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

FY21 Performance Progress Report

Due date: July 26, 2022

Cover Page

Principle Investigator (PI):	Yanhong Dong
Institution:	University of Minnesota
E-mail:	dongx001@umn.edu
Phone:	612-625-2751
Fiscal Year:	2021
USDA-ARS Agreement ID:	59-0206-0-177
USDA-ARS Agreement Title:	Diagonostic Services for DON
FY20 USDA-ARS Award Amount:	$327,089
Recipient Organization:	University of Minnesota Department of Plant Pathology 495 Borlaug Hal, 1991 Upper Buford Circle St. Paul, MN 55108
DUNS Number:	555917996
EIN:	41 -6007513
Recipient Identifying Number or Account Number, if any:	CON000000086307
Project/Grant Period:	5/15/21 - 5/14/23
Reporting Period End Date:	5/14/2022

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 ☐ 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.

Yanhong Dong

Principal Investigator Signature

07/20/2022

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

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 2021 to May 2022, our laboratory analyzed 25,789 samples submitted by 39 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, Tennessee, and Wisconsin. The samples included 24,469 regular mature grain samples (4 -100 g) and 1,320 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. Ruth Dill-Macky's lab.

Table 1. Summary of 2021/2022 samples

PI/Cooperator	Number of Sample			Institution
	Analyzed	Surveyed (June 2021)	Surveyed (August 2019)	
Anderson, Jim	2084	1000	1000	University of Minnesota
Bai, Guihua	669	1000	1000	USDA-ARS, KS
Bergstrom, Gary	120	120	600	Cornell University
Bissonnette, Kaitlyn	252	252	200	University of Missouri
Bradley, Carl	442	800	800	University of Kentucky
Chen, Jianli	284	500	500	University of Idaho
Chilvers, Martin	322	328	600	Michigan State University
Cowger, Christina	468	470	400	USDA-ARS, Raleigh, NC
Crutcher, Frankie	1188	950		Montana State University
De Wolf, Erick	736	650	200	Kansas State University
Dill-Macky, Ruth	204	258	1500	University of Minnesota
Elias, Elias	620	1000	1200	North Dakota State University
Esker, Paul/Collins, Alyssa	572	488	500	Pennsylvania State University
Funnell-Harris, Deanna	0	64		USDA-ARS, NE
Green, Andrew	977	1000	1000	North Dakota State University
Harrison, Stephen/Padgett, Boyd	1556	1480	2200	Louisiana State University Ag. Center
Hu, Gongshe	131	300	300	USDA-ARS, ID
Ibrahim, Amir/Stephen Harrison	209			Texas A &M
Kelley, Jason	1185	1500	2000	University of Arkansas
Kelly, Heather	219	192	48	University of Tennessee
Kianian, Shahryar	0	100	115	USDA-ARS, MN
Kistler, H. Corby	0	200	1500	University of Minnesota
Marshall, Juliet	1012	1000	950	University of Idaho
Mergoum, Mohamed	0	2000	2000	University of Georgia
Mideros, Santiago/Nathan Kleczewski	448	171	300	University of Illinois at Urbana Champaign
Mohammadi, Mohsen	140	200	400	Purdue University
Muehlbauer, Gary	350	400	250	University of Minnesota
Murche, Jana	0	177		KWS Cereals USA, LLC.
Murphy, J. Paul	1518	1590	1500	North Carolina State University
Olson, Eric	1612	1100	1200	Michigan State University
Paul, Pierce	0	400	1500	Ohio State University
Rawat, Nidhi	1004	700	1250	University of Maryland
Rupp, Jessica	0		800	Kansas State University
Rutkoski, Jessica	1992	2000	2000	University of Illinois at Urbana Champaign
See, Deven (Marlow, Karol)	0	133		USDA-ARS, WA
Shah, Jyoti (Vijee Mohan)	0	100	50	University of North Texas
Smith, Damon	338	500	500	University of Wisconsin-Madison
Smith, Kevin	1513	200	1500	University of Minnesota
Sneller, Clay	803	900	260	Ohio State University
Sorrells, Mark	318	325	400	Cornell University
Steffenson, Brian/Yang, Ce	1174	1500	1000	University of Minnesota
Stockinger, Eric	268	300	2000	Ohio State University
Telenko, Darcy	214	240	320	Purdue University
Tiwari, Vijay	341	2000	1250	University of Maryland
Trail, Frances	389	188	150	Michigan State University
Van Sanford, Dave	90	1000	3000	University of Kentucky
Xu, Jin-Rong	0	80		Purdue University
Yen, Yang	0		500	University of Minnesota
QA	27			USWBSI
Total	25,789	29,856	38,743	

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 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).

