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

FY21 Performance Progress Report

Due date: July 26, 2023

Cover Page

USDA-ARS Agreement ID:	59-0206-0-177
USDA-ARS Agreement Title:	Diagonostic Services for DON
Principle Investigator (PI):	Yanhong Dong
Institution:	University of Minnesota
Institution UEI:	KABJZBBJ4B54
Fiscal Year:	2021
FY21 USDA-ARS Award Amount:	$327,089
PI Mailing Address:	University of Minnesota, Department of Plant Pathology 495 Borlaug Hal, 1991 Upper Buford Circle St. Paul, MN 55108
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Period of Performance:	5/15/21 - 5/14/23
Reporting Period End Date:	5/14/2024

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
FST-S	Diagnostic services for DON	$327,089
	FY21 Total ARS Award Amount	$327,089

I am submitting this report as an: ☒ Annual 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

06/16/2023

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: Diagnostic services for DON

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1. **What are the major goals and objectives of the research project?**
   The goal of this project is to provide rapid, cost-effective, and accurate mycotoxin analysis - especially deoxynivalenol (DON) - for Fusarium Head Blight (FHB or scab) research projects.

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?
   Analyzed DON and related mycotoxins in wheat, barley and fungal culture extract using GC-MS and prepared purification columns.

   b) What were the significant results?
   From June 2022 to May 2023, our laboratory analyzed 25,557 samples submitted by 37 research groups from 20 states including Arkansas, Idaho, Indiana, Illinois, Kansas, Kentucky, Louisiana, Maryland, Michigan, Minnesota, Missouri, Montana, New York, North Carolina, North Dakota, Ohio, Pennsylvania, Texas, Washington, and Wisconsin. The samples included 24,350 regular mature grain samples (4 -100 g) and 1,207 small size samples such as grain samples less than 4 g, single kernel, single spikelet, single head, and fungal culture extracts. The target toxins included DON, 15-Acetyl-DON, 3- Acetyl-DON, and nivalenol. Zearaleone was analyzed for some samples from Dr. Brian Steffenson's lab.

   c) List key outcomes or other achievements.
   The DON data has been used in all areas of scab research. By analyzing mycotoxins, the project provided support to barley and wheat breeding programs to develop resistant varieties, and to researchers to study disease mechanisms and to develop effective chemical and biological disease controls. Mycotoxin data provided to scab researchers by our laboratory gave them a means to evaluate the effectiveness of their efforts in fighting Fusarium Head Blight.

3. **What opportunities for training and professional development has the project provided?**
   Nothing to report.

4. **How have the results been disseminated to communities of interest?**
   The results were emailed to researchers and were then disseminated to communities of interest via conference papers and presentations, and journal publications.

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).

1. Van Sanford, D.A., Clark, A.J., Bradley, C.A., Brown-Guedira, G., Cowger, C., Dong, Y., Baik, B. "Registration of 'Pembroke 2021' Soft Red Winter Wheat", *J. Plant Registrations,* **2023,** 17, 376-384 (https://doi.org/10.1002/plr2.20271).
   Status: Published
   Acknowledgement of Federal Support: Yes

2. O'Mara, S.P., Broz, K., Dong, Y., Elmore, M., Kistler, H.C. "The *Fusarium graminearum* transporters Abc1 and Abc6 are important for xenobiotic resistance, trichothecene accumulation, and virulence to wheat.", *Phytopathology*, **2023,** June 1 (DOI: 10.1094/PHYTO-09-22-0345-R).
   Status: Published
   Acknowledgement of Federal Support: Yes

3. Cowger, C., Read, Q., Clark, L., Dong, Y. "Optimal timing of fungicide application to manage Fusarium head blight in winter barley", *Plant Disease*, **2023,** Apr 11 (DOI: 10.1094/PDIS-01-23-0021-RE).
   Status: Published
   Acknowledgement of Federal Support: Yes

4. Wallace, S., Chhabra, B., Dong, Y., Ma, X., Coleman, G., Tiwari, V., Rawat, N. "Exploring Fusarium Head Blight Resistance in a Winter Triticale Germplasm Collection", *Crop Science,* submitted on May16, 2023 (CROP-2023-05-0278-OA).
   Status: Submitted
   Acknowledgement of Federal Support: Yes

