

**USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY15 Final Performance Report
Due date: July 15, 2016**

Cover Page

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Fiscal Year:	2015
USDA-ARS Agreement ID:	N/A
USDA-ARS Agreement Title:	Pedigree Based Association Analysis of Novel Sources of FHB Resistance in Durum Wheat.
FY15 USDA-ARS Award Amount:	\$ 15,000

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
DUR-CP	Enhancing FHB Resistance by Epigenetic Modification of Durum Cultivars.	\$ 15,000
	FY15 Total ARS Award Amount	\$ 15,000

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?

1)/2) major activities/specific objectives

Repeated phenotypic evaluation of durum lines with altered methylation pattern (i.e. mutant lines) (Obj. 1)

Development of base material for radiation treatment (Obj. 2)

3) significant results

- Total of 40 advanced mutant lines (M4) were tested in during summer 2015, at 3 different locations: St. Paul, Fargo and Carrington. At all three locations, mix inoculum of different Fusarium strains (not necessarