

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

Cover Page

Principle Investigator (PI):	Ruth Dill-Macky
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Fiscal Year:	2018
USDA-ARS Agreement ID:	59-0206-4-016
USDA-ARS Agreement Title:	Management of Fusarium Head Blight in Small Grains.
FY18 USDA-ARS Award Amount:	\$ 122,616
Recipient Organization:	Regents of the University of Minnesota Suite 450 Sponsored FIN RPT-P100100001 Minneapolis, MN 55455-2003
DUNS Number:	555917996
EIN:	41 -6007513
Recipient Identifying Number or Account Number:	CON000000048329
Project/Grant Reporting Period:	5/6/18 - 5/5/19
Reporting Period End Date:	05/05/19

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
MGMT	Minnesota Component of the FHB Integrated Management Coordinated Project.	\$ 29,148
GDER	A Field Nursery for Testing Transgenic Spring Wheat and Barley from the USWBSI.	\$ 17,004
EC-HQ	Support for the USWBSI Researcher Co-Chair and Executive Director of the NFO.	\$ 76,464
	FY18 Total ARS Award Amount	\$ 122,616



Principal Investigator

7-12-2019

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: *Minnesota Component of the FHB Integrated Management Coordinated Project.*

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

Demethylation inhibitor (DMI) fungicides such as prothioconazole, metconazole, and tebuconazole are the most effective for Fusarium head blight (FHB) and deoxynivalenol (DON) management. When applied at or up to 6 days after anthesis to moderately resistant cultivars, these fungicides provide more than 70% reduction of both FHB index and DON, relative to an untreated, susceptible check. Preliminary results from a limited number of trials showed that Miravis Ace (Adepidyn; Pydiflumetofen), a new succinate dehydrogenase inhibitor fungicide that is currently being labeled for use in wheat, has comparable efficacy against FHB and DON to the DMI fungicides Prosaro and Caramba when applied at anthesis (Feekes 10.5.1) or at 50% head emergence (Feekes 10.3). This project represented the Minnesota participation in two experiments proposed in the overall MGMT-CP, an integrated management trial (IM) and a uniform fungicide trial (UFT). In combination these trials have contributed to the overall effort to test Miravis Ace across grain market classes and growing conditions.

2. What was accomplished under these goals? *Address items 1-4) below for each goal or objective.*

1) major activities

We participated in the two experiments proposed in the overall MGMT-CP, an integrated management trial (IM) and a uniform fungicide trial (UFT). In combination these will contribute to the overall effort to test Miravis Ace across grain market classes and growing conditions. Experiments were established at two locations (St Paul and Crookston) for two grain classes (hard red spring wheat and barley) and completed following the experimental design as established by the coordinating group

2) specific objectives

In the Minnesota component of this project we conducted inoculated field experiments, using three cultivars of hard red spring wheat at two locations with the intent of providing useful data for the meta-analysis following the completion of similar experiments by others.

3) significant results

We generated useful levels of FHB and obtained data from the two locations where the experiments were established. The toxin analyses for the 2018 trial were completed in early 2019 and the data files are currently being compiled ahead of submission to the project coordinator. I am behind as my field technician left before the data were fully compiled but, I expect to have the data available soon.

4) key outcomes or other achievements

Results of these experiments will be used to advance the development of best management practices for FHB and DON.

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

In both sub-projects undergraduate researchers utilized the project to gain experience in field-based research techniques.

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

The data collected from these trials, along with trials conducted by other colleagues as part of the integrated management coordinated project funded by the USWBSI, will ultimately be used in a meta-analysis that will be published in peer-reviewed scientific journals. The outcome of this large collaborative research effort will ultimately provide information of the efficacy of fungicide treatments for FHB that would not be obtainable by any individual scientist.

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Project 2: *A Field Nursery for Testing Transgenic Spring Wheat and Barley from the USWBSI.*

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

This project had the objective of establishing an annual nursery to provide a central field-testing site for transgenic spring wheat and barley lines developed by researchers in the USWBSI.

2. What was accomplished under these goals? *Address items 1-4) below for each goal or objective.*

1) major activities

In 2018 a nursery was planted that to include 76 wheat and 12 barley entries evaluated in side by side experiments. The trial was planted at UMore Park, Rosemount MN on May 22, 2018. Trial entries and untransformed controls* for wheat were submitted by the University of Minnesota (52 wheat lines + Bobwhite*, Linkert* and Rollag* along with the checks Norm and Sumai 3), Rutgers University (16 wheat lines + Bobwhite*, RB07* and Rollag*) and the USDA (8 lines and CB037*). All barley lines included in the nursery were provided by the University of Minnesota (12 barley lines + Rasmusson*). Entries within each experiment were planted 2.43 m long single row plots, arranged in a randomized complete block design with four replications. Lines with known reactions to Fusarium head blight (FHB) were also included as checks. The wheat checks included the moderately resistant cultivars Linkert (FHB-5), RB07 (FHB-4), and Rollag (FHB-3) and the susceptible cultivars Norm (FHB-8) and Wheaton (FHB-8). The barley checks were the moderately resistant cultivar Quest (FHB-5) and the susceptible cultivar Lacey (FHB-8).

