USDA-ARS
U.S. Wheat and Barley Scab Initiative
FY19 Performance Report
Due date: September 30, 2020

Cover Page

Cooperating Principle Investigator (CPI):	Yanhong Dong
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Fiscal Year:	2019
USDA-ARS Agreement ID:	58-5062-8-017
USDA-ARS Agreement Title:	Diagnostic Screening for Deoxynivalenol
FY19 USDA-ARS Award Amount:	$ 250,978
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:	CON000000075991
Agency PI:	H. Corby Kistler
Project/Grant Reporting Period:	9/1/19 - 8/31/20
Reporting Period End Date:	8/31/2020

USWBSI Individual Project(s)

USWBSI Research Category[*]	Project Title	ARS Award Amount
FST-S	Diagnostic Services for DON	$ 250,978
	FY19 Total ARS Award Amount	**$ 250,978**

09-28-2020

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Principal Investigator   Date

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[*] 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

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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 items a-b) below.)*

    a) What were the major activities?

        Analyzed DON and related mycotoxins in wheat, barley and fungal culture extract using GC-MS; grinded grain seeds; extracted DON from grain samples; derivatized DON for GC-MS analysis; and prepared purification columns.

    b) What were the significant results?

        Despite the lab closure between March 16 and June 10, 2020 due to COVID-19, our laboratory was able to analyze 27,436 samples (**Table** 1) from September 2019 to August 2020, which was only slightly less than last year (29,073). The samples were submitted by 37 scab research groups from 19 states including California, Georgia, Idaho, Illinois, Indiana, Kansas, Kentucky, Louisiana, Maryland, Michigan, Minnesota, Missouri, New York, North Carolina, North Dakota, Ohio, Pennsylvania, Washington and Wisconsin. The samples included 24,145 regular mature grain samples (4-100 g) and 3,291 small size samples such as grain samples less than 4 g, single kernel, single spikelet, single head, small stem, and fungal culture extract. The target toxins included DON, 15-Acetyl-DON, 3-Acetyl-DON, and nivalenol.

    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. **Was this research impacted by the COVID-19 pandemic (i.e. university shutdowns, reduced or lack of support personnel, etc.)? If yes, please explain how this research was impacted or is continuing to be impacted.**

    The lab was closed between March 18 and June 10, 2020 due to COVID-19 pandemic. All the lab activities were stopped during this period, which caused a three-month delay for some researchers to receive their DON data. Due to social distancing requirements, we couldn't put more work hours on

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the project as we would like to. Fortunately, PIs have started sending ground samples to the lab since late August, which will facilitate DON analysis process and ensure researchers to receive data in a timely manner.

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

Nothing to report.

5. 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.

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Table 1. Summary of 2019/2020 samples

PI	Number of Sample			Institution
	Analyzed	Estimated	Difference	
Allison Brown	300	0	300	University of California, Davis
Alyssa Collins	0	216	-216	Pennsylvania State University
Andrew Green	951	1000	-49	North Dakota State University
Anne McKendry	853	1000	-147	university of Missouri
Brian Steffenson	2623	1800	823	University of Minnesota
Carl Bradley	156	800	-644	University of Kentucky
Clay Sneller	191	150	41	Ohio State University
Corby Kistler	439	3500	-3061	University of Minnesota
Christina Cowger	497	300	197	USDA-ARS, Raleigh, NC
Damon Smith	524	250	274	University of Wisconsin-Madison
David Van Sanford	1177	3000	-1823	University of Kentucky
Deven See/Mike Pumphrey	105	0	105	Washington State University
Don Ober	300	0	300	Limagrain Cereal Seeds, IN
Elias Elias	1221	1500	-279	North Dakota State University
Eric DeWolf	144	350	-206	Kansas State University
Eric Olson	1052	1500	-448	Michigan State University
Eric Stockinger	0	1000	-1000	Ohio State University
Floyd Dowell	0	100	-100	USDA-ARS, KS
Frances Trail	155	150	5	Michigan State University
Frederic Kolb	0	1800	-1800	UIUC
Gary Bergstrom	357	750	-393	Cornell University
Gary Muehlbauer	100	300	-200	University of Minnesota
Gongshe Hu	295	0	295	USDA-ARS, Idaho
Guihua Bai	1052	1000	52	USDA-ARS, KS
Heather Kelly	0	100	-100	University of Tennessee
Jason Wight	0	350	-350	University of Maryland
Jessica Rutkoski	2494	0	2494	UIUC
Jianli Chen	358	600	-242	University of Idaho
Jim Anderson	184	1000	-816	University of Minnesota
Jinrong Xu	0	100	-100	Purdue University
Jochum Wiersma	0	100	-100	University of Minnesota
Juliet Marshall	839	435	404	University of Idaho
Jyoti Shah	0	100	-100	University of North Texas
Kevin Smith	1824	1000	824	University of Minnesota
Madeleine Smith	0	200	-200	University of Minnesota
Mark Sorrells	769	400	369	Cornell University
Martin Chilvers	509	600	-91	Michigan State University
Martin Nagelkirk	120	220	-100	Michigan State University
Mohamed Mergoum	1914	1000	914	University of Georgia
Mohsen Mohammadi	989	0	989	Purdue University
Nathan Kleczewski	216	500	-284	UIUC
Nidhi Rawat	892	0	892	University of Maryland
Paul Esker	255	0	255	Pennsylvania State University
Paul Murphy	1232	1000	232	North Carolina State University
Pierce Paul	602	2700	-2098	Ohio State University
Richard Esten Mason	0	1500	-1500	University of Arkansas
Ruth Dill-Macky	734	2000	-1266	University of Minnesota
Shahryar Kianian	0	514	-514	USDA-ARS, MN
Stephen Harrison	989	1200	-211	Louisiana State University
Yang Yen	0	200	-200	South Dakota State University
QA	24	27	-3	
Total	27436	36285	-8849	

