USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY19 Final Performance Progress Report
Due date: July 29, 2021

Cover Page

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Fiscal Year:	2019
USDA-ARS Agreement ID:	59-0206-8-199
USDA-ARS Agreement Title:	Integrated Management Strategies and Fungicide Testing for FHB and DON in Small Grains in ND
FY19 USDA-ARS Award Amount:	$ 63,624
Recipient Organization:	North Dakota State University Office of Grant & Contract Accouting NDSU Dept 3130, PO Box 6050 Fargo, ND 58108-0650
DUNS Number:	80-388-2299
EIN:	45-6002439
Recipient Identifying Number or Account Number:	FAR0030036
Project/Grant Reporting Period:	5/5/19 - 5/4/21
Reporting Period End Date:	5/4/2021

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
MGMT	Integrated Management Strategies and Fungicide Testing for FHB and DON in Small Grains in ND	$ 63,624
	FY19 Total ARS Award Amount	**$ 63,624**

7/28/21

Principal Investigator Date

* MGMT – FHB Management
FST – Food Safety & Toxicology
R – Research
S – Service (DON Testing Lab)
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 Strategies and Fungicide Testing for FHB and DON in Small Grains in ND*

1. **What are the major goals and objectives of the research project?**
   The primary objectives are to (1) evaluate the efficacy of adepidyn+propiconazole (Miravis Ace®), prothioconazole+tebuconazole, metconazole and tebuconazole on suppressing FHB and DON – efficacy trials (2) Evaluate integrated management strategies in small grain market classes (hard red spring wheat, hard red winter wheat, spring durum and spring barley) to suppress FHB and DON – integrated management trials.

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?**
   A strong statewide collaboration effort was used to establish fungicide efficacy and integrated management trials at five locations; Carrington, Fargo, Langdon, Prosper and Williston. A total of 26 field experiments were established on spring barley, spring durum or hard red spring wheat, and hard red winter wheat.

   b) **What were the significant results?**
   Varying levels of scab pressure developed at the research sites. This is advantageous as the varieties and fungicide timings were evaluated under varying levels of disease pressure. Summarized field data showed that when Miravis Ace was applied at early-flowering in wheat or at full head in barley, the level of efficacy was comparable to both Prosaro® and Caramba®. However, when Miravis Ace was applied at half-head in both wheat and barley, results were inconsistent in reducing the level of DON in grain. The most DON reduction in the integrated management trials was achieved when a moderately resistant variety was used and when a fungicide was applied at early flowering or 4 to 7 days later in wheat and at full head or 4 to 7 days later in spring barley. Regardless of market class, sequential applications of Miravis Ace followed by Prosaro or Caramba resulted in the lowest DON and highest yield

   c) **List key outcomes or other achievements.**
   When combined with other USWBSI IM-CP research, the efficacy of Miravis Ace is suggested to be the same as Prosaro and Caramba when applied at early-flowering in wheat or full head in barley. Additionally, good DON suppression was achieved when Miravis Ace, Prosaro and Caramba were applied at 3-7 days after the onset of flowering in wheat or 3-7 days after full-head in barley. This strongly supports that the application window has widened.

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.

Yes, the research was slightly impacted by COVID-19. Travel costs were higher (ie: one person per vehicle), and it often required more people to complete research tasks. For example, the processing of harvest bags took longer due to social distancing guidelines. However, everything was still accomplished to meet the project's goals.

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

In 2019 and modified in 2020, research trials were used as an outside classroom for graduate students and research specialists in the NDSU Extension program. Individuals were taught about *Fusarium graminearum* biology, FHB management and principles of field research. Although no formal course was designed, students gained valuable insight and awareness on a very important disease in North Dakota. In 2019, the research trials at the Fargo location were used as demonstrations for students visiting from Bismarck State College and North Dakota State College of Science.

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

Data was included in a national meta-analysis and submitted to Pierce Paul (Ohio State University). Summary slides were created that highlighted the collaborative work of the MGMT team and were used in future presentations. The national results and results from ND trials were communicated and disseminated to growers, Extension agents and other agriculture professionals either live or virtually through Extension meetings, agricultural expo shows, internet, interviews (radio, tv and print), CCA trainings and field days.

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the **FY19 award period (5/5/19 - 5/4/21)**. 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
   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
   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
   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
   If yes, how many? Click to enter number here.

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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 **FY19 award period (5/5/19 - 5/4/21)**. 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**	**FHB Rating (0-9)**	**Year Released**
Not applicable to this project.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year
Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year
Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year
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Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year
Click here to enter text.	Select Grain Class	Select what represents your most resistant check	Enter as text 0-9 rating	Select Year

NOTE: List the associated release notice or publication under the appropriate sub-section in the 'Publications' section of the FPR.

