USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY18 Performance Report
Due date: July 12, 2019

Cover Page

Principle Investigator (PI):	Corby Kistler
Institution:	USDA-ARS
E-mail:	corby.kistler@ars.usda.gov
Phone:	612-625-9974
Fiscal Year:	2018
USDA-ARS Agreement ID:	N/A
USDA-ARS Agreement Title:	Pathogen Genes for Enhanced Resistance to FHB.
FY18 USDA-ARS Award Amount:	$ 36,856

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
PBG	Pathogen Transporters for Enhanced Resistance to FHB.	$ 36,856
	FY18 Total ARS Award Amount	**$ 36,856**

H. C. Kistler

July 10, 2019

Principal Investigator Date

* 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

Project 1: *Pathogen Transporters for Enhanced Resistance to FHB.*

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

   The specific goal of this proposal is to examine several candidate multidrug transporters in *Fusarium graminearum* for their potential role in trichothecene export and fungal virulence. The ultimate goal is to develop transgenic wheat and barley lines with increased trichothecene tolerance achieved by expression of Fusarium proteins conferring resistance to DON.

2. **What was accomplished under these goals?** *Address items 1-4) below for each goal or objective.*

   1) major activities. Fusarium genes for putative DON transporters were deleted and recombined in novel genetic combinations. Genes were codon optimized and expressed in yeast.

   2) specific objectives. Each of five *Fusarium graminearum* genes have been individually deleted and the mutant alleles have been combined by sexual recombination to create strains with deletions in combinations of two and three per strain. Additionally, the five genes were individually expressed in yeast to determine their ability to allow for DON resistance.

   3) significant results. Single deletion mutants for three ABC and MFS transporters showed reduced mycotoxin accumulation *in vitro* and/or *in planta* and reduced virulence. Certain mutation combinations resulted in additive effects in reducing mycotoxin accumulation and virulence. Disrupting multiple mycotoxin export mechanisms simultaneously can nearly eliminate mycotoxin accumulation and virulence *in planta*. When expressed in yeast, one ABC transporter greatly increased its tolerance to 15ADON and DON, while one MFS transporter increased the sensitivity of the recipient strain to 15ADON and DON.

   4) key outcomes or other achievements. These results may be helpful in providing targets for designing new, more effective, management strategies for FHB. Introducing certain transporters into wheat or barley may allow for plant resistance to DON and 15ADON.

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?**
   Nothing to Report.

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY18 award period. 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 FY18 award period?** Yes.

   If yes, how many? One.

2. **Did any graduate students in your research program supported by funding from your USWBSI grant earn their Ph.D. degree during the FY18 award period?** No.

   If yes, how many?

3. **Have any post docs who worked for you during the FY18 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 FY18 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 full or partial support through the USWBSI during the FY18 award period. 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 FY18-FPR_Instructions for detailed instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY18 grant. Only include citations for publications submitted or presentations given during your award period. If you did not have any publications or presentations, state 'Nothing to Report' directly above the Journal publications section.

NOTE: Directly below each reference/citation, you must indicate the Status (i.e. published, submitted, etc.) and whether acknowledgement of Federal support was indicated in publication/ presentation. See example below for a poster presented at the FHB Forum:

> Conley, E.J., and J.A. Anderson. 2018. Accuracy of Genome-Wide Prediction for Fusarium Head Blight Associated Traits in a Spring Wheat Breeding Program. In: Proceedings of the XXIV International Plant & Animal Genome Conference, San Diego, CA.
> Status: Abstract Published and Poster Presented
> Acknowledgement of Federal Support: YES (poster), NO (abstract)

Journal publications.

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

Other publications, conference papers and presentations.

O'Mara, S.P., Dong, Y., and Kistler, H.C. 2018. "Mutations in genes for Fusarium transporters result in reduced DON accumulation and virulence." In: Canty, S., A. Hoffstetter, B. Wiermer and R. Dill-Macky (Eds.), Proceedings of the 2018 National Fusarium Head Blight Forum (p. 89). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative.
Status: Abstract submitted and poster presented.
Acknowledgement of Federal Support: YES (poster, abstract).

O'Mara, S.P., Broz, K., Dong, Y., and Kistler, H.C. 2019. Mutations altering transport function result in decreased virulence and DON accumulation in *Fusarium graminearum.* Abstract for the Mycological Society of America meeting. Minneapolis, MN: Aug. 10 -14, 2019.
Status: Abstract submitted.
Acknowledgement of Federal Support: YES (poster), NO (abstract)