2020%20Research%20Reports/2020\\_Spring\\_Barley\\_Fungicide\\_Report.pdf](https://www.uvm.edu/sites/default/files/Northwest-Crops-and-Soils-Program/2020%20Research%20Reports/2020_Spring_Barley_Fungicide_Report.pdf).

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