Publications, Conference Papers, and Presentations

Instructions: Refer to the FPR_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 (5/1/19 - 4/30/21**) 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:

Z.J. Winn, R. Acharya, J. Lyerly, G. Brown-Guedira, C. Cowger, C. Griffey, J. Fitzgerald, R.E. Mason and J.P. Murphy. 2020. "Mapping of Fusarium Head Blight Resistance in NC13-20076 Soft Red Winter Wheat." In: S. Canty, A. Hoffstetter, and R. Dill-Macky (Eds.), *Proceedings of the 2020 National Fusarium Head Blight Forum (*p. 12.), Virtual; December 7-11. Online: https://scabusa.org/pdfs/NFHBF20_Proceedings.pdf.
Status: Abstract Published and Poster Presented
Acknowledgement of Federal Support: YES (Abstract and Poster)

Journal publications.

Paul, P.A., Salgado, J.D., Bergstrom, G., Bradley, C., Byamukama, E., Byrne, A.M., Chapara, V., Cummings, J.A., Chilvers, M.I., Dill-Macky, R., Friskop, A., Kleczewski, N., Madden, L.V., Nagelkirk, M., Stevens, J., Smith, M., Wegulo, S., Wise, K., and Yabwalo, D. 2019. Integrated effects of genetic resistance and prothioconazole + tebuconazole application timing on Fusarium head blight in wheat. Plant Disease 103:223-237.
Status: Published in Plant Disease.
Acknowledgement of Federal Support: Yes.

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

Nothing to report.

Other publications, conference papers and presentations.

Conference

Luis, J.M., Ng, S.J., Bergstrom, G., Bissonnette, K., Bowe, 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., Langston, D.B., 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. Fusarium head blight management coordinated project: Uniform fungicide trials 2018-2020. Proceedings of the 202020 National FHB Forum,

Dec 7-11, 2020. Virtual. US Wheat and Barley Scab Initiative publishers, East Lansing, MI/Lexington, KY

Status: Poster presentation given by lead author.
Acknowledgement of Federal Support: Yes.

Luis, J.M., Ng, S.J., Bergstrom, G., Bissonnette, K., Bowe, 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., Langston, D.B., 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. Fusarium head blight management coordinated project: Integrated management trials 2018-2020. Proceedings of the 202020 National FHB Forum, Dec 7-11, 2020. Virtual. US Wheat and Barley Scab Initiative publishers, East Lansing, MI/Lexington, KY

Status: Poster presentation given by lead author.
Acknowledgement of Federal Support: Yes.

Pierce A Paul , Sin Joe Ng , Gary Bergstrom , Kaitlyn Bissonnette, Kira Bowen, Carl Bradley, Emmanuel Byamukama, Martin Chilvers, Alyssa Collins, Christina Cowger, Heather Darby, Erick DeWolf, Ruth Dill Macky, Paul Esker, Andrew Friskop, Nathan Kleczewski, Alyssa Koehler, Laurence Madden, Juliet Marshall, Hillary Mehl, Wanderson Moraes, Martin Nagelkirk, Nidhi Rawat, Damon Smith, Darcy Telenko and Stephen Wegulo, and Heather Young-Kelly. Fusarium head blight management coordinated project: Integrated management trials 2018-2019. Proceedings of the 2019 National FHB Forum, Dec 1-3, 2019, Milwaukee, WI. US Wheat and Barley Scab Initiative publishers, East Lansing, MI/Lexington, KY.

Status: Poster presentation given by lead author.
Acknowledgement of Federal Support: Yes.

Pierce A Paul , Sin Joe Ng , Gary Bergstrom , Kaitlyn Bissonnette, Kira Bowen, Carl Bradley, Emmanuel Byamukama, Martin Chilvers, Alyssa Collins, Christina Cowger, Heather Darby, Erick DeWolf, Ruth Dill Macky, Paul Esker, Andrew Friskop, Nathan Kleczewski, Alyssa Koehler, Laurence Madden, Juliet Marshall, Hillary Mehl, Wanderson Moraes, Martin Nagelkirk, Nidhi Rawat, Damon Smith, Darcy Telenko and Stephen Wegulo, and Heather Young-Kelly. Fusarium head blight management coordinated project: Integrated management trials 2018-2019. Proceedings of the 2019 National FHB Forum, Dec 1-3, 2019, Milwaukee, WI. US Wheat and Barley Scab Initiative publishers, East Lansing, MI/Lexington, KY.

Status: Poster presentation given by lead author.
Acknowledgement of Federal Support: Yes.

Gross, P.L., Halvorson, J., Meyer, S., Schuh, C., Chapara, V., Hanson, B., Henry, L., Hakanson, T., Arens, A., Brueggeman, R., and Friskop, A. 2019. Evaluating adepidyn and host resistance at two years and locations to reduce Fusarium head blight and

deoxynivalenol in spring barley. Proceedings of the 2019 National FHB Forum, Dec 1-3, 2019, Milwaukee, WI. US Wheat and Barley Scab Initiative publishers, East Lansing, MI/Lexington, KY.

Status: Poster presentation given by lead author.
Acknowledgement of Federal Support: Yes.

Extension Presentations

Friskop, A. Major Wheat Diseases of North Dakota. Ukrainian Ag Professionals. 2019. Fargo, ND.
Status: Oral Presentation
Acknowledgement of Federal Support: Yes.

Friskop, A. Late-season Wheat Disease Management. Crop Management Field School. 2019. Carrington, ND.
Status: Oral and Hands-on Presentation
Acknowledgement of Federal Support: Yes.

Friskop, A. Small Grain Disease Update. Hettinger REC Field Day. 2019. Hettinger, ND.
Status: Oral Presentation
Acknowledgement of Federal Support: Yes.

Friskop, A. Small Grain Disease Management. Dickinson Area Wheat Production Workshop. 2019. Dickinson, ND.
Status: Oral and Hands-on Presentation
Acknowledgement of Federal Support: Yes.

Friskop, A. Cereal Disease Update. NDSU Agronomy Seed Farm Field Day. 2019. Casselton, ND.
Status: Oral Presentation
Acknowledgement of Federal Support: Yes.

Friskop, A. Wheat and Barley Disease Update. Langdon REC Field Day. 2019. Langdon, ND.
Status: Oral Presentation
Acknowledgement of Federal Support: Yes

Friskop, A. Case studies in ND Plant Pathology. NDSCS and BSC Prospective Student Visit. 2019. Fargo, ND.
Status: Hands-on Presentation
Acknowledgement of Federal Support: Yes

Friskop, A. Barley Disease Management. NDSU Barley Field School. 2019. Fargo, ND.
Status: Oral and Hand-on Presentation
Acknowledgement of Federal Support: Yes

Friskop, A. Crop Disease Review of Southwest ND. Western Dakota Crops Day. 2019. Hettinger, ND.
Status: Oral Presentation
Acknowledgement of Federal Support: Yes

Friskop, A. Keeping Diseases at Bay in Reduced Tillage. Lake Region Roundup. 2020. Devils Lake, ND.
Status: Oral Presentation
Acknowledgement of Federal Support: Yes.

Friskop, A. The Bad and the Ugly – BLS and FHB. Best of the Best East. 2020. Grand Forks, ND.
Status: Oral Presentation
Acknowledgement of Federal Support: Yes.

Friskop, A. The Bad and the Ugly – BLS and FHB. Best of the Best East. 2020. Moorhead, MN.
Status: Oral Presentation
Acknowledgement of Federal Support: Yes.

Friskop, A. Wheat Fungicides and Corn Diseases. Cass County Ag Improvement Meeting. 2020. Mapleton, ND.
Status: Oral Presentation
Acknowledgement of Federal Support: Yes.

Friskop, A. Small Grain Disease Update. Best of the Best West. 2020. Williston, ND.
Status: Oral Presentation
Acknowledgement of Federal Support: Yes.

Friskop, A. Small Grain Disease Update. Best of the Best West. 2020. Minot, ND.
Status: Oral Presentation
Acknowledgement of Federal Support: Yes.

Friskop, A. Small Grain Disease Update – What We Learned in 2019. International Crop Expo. 2020. Grand Forks, ND.
Status: Oral Presentation
Acknowledgement of Federal Support: Yes.

Friskop, A. ND Spring Wheat Disease Update. 2020. Virtual Hard Red Spring Wheat Pre-Harvest Update. Fargo, ND.
Status: Presentation delivered virtually.
Acknowledgement of Federal Support: Yes.

Friskop, A. ND Durum Disease Update. 2020. Virtual Durum Crop Update. Fargo, ND.
Status: Presentation delivered virtually.
Acknowledgement of Federal Support: Yes.

Friskop, A. Small Grain Fungicide Update. 2021. Lake Region Roundup. Fargo, ND.
Status: Presentation delivered virtually.
Acknowledgement of Federal Support: Yes.

Friskop, A. Fusarium Head Blight. Best of the Best East. 2021. Moorhead, MN.
Status: Video Recorded.
Acknowledgement of Federal Support: Yes.

Friskop, A. Fusarium Head Blight. Best of the Best East. 2021. Grand Forks, ND.
Status: Video Recorded.
Acknowledgement of Federal Support: Yes.

Friskop, A. Small Grain Disease Update. Western Crop and Pest School. 2021. Fargo, ND.
Status: Presentation delivered virtually.
Acknowledgement of Federal Support: Yes.