2) specific objectives

In 2018 the major objectives were completing the screening as planned and delivering the data to the cooperators.

3) significant results

Specific results were delivered to the cooperators and presented in the poster at the USWBSI forum in December 2018.

4) key outcomes or other achievements

In 2018 we conducted a successful nursery. The PI's submitting entries had their data ahead of the USWBSI forum and we presented the field data in a poster at that meeting.

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

None. Given the nature of the monitoring work access to the site was restricted to project personnel with considerable experience in running transgenic nurseries.

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

The USWBSI-funded PI's with wheat and barley entries in the nursery have been provided their data and copied on all communications with APHIS regarding site monitoring.

Project 3: *Support for the USWBSI Researcher Co-Chair and Executive Director of the NFO.*

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

The funding for this project is to provide personnel support for Dr. Ruth Dill-Macky, USWBSI Co-Chair and Executive Director of the USWBSI Networking & Facilitation Office. The project will support a full-time research assistant to help with Dr. Dill-Macky's USWBSI research projects, thereby allowing Dr. Dill-Macky to redirect time to her USWBSI administration responsibilities. The project will also support a very small amount (~1%) of the NFO's Director of Operations (DOO) salary to assist Dr. Dill-Macky with her PI responsibilities associated with the ARS/USWBSI agreement, etc. (funding applications, annual performance reports, travel assistance, etc.).

2. What was accomplished under these goals? *Address items 1-4) below for each goal or objective.*

1) major activities

A research technician was trained to oversee the aspects of inoculating and rating Fusarium head blight in the field. This includes overseeing planting activities, inoculum preparation, installing mist-irrigation and rating FHB.

2) specific objectives

The objective of this project was to train and support a research technician to oversee the everyday aspects of Dr. Ruth Dill-Macky's lab and field research related to Fusarium head blight. The training of this technician allows Dr. Dill-Macky to focus on her administrative responsibilities for the USWBSI.

3) significant results

A research technician was trained to run the day to day aspects of the lab. This includes preparing and inoculating the transgenic FHB nursery, coordinating FHB fungicide trials, and rating FHB in the field.

4) key outcomes or other achievements

Both the transgenic nursery and FHB fungicide trials were successful. The research technician has quickly adapted to running the aspects of the lab and has recently taken on more responsibilities related to the FHB projects. The technician has also been instrumental in advising Dr. Dill-Macky's undergraduate advisees and summer interns. She attended and participated in the 2018 annual forum. In addition, she provided staff support during the forum by helping with the registration process and coordinating Q&A's during the general sessions.

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

Not applicable to this project.

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

Not applicable to the objective of this project.

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?**

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 FY18 award period?**

No

If yes, how many?

- 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?**

No

If yes, how many?

- 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?**

No

If yes, how many?

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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

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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 (5/6/18 - 5/5/19). 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.

Journal publications.

Paul, P.A., Bradley, C.A., Madden, L.V., Lana, F.D., Bergstrom, G.C., Dill-Macky, R., Wise, K.A., Esker, P., McMullen, M.P., Grybauskas, A., Kirk, W.W., Milus, E.A., and Ruden, K. (2018). Effects of pre- and post-anthesis applications of demethylation inhibitor fungicides on Fusarium head blight and deoxynivalenol in spring and winter wheat. *Plant Disease*, 102:2500-2510.

Status: Published

Acknowledgement of Federal Support: Yes

Paul, P.A., Bradley, C.A., Madden, L.V., Lana, F.D., Bergstrom, G.C., Dill-Macky, R., Esker, P., Wise, K.A., McMullen, M.P., Grybauskas, A., Kirk, W.W., Milus, E.A., and Ruden, K. (2018). Meta-analysis of the effects of QoI and DMI fungicide combinations on Fusarium head blight and deoxynivalenol in wheat. *Plant Disease*, 102:2602-2615.

Status: Published

Acknowledgement of Federal Support: Yes

Anderson, J.A., Wiersma, J.J., Linkert, G.L., Reynolds, S.K., Kolmer, J.A., Jin, Y., Rouse M., Dill-Macky, R., Hareland G.A., and Ohm, J.-B. 2018. Registration of 'Norden' hard red spring wheat. *Journal of Plant Registrations*, 12:90-96.