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Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY19 award period (9/1/19 - 8/31/20). 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?**
     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 FY19 award period?**
     No

   If yes, how many?

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?**
     No

   If yes, how many?

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?**
     No

   If yes, how many?

Release of Germplasm/Cultivars

Instructions: In the table below, list all germplasm and/or cultivars released with <u>full or partial </u>support through the USWBSI during the <u>FY19 award period</u>. 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

Publications, Conference Papers, and Presentations

Instructions: Refer to the FY19-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 <u>published</u> (submitted or accepted) or presentations <u>presented</u> during the **award period (9/1/19 - 8/31/20)** should be included. If you did not publish/submit or present anything, state 'Nothing to Report' directly above the Journal publications section.

<u>NOTE:</u> 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.

Journal publications.

Carmack, W.J., Clark, A.J., Dong, Y., Van Sanford, D. "Mass selection for reduced deoxynivalenol concentration using an optical sorter in SRW wheat", *Agronomy,* **2019,** 9 (12), 816 (https://doi.org/10.3390/agronomy9120816).
<u>Status:</u> Published
<u>Acknowledgement of Federal Support:</u> Yes

Larkin, D.L., Holder, A.L., Mason, D.E., Brown-Guedira, G., Price, P.T., Harrison, S., Dong, Y. "Genome-Wide Analysis and Prediction of Fusarium Head Blight Resistance in Soft Red Winter Wheat", *Crop Science,* **2020** (DOI: 10.1002/csc2.20273)
<u>Status:</u> Published
<u>Acknowledgement of Federal Support:</u> Yes

Carmack, W.J., Clark, A.J., Dong, Y., Brown-Guedira, G., Van Sanford, D. "Optical Sorter-Based Selection Effectively Identifies Soft Red Winter Wheat Breeding Lines with *Fhb1* and Enhances FHB Resistance in Lines with and without *Fhb1*", *Frontiers in Microbiology,* **2020,** 11, article 1318 (https://doi.org/10.3389/fpls.2020.01318)
<u>Status:</u> Published
<u>Acknowledgement of Federal Support:</u> Yes

Verges, V.L., Lyerly, J., Dong, Y., Van Sanford, D. "Training Population Design with the Use of Regional Fusarium Head Blight Nurseries to Predict Independent Breeding Lines for FHB Traits", *Frontiers in Plant Science*, **2020,** 11, article 1083 (doi: 10.3389/fpls.2020.01083)
<u>Status:</u> Published
<u>Acknowledgement of Federal Support:</u> Yes

O'Mara, S.P., Broz, K., Boenisch, M., Zhong, Z., Dong, Y., Kistler, H.C. "The *Fusarium graminearum* t-SNARE *Sso1* is involved in growth, defense, and DON accumulation and virulence", *Molecular Plant-Microbe Interactions*.
<u>Status:</u> Accepted
<u>Acknowledgement of Federal Support:</u> Yes

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Cowger, C., Beccari, G., Dong, Y. "Timing of susceptibility to Fusarium head blight in winter wheat", *Plant Disease.*
Status: Accepted
Acknowledgement of Federal Support: Yes

Singh, L., Wight, J.P., Dong, Y., Rawat, N. "Evaluation of a new SDHI Chemistry Based Fungicide product: Miravis Ace for efficacy on control of Fusarium Head Blight and Deoxynivalenol content in wheat", *Plant Health Progress.*
Status: Submitted
Acknowledgement of Federal Support: Yes

Gaire, R., Brown-Guedira, G., Dong, Y., Ohm, H., Mohammadi, M. "Pyramiding benefits of major QTL in Fhb7-introgressed wheat population identified by genome-wide association studies", *Plant Disease.*
Status: Submitted
Acknowledgement of Federal Support: Yes

Su, W., Yang, C**.,** Dong, Y., Johnson, R., Page, R., Szinyei, T., Steffenson, B.J., Hirsch, C.D. "Hyperspectral imaging and improved feature variable selection for automated determination of deoxynivalenol in various genetic lines of barley kernels for resistance screening"**,** *Food Chem.*
 Status: Accepted
Acknowledgement of Federal Support: Yes

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

Other publications, conference papers and presentations.

Yimer, B.A., Arcibal, S.S., Dong, Y., Marshall, J.M. 2019. "Management of FHB and DON using Fungicides and Host Resistance in Hard Spring Wheat in Idaho" In: Canty, S.; Hoffstetter, A., Campbell, H., Dill-Macky, R. (Eds.), *Proceedings of the 2019 National Fusarium Head Blight Forum* (P. 34). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative.
 Status: Abstract Published and Poster presented
Acknowledgement of Federal Support: Yes

Huang, Y., Yin, L., Sallam, A., Heinen, S., Beaubien, K., Dill-Macky, R., Dong, Y., Steffenson, B., Smith, K.P., Muehlbauer, G.J. 2019. "Genetic Analysis of Fusarium Head Blight Severity, Malting Quality and Agronomic Traits in the Centromeric Region of Chromosome 6H in Barley" In: Canty, S.; Hoffstetter, A., Campbell, H., Dill-Macky, R. (Eds.), *Proceedings of the 2019 National Fusarium Head Blight Forum* (P. 51). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative.
 Status: Abstract Published and Poster presented
Acknowledgement of Federal Support: Yes

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O'Mara, S.P., Broz, K., Boenisch, M., Zhong, Z., Dong, Y., Kistler, H.C. 2019. "The *Fusarium graminearum* t-SNARE Sso1 is involved in Growth, Defense, and DON Accumulation and Virulence" In: Canty, S.; Hoffstetter, A., Campbell, H., Dill-Macky, R. (Eds.), *Proceedings of the 2019 National Fusarium Head Blight Forum* (P. 75). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative.
 Status: Abstract Published and Poster presented
Acknowledgement of Federal Support: Yes

Carmack, W.J., Clark, A.J., Dong, Y., Van Sanford, D.A. 2019. "Mass Selection for Reduced Deoxynivalenol Concentration using an Optical Sorter in SRW Wheat" In: Canty, S.; Hoffstetter, A., Campbell, H., Dill-Macky, R. (Eds.), *Proceedings of the 2019 National Fusarium Head Blight Forum* (P. 89). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative.
 Status: Abstract Published and Poster presented
Acknowledgement of Federal Support: Yes

Page, R., Steffenson, B., Szinyer, T., Martin, M., Matny, O., Sallam, A., Wodarek, J., Dong, Y. 2019. "Evaluation of Select Barley Accessions for Resistance to Fusarium Head Blight and DON Accumulation in Multi-Year, Multi-Environment Trails in the Upper Midwest" In: Canty, S.; Hoffstetter, A., Campbell, H., Dill-Macky, R. (Eds.), *Proceedings of the 2019 National Fusarium Head Blight Forum* (P. 108). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative.
 Status: Abstract Published and Poster presented
Acknowledgement of Federal Support: Yes

Ward, B.P., Brown-Guedira, G., Cowger, C., Marshall, D., Dong, Y. 2019. "Machine Learning Models for Predicting Deoxynivalenol Concentration from Grain Imaging Data" In: Canty, S.; Hoffstetter, A., Campbell, H., Dill-Macky, R. (Eds.), *Proceedings of the 2019 National Fusarium Head Blight Forum* (P. 124). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative
 Status: Abstract Published and Poster presented
Acknowledgement of Federal Support: Yes

PI: Dong, Yanhong
Project: Diagnostic Services for DON

FY19 PR – USWBSI ADDENDUM
DON Service Labs – Quality Control (QC) Data

<u>Note</u>: What is being requested is the across lab quality control data (separate QC from Trilogy).

Insert below Quality Control Data/Results from the FY19 Award Period (9/1/19 - 8/31/20):

	Check 1	Check 2	Check 3
N[a]	472	421	171
Mean (ppm)	3.11	9.91	6.86
SD[b]	0.46	0.81	0.62
% CV[c]	14.8	8.2	9.0

[a]Number of check samples. [b]Standard deviation. [c]Coefficient of variance

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