5. Li, Y., Bian, Y., Fritz, A., Zhang, G., Dong, Y., Zhao, L., Xu, Y., Ghori, N., Bernardo, A., Paul, S.A., Rupp, J., Bruce, M., Wang, W., Akhunov, E., Carver, B., Bai, G. "Genetic architecture of quantitative trait loci (QTL) for FHB resistance and agronomic traits in a hard winter wheat population", *The Crop Journal*, submitted on March 22, 2023.
   Status: Submitted
   Acknowledgement of Federal Support: Yes

6. Bethke, G., Huang, Y., Hensel, G., Heinen, S., Liu, C., Wyant, S., Li, X., Quin, M., McCormick, S., Morrell, P., Dong, Y., Kumlehn, J., Salvi, S., Berthiller, F., Muehlbauer, G. "HvUGT13248 Confers Type II Resistance to Fusarium graminearum in Barley" *Plant Physiology*, Submitted on April 6, 2023 (PP2023-RA-00558).
   Status: Submitted
   Acknowledgement of Federal Support: Yes

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).

Nothing to Report.

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.

1. Bethke, G., Huang, Y., Hensel, G., Heinen, S., Liu, C., Wyant, S., Li, X., McCormick, S., Morrell, P., Dong, Y., Kumlehn, J., Salvi, S., Berthiller, F., Muehlbauer, G.J. **"** The UDP-Glycosyltransferase UGT13248 is Required for Type 2 Resistance to Fusarium Head Blight in Barley"; *Proceedings of the 2022 National Fusarium Head Blight Forum,* P40; December 4-6, 2022, Tampa, Florida; Retrieved from: https://scabusa.org/forum/2022/2022NFHBForumProceedings.pdf

2. Chhabra, B., Tiwari, V., Gill, B.S., Dong, Y., Rawat, N. **"**Discovery of a Susceptibility Factor for Fusarium Head Blight on Chromosome 7A of Wheat"; *Proceedings of the 2022 National Fusarium Head Blight Forum,* P42; December 4-6, 2022, Tampa, Florida; Retrieved from: https://scabusa.org/forum/2022/2022NFHBForumProceedings.pdf

3. Huang, Y., Haaning, A., Bethke, G., O'Mara, S., Dong, Y., Gary J Muehlbauer, G.J., **"**Microscopy and RNA-Seq Analysis of Fusarium Head Blight Infection in a Barley Mutant Deficient in Deoxynivalenol Detoxification"; *Proceedings of the 2022 National Fusarium Head Blight Forum,* P49; December 4-6, 2022, Tampa, Florida; Retrieved from: https://scabusa.org/forum/2022/2022NFHBForumProceedings.pdf

4. Mittal, I., Alam, S., Chhabra, B., Shulaev, E., Mohan, V., Girija, A., Rawat, N., Dong, Y., Trick, H.N., Scofield, S., Shah, J. "Targeting Susceptibility Genes in Wheat to Enhance Resistance Against Fusarium Head Blight"; *Proceedings of the 2022 National Fusarium Head Blight Forum,* P55; December 4-6, 2022, Tampa, Florida; Retrieved from: https://scabusa.org/forum/2022/2022NFHBForumProceedings.pdf.

5. Concepcion, J.S., Dong, Y., Thompson, A.M., Noble, A.D., Eric L. Olson, E.L., **"**High-Throughput Deoxynivalenol Concentration Detection and Prediction in Fusarium-Damaged Wheat Kernels using Handheld Hyperspectral Imaging Platform"; *Proceedings of the 2022 National Fusarium Head Blight Forum,* P79; December 4-6, 2022, Tampa, Florida; Retrieved from: https://scabusa.org/forum/2022/2022NFHBForumProceedings.pdf

6. Smith, K.P., Schiefelbein, E., Velasquez, G., Dong, Y., **"**Reducing DON Concentration with Naked Barley"; *Proceedings of the 2022 National Fusarium Head Blight Forum,* P93; December 4-6, 2022, Tampa, Florida; Retrieved from: https://scabusa.org/forum/2022/2022NFHBForumProceedings.pdf

7. Hawkins, J., Dong, Y., Smith, K.P., "Shedding deoxynivalenol with naked barley", 23rd North American Barley Researchers Workshop and 43rd Barley Improvement Conference, 2022.

8. Yimer, B.A., Baldwin, S.A., Dong, Y., Marshall, J. "Evaluation of spring wheat varieties and breeding lines to Fusarium head blight in southeast Idaho", 2022 American Phytopathological Society Annual Meeting.