Status: Published

Acknowledgement of Federal Support: Yes

Anderson, J.A., Wiersma, J.J., Linkert, G.L., Reynolds, S.K., Kolmer, J.A., Jin, Y., Rouse M., Dill-Macky, R., Hareland G.A., and Ohm, J.-B. 2018. Registration of 'Linkert' spring wheat with good straw strength and adult plant resistance to the Ug99 family of stem rust races. *Journal of Plant Registrations*, 12:208-214.

Status: Published

Acknowledgement of Federal Support: Yes

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Anderson, J.A., Wiersma, J.J., Linkert, G.L., Reynolds, S.K., Kolmer, J.A., Jin, Y., Rouse M., Dill-Macky, R., Smith, M.J., Hareland G.A., and Ohm, J.-B. 2018. Registration of 'Bolles' hard red spring wheat with high grain protein concentration and superior baking quality. *Journal of Plant Registrations*, 12:215-221.

Status: Published

Acknowledgement of Federal Support: Yes

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

Nothing to Report

Other publications, conference papers and presentations.

Salgado, J.D., Bergstrom, G., Bradley, C., Bowen, K., Byamukama, E., Byrne, A., Collins, A., Cowger, C., Cummings, J., Chapara, V., Chilvers, M.I., De Wolf, E., Dill-Macky, R., Darby, H.R., Esker, P.D., Friskop, A., Halvorson, J., Kleczewski, N., Madden, L.V., Marshall, J., Mehl, H., Nagelkirk, M., Starr, J., Stevens, J., Smith, D., Smith, M., Wegulo, S., Wise, K., Yabwalo, D., Young-Kelly, H.M., and Paul, P. (2018). Efficacy of Miravis® Ace for FHB AND DON management across environments and grain market classes: A progress report. In: *Proceedings of the 2018 National Fusarium Head Blight Forum*, St. Louis, Missouri, USA, December 2-4, 2018, pp. 40-44.

Status: Abstract Published and Poster Presented

Acknowledgement of Federal Support: Yes (poster), No (abstract)

Salgado, J.D., Bergstrom, G., Bradley, C., Bowen, K., Byamukama, E., Byrne, A., Collins, A., Cowger, C., Cummings, J., Chapara, V., Chilvers, M.I., Dill-Macky, R., Darby, H.R., Friskop, A., Kleczewski, N., Madden, L.V., Marshall, J., Mehl, H., Nagelkirk, M., Starr, J., Stevens, J., Smith, D., Smith, M., Wegulo, S., Wise, K., Yabwalo, D., Young-Kelly, H.M., and Paul, P. (2018). Efficacy of two-treatment fungicide programs for FHB management: A multistate coordinated project. In: *Proceedings of the 2018 National Fusarium Head Blight Forum*, St. Louis, Missouri, USA, December 2-4, 2018, pp. 45-46.

Status: Abstract Published and Poster Presented

Acknowledgement of Federal Support: Yes (poster), No (abstract)

Dill-Macky, R., Elakkad, A.M., Zargarán, B., Muehlbauer, G.J., Bethke, G., McLaughlin, J., Tumer, N., and Funnell-Harris, D. (2018). Testing Transgenic Spring Wheat and Barley Lines for Reaction to Fusarium Head Blight: 2018 Field Nursery Report. In: *Proceedings of the 2018 National Fusarium Head Blight Forum*, St. Louis, Missouri, USA, December 2-4, 2018, pp. 68-69.

Status: Abstract Published and Poster Presented

Acknowledgement of Federal Support: Yes (poster), No (abstract)

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McLaughlin, J.E., Tyagi, N., Trick, H.N., McCormick, S., Dill-Macky, R., and Tumer, N.E. (2018). *Arabidopsis* and wheat non-specific lipid transfer (nsLTP) proteins inhibit *Fusarium graminearum* and confer enhanced resistance to FHB: Greenhouse, field, and *in vitro* evidence. In: *Proceedings of the 2018 National Fusarium Head Blight Forum*, St. Louis, Missouri, USA, December 2-4, 2018, pp. 72-73.

Status: Abstract Published and Poster Presented

Acknowledgement of Federal Support: Yes (poster), No (abstract)

Kumar, J., Xu, S., Elias, E.M., Dill-Macky, R., and Kianian, S. (2018). Epigenome modification in durum wheat provides FHB resistance. In: *Proceedings of the 2018 National Fusarium Head Blight Forum*, St. Louis, Missouri, USA, December 2-4, 2018, pp. 117-118.

Status: Abstract Published and Poster Presented

Acknowledgement of Federal Support: Yes (poster), No (abstract)

Bakker, M.G., McCormick, S.P., and Dill-Macky, R. (2018). Microbial correlates of *Fusarium* biomass and deoxynivalenol content in individual wheat seeds. In: *Proceedings of the 11th International Congress of Plant Pathology*, Boston MA, USA, July 29-Aug 3, 2018. (Poster 1216)

Status: Abstract Published and Poster Presented

Acknowledgement of Federal Support: Yes (poster), No (abstract)