USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY16 Final Performance Report
Due date: July 28, 2017

Cover Page

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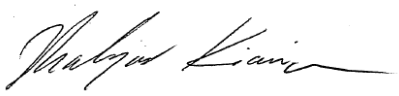
Fiscal Year:	2016
USDA-ARS Agreement ID:	N/A
USDA-ARS Agreement Title:	Pedigree Based Association Analysis of Novel Sources of FHB Resistance in Durum Wheat.
FY16 USDA-ARS Award Amount:	$ 45,599

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
DUR-CP	Enhancing FHB Resistance by Epigenetic Modification of Durum Cultivars.	$ 45,599
	FY16 Total ARS Award Amount	**$** 45,599



July 14, 2017

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: *Enhancing FHB Resistance by Epigenetic Modification of Durum Cultivars.*

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

The immediate objectives of this project were to:

1. characterize the epigenetic changes of FHB resistant durum cultivars produced by altering the DNA methylation pattern, and
2. characterize durum cultivars missing portions of chromosome 2A region that may contain a FHB suppressor locus.

The ultimate objective of this project is to enhance the resistance in durum cultivars by removal of a persistent suppression mechanism.

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

1) major activities and 2) specific objectives

Repeated phenotypic evaluation of durum lines with altered methylation pattern (i.e. mutant lines) (Obj. 1)
Collection of critical tissue from the most resistant and susceptible parents for RNA isolation (Obj. 1)
Sequencing and transcriptome analysis of tissue from most resistance and susceptible parents (Obje. 1)
Irradiation and crossing of lines to generate chromosome 2A deletion lines (Obj. 2)

3) significant results

- Five mutant lines have been identified based on repeated testing (several field season years, and many greenhouse locations) as being significantly more resistant (FHB severity, reduce FDK and reduce DON amount) than the parental lines to FHB. These lines have been forwarded to the durum breeding program for inclusion in their breeding effort.
- Two of these lines were crossed to susceptible cultivars and are being advanced without selection. F1, BC1 and F3 plants will be evaluated to examine if the modified resistance gene(s) are stably inherited.
- Tissue samples from resistant lines and parental checks with and without Fusarium infection were collected and sent to UMGC for sequencing. A total of 27 TurSeq dual indexed RNA libraries were constructed and sequenced across 6 lanes of HiSeq 2500 High Output PE flow cells. Each lane generated ≥220 M Pass-Filter (PF) reads. We have obtained transcriptome data from these samples and are analyzing them for differentially expressed genes.
- The radiation hybrid population missing portions of chromosome 2A is under development and marker screening to identify the deleted regions is continuing.

4) key outcomes or other achievements

- Identification of FHB resistant durum lines by epigenetic modification

- Advancement of resistant lines through crossing with durum cultivars
- Transcriptome analysis of resistant lines for identification of differentially expressed genes
- Development of durum populations missing portions of chromosome 2A

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

Dr. Jitendra Kumar is the postdoctoral scientist on this project. Drs. Dill-Macky and Kianian has been actively advising/mentoring Dr. Kumar as he advances through his career. He has attended professional meetings (e.g., USWBSI Scab Forum) and has actively participated at various on-campus meeting (e.g., Department of Plant Pathology Seminar series). He has made several oral presentations to various groups (e.g., departmental, Cereal Disease Laboratory, and lab groups) and has been active in publishing manuscripts from his research.

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

Through presentations and publication of outcomes.

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY16 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 FY16 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 FY16 award period?** NO.

   If yes, how many?

3. **Have any post docs who worked for you during the FY16 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 FY16 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 FY16 award period. All columns must be completed for each listed germplasm/cultivar. Use the key below the table for Grain Class abbreviations. *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 FY16-FPR_Instructions for detailed instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY16 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.

Journal publications.

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

Other publications, conference papers and presentations.

Kumar, J., F. Ghavami, S.M. Pirseyedi, A. Kumar, S. Xu, E.M. Elias, R. Dill-Macky, and S.F. Kianian. 2016. "Epigenetic control of FHB in durum wheat." In: S. Canty, A. Clark, K. Wolfe and D. Van Sanford (Eds.), *Proceedings of the 2016 National Fusarium Head Blight Forum*, East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative. p. 82.
Status: Abstract Published and Poster Presented
Acknowledgement of Federal Support: YES (poster #40 and abstract)