1. Van Sanford, D.A., Clark, A.J., Bradley, C., Brown-Guedira, G., Cowger, C., Dong, Y., Baik, B.K. "Registration of 'Pembroke 2021' Soft Red Winter Wheat", J. *Plant Registration,* Status: Submitted
   Acknowledgement of Federal Support: yes

2. Ghimire, B., Mergoum, M., Martinez-Espinoza, A.D., Sapkota, S., Pradhan, S., Babar, M.A., Bai, G., Dong, Y., Buck, J.W. "Genetic of Fusarium Head Blight Resistance in Soft Red Winter Wheat Using a Genome-Wide Association Study" *The Plant Genome,* **2022,** **(**https://doi.org/10.1002/tpg2.20222). Status:
   Published
   Acknowledgement of Federal Support: yes

3. 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". *Plants*, *Preprints* **2021**, 2021040300 (doi: 10.20944/preprints202104.0300.v1).
   Status: Published
   Acknowledgement of Federal Support:
   yes
4. Gaire, R., Brown-Guedira, G., Dong, Y., Ohm, H., Mohammadi, M. "Genome-wide association studies for Fusarium head blight resistance and it's trade-off with grain yield in soft red winter wheat", *Plant Disease,* **2021**, 105, 2435-2444 (https://doi.org/10.1094/PDIS-06-20-1361-RE).
   Status:Published
   Acknowledgement of Federal Support: yes

5. Singh, L., Schulden, T., Wight, J.P., Crank, J., Thorne, L., Erwin, J., Dong, Y., Rawat, N. "Evaluation of application timing of Miravis-Ace for control of Fusarium head blight in

wheat", *Plant Health Progress,* **2021,** 22, 94-100 (https://doi.org/10.1094/PHP-01-21-0007-RS).
Status: Published
Acknowledgement of Federal Support: yes

6. Huang, Y. Yin, L., Sallam, A.H., Heinen, S., Li, L., Beaubien, K., Dill-Macky, R., **Dong, Y.,** Steffenson, B.J., Smith, K.P., Muehlbauer, G.J. "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*, **2021**, 134(12), 3963-3981 (DOI: 10.1007/s00122-021-03941-9).
Status: Published
Acknowledgement of Federal Support: yes

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.

1. Bethke, G., Huang, Y., Hensel, G., Wyant, S., Li, X., Heinen, S., McCormick, S., Morrell, P., Dong, Y., Kumlehn, J., Salvi, S., Berthiller, F., Muehlbauer, G.J. (2021). The Barley UDP-Glycosyltransferase *UGT13248* is Required for Deoxynivalenol Conjugation and Type 2 Resistance to Fusarium Head Blight. *Proceedings of the 2021 National Fusarium Head Blight Forum*; Virtual, December 6-7, 2021. Retrieved from: https://scabusa.org/forum/2021/2021NFHBForumProceedings.pdf
2. Chhabra, B., Tiwari, V., Gill, B.S., Dong, Y., Rawat, N. (2021). Discovery of a Susceptibility Factor for Fusarium Head Blight on Chromosome 7A of Wheat. *Proceedings of the 2021 National Fusarium Head Blight Forum*; Virtual, December 6-7, 2021. Retrieved from: https://scabusa.org/forum/2021/2021NFHBForumProceedings.pdf
3. Mittal, I., Alam, S., Chhabra, B., Shulaev, E., Mohan, V., Dong, Y., Scofield, S., Rawat, N., Shah, J. (2021). Knockdown of *Lpx3* Function in Wheat Enhances FHB Resistance and Lowers DON Content. *Proceedings of the 2021 National Fusarium Head Blight* Virtual, December 6-7, 2021. Retrieved from: https://scabusa.org/forum/2021/2021NFHBForumProceedings.pdf
4. Sallam A., Haas, M., Huang, Y., Dong, Y., Tandukar, Z., Muehlbauer, G., Smith, K.P., Steffenson, B.J. (2021). Meta-Analysis of the Genetics of Resistance to FHB and DON Accumulation Based on a New Barley Consensus Map. *Proceedings of the 2021 National Fusarium Head Blight Forum*; Virtual, December 6-7, 2021. Retrieved from: https://scabusa.org/forum/2021/2021NFHBForumProceedings.pdf
5. Wallace, S., Chhabra, B., Dong, Y., Ma, X., Coleman, G., Tiwari, V., Rawat, N. (2021). Exploring the Genetic Diversity of Fusarium Head Blight Resistance in a Diverse Triticale Collection. *Proceedings of the 2021 National Fusarium Head Blight Forum*; Virtual, December 6-7, 2021. Retrieved from: https://scabusa.org/forum/2021/2021NFHBForumProceedings.pdf