USDA-ARS
U.S. Wheat and Barley Scab Initiative
FY20 Annual Performance Progress Report
Due date: July 29, 2021

Cover Page

Principle Investigator (PI):	Corby Kistler
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Phone:	612-625-9774
Fiscal Year:	2020
USDA-ARS Agreement ID:	N/A
USDA-ARS Agreement Title:	Pathogen Genes for Enhanced Resistance to FHB
FY20 USDA-ARS Award Amount:	$ 17,056
Project/Grant Reporting Period:	5/1/20 - 4/30/21
Reporting Period End Date:	4/30/2021

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
PBG	Expression of Fungal DON Transporters in Wheat for FHB Resistance	$ 17,056
	FY20 Total ARS Award Amount	**$ 17,056**

Harold C Wiitt 07/25/2021

Principal Investigator Date

* MGMT – FHB Management
FST – Food Safety & Toxicology
R- Research
S – Service (DON Testing Labs)
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

FY20 Annual Performance Progress Report
PI: Kistler, Corby
USDA-ARS Agreement #: N/A
Reporting Period: 5/1/20 - 4/30/21

Project 1: *Expression of Fungal DON Transporters in Wheat for FHB Resistance*

1. **What are the major goals and objectives of the research project?**

   1) Characterize the spectrum of resistance to xenobiotics (e.g. mycotoxins, fungicides) conferred by the *Fusarium graminearum* genes *Abc1* and *Tri12* when expressed in yeast. We anticipate that Abc1, a multidrug resistance gene homolog will confer resistance to a broad spectrum of fungicides in addition to trichothecene toxins.

   2) Express the genes *Abc1* and *Tri12* in wheat and test lines for resistance to FHB and for DON levels compared to those of non-transformed parental lines. We will test whether expression of *Abc1* in wheat reduces FHB symptoms and DON levels.

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 *Fusarium* strain with a deletion in *Abc1* was introgressed into a genetic background lacking an Sso1 vesicular transport system. Five Fusarium genes were individually expressed in yeast to determine their ability to allow for DON resistance. Constructions for expressing *Tri12* and *Abc1* in wheat plants were created and shipped to the transformation facility at Kansas State.

   b) What were the significant results?
   Strains lacking both *Abc1* and *Sso1* accumulated less DON in infected plants than strains lacking either *Abc1* or *Sso1* alone. Both *Abc1* and *Abc6* allowed greater trichothecene tolerance when expressed in yeast.

   c) List key outcomes or other achievements.
   This research discovered several key elements responsible for exporting DON to plants. These processes potentially may be targeted by RNA-based silencing methods to reduce DON levels.

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. Members of the lab were limited in their ability to do laboratory work. Only one person was allowed to work in the lab at a time. The graduate student graduated and the lab technician has been on maximum telework status since March, 2020. This has halted

all laboratory work on this project across the board. Transgenic wheat was not received from KSU.

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

The funded graduate student, Sean O'Mara, has now graduated from the University of Minnesota with a Ph.D. and is working as a postdoctoral associate with Gary Muehlbauer.

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

Nothing to report

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY20 award period (5/1/20 - 4/30/21). 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 FY20 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 FY20 award period?**
   ☒Yes ☐No
   If yes, how many? 1

3. **Have any post docs who worked for you during the FY20 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 FY20 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.

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 FY20 award period (5/1/20 - 4/30/21). 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
Nothing to report	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
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
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
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
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
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 PR_Instructions for detailed more instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY20 grant award. Only citations for publications published (submitted or accepted) or presentations presented during the **award period (5/1/20 - 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.

O'Mara, S. P., Broz, K., Boenisch, M., Zhong, Z., Dong, Y., Kistler, H.C. 2020. The *Fusarium graminearum* t-SNARE Sso2 is involved in growth, defense, and DON accumulation and virulence. Molecular Plant-Microbe Interactions https://doi.org/10.1094/MPMI-01-20-0012-R
Status: Published
Acknowledgement of Federal Support: Yes

O'Mara, S. P., Broz, K., Dong, Y., Kistler, H.C. 2021. The *Fusarium graminearum* transporters *Abc1* and *Abc6* are important for xenobiotic resistance, trichothecene accumulation, and virulence to wheat. BioRxiv https://www.biorxiv.org/content/biorxiv/early/2021/06/15/2021.06.15.448535.full.pdf
Status: Published
Acknowledgement of Federal Support: Yes

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

Nothing to report

Other publications, conference papers and presentations.

Nothing to report