USDA-ARS | U.S. Wheat and Barley Scab Initiative

FY21 Performance Progress Report

Due date: July 26, 2022

Cover Page

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Fiscal Year:	2021
USDA-ARS Agreement ID:	59-0206-0-132
USDA-ARS Agreement Title:	Management of Fusarium Head Blight in Small Grains
FY20 USDA-ARS Award Amount:	$43,156
Recipient Organization:	University of Minnesota Department of Plant Pathology 495 Borlaug Hall, 1991 Upper Buford Circle St. Paul, MN 55108
DUNS Number:	555917996
EIN:	41-6007513
Recipient Identifying Number or Account Number, if any:	CON000000088217
Project/Grant Period:	5/6/21 - 5/5/23
Reporting Period End Date:	5/5/2022

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
MGMT-IM	Minnesota Component of the FHB Integrated Management Coordinated Project	$26,246
GDER	A Field Nursery for Testing Transgenic Spring Wheat and Barley from the USWBSI	$16,910
	FY21 Total ARS Award Amount	$43,156

I am submitting this report as an: ☒ Annual Report ☐ 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.

Ruth Dill-Macky

Principal Investigator Signature

6/26/2022

Date Report Submitted

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‡ 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: Minnesota Component of the FHB Integrated Management Coordinated Project

1. **What are the major goals and objectives of the research project?**
   Demethylation inhibitor (DMI) fungicides have been proven to be the most effective for Fusarium head blight (FHB) and deoxynivalenol (DON) management, providing more than 70% reduction of both FHB index and DON. This research project was part of a large coordinated effort, established in 2018, to examine the efficacy of Miravas Ace®, which is one of a new class of fungicides (succinate dehydrogenase inhibitors). If this fungicide proves to be effective it will provide an additional option for the chemical control of FHB and reduce the risk of resistance developing to the widely used DMI fungicides.
   The specific objectives of this FHB Management Coordinated Project (MGMT_CP) were to:
   - Evaluate the integrated effects of fungicide treatment and genetic resistance on FHB and DON in hard red spring wheat, with emphasis on a new (non-DMI) fungicide, Miravis Ace;
   - Compare the efficacy of Miravis Ace when applied at heading or at anthesis to that of standard anthesis application of Prosaro® or Caramba®;
   - Generate data to further quantify the economic benefit of FHB/DON management strategies;
   - Develop more robust "*best-management practices*" for FHB and DON; and
   - Generate data to validate and advance the development of FHB and DON risk prediction models.

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?**
      We participated annually in the two nationally coordinated experiments in the MGMT-CP, the integrated management (IM) and uniform fungicide (UF) trials in 2021. In combination, the data from these trials 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 hard red spring wheat. The experiments were completed following the experimental design as established by the coordinating group.

   b) **What were the significant results?**
      In 2021 we generated significant levels of FHB and obtained data from the two locations in wheat where the experiments were established. The IM trial in St Paul was lost to the adverse weather conditions. The toxin data for the three completed trials was obtained in March 2022 and the data has been compiled ready for submission to the project coordinator.

   c) **List key outcomes or other achievements.**
      Based on the data from 2018 -2020 in Minnesota and other research programs we expect that our 2021 data, in addition to the data collected previously, will support the

use of Miravis Ace in the management of FHB and DON and provide a rationale for how we best use this new chemistry effectively.

3. **What opportunities for training and professional development has the project provided?**
   No graduate students worked on this project. Undergraduate student researchers utilized this project to gain experience in field-based research techniques.

4. **How have the results been disseminated to communities of interest?**
   Summary results from these studies will be published as part of a national publication on integrated management guidelines for FHB and DON. Regionally, results have be delivered to growers, dealerships, county extension educators and others in the wheat and barley production industries through extension programs. In addition, data from these trials will be used to advance the development and validations of FHB and DON risk assessment models.

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

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1. **What are the major goals and objectives of the research 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 or objectives?** *(For each major goal/objective, address these three items below.)*

   a) **What were the major activities?**
   In 2021 no nurseries were conducted as no entries were received. Monitoring for volunteers, as required to follow the compliance requirements of the 2019 APHIS permits continued throughout the 2021 field season. At the start of the 2022 season the required monitoring period ended and thus this project has now been completed.

   b) **What were the significant results?**
   The data from the 2019 growing season was the final year of data collected. Monitoring of the site for volunteers was continued for two full growing seasons in accordance with the APHIS permits. This involved an in person site inspection every 21 days throughout the growing season from the time the ground thawed till the first hard frost. With the final year of monitoring successfully completed the site will be released from the APHIS permit requirements in spring 2022.

   c) **List key outcomes or other achievements.**
   In 2021 we met all APHIS permit requirements.

3. **What opportunities for training and professional development has the project provided?**
   None. Given the nature of the project, only personnel with considerable experience in running transgenic nurseries and with APHIS and IBC authorization are allowed on the trial site.

4. **How have the results been disseminated to communities of interest?**
   The USWBSI-funded PIs with wheat and barley entries in the 2019 nursery have been provided their data and copied on all communications with APHIS regarding the ongoing post-harvest site monitoring that was necessary to meet permit obligations.

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 grant 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).

Huang, Y., Yin, L., Sallam, A.H., Heinen, S., Li, L., Beaubien, K., Dill-Macky, R., Dong, Y., Steffenson, B.J., Smith, K.P., and Muehlbauer, G.J. (2021). Genetic dissection of a pericentromeric region of barley chromosome 6H associated with Fusarium head blight resistance, grain protein content and agronomic traits. Theoretical and Applied Genetics, 134:3963-3981. https://doi.org/10.1007/s00122-021-03941-9; acknowledgment of federal support - yes.

Anderson, J.A., Wiersma, J.J., Reynolds, S.K., Conley, E.J., Caspers, R., Linkert, G.L., Kolmer, J.A., Jin, Y., Rouse, M.N., Dill-Macky, R., Smith, M.J., Dykes, L., and Ohm, J.-B. (2021). Registration of 'Lang-MN' hard red spring wheat. *Journal of Plant Registrations*, 15:479-489. https://doi.org/10.1002/plr2.20099; acknowledgment of federal support - yes

McLaughlin, J.E., Darwish, N.I., Garcia-Sanchez, J., Tyagi, N., Trick, H.N., McCormick, S., Dill-Macky, R., and Tumer, N.E. (2021). A lipid transfer protein has antifungal and antioxidant activity and suppresses Fusarium head blight disease and DON accumulation in transgenic wheat. *Phytopathology,* 111:671-683. https://doi.org/10.1094/PHYTO-04-20-0153-R; acknowledgement of federal support - yes.

Books or other non-periodical, one-time publications as a result of FY21 grant 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).

Nothing to report

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

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

Singla, S., Duray, Z., Dill-Macky, R., O'Neil, P., Bernhardson, L., Tatineni, S., Sattler, S., Wegulo, S.N., and Funnell-Harris D.L. (2021). Investigating phenylpropanoid-based Fusarium head blight resistance in wheat. 2021 APS North Central Division Meeting. Online/Ames, Iowa: June 15-16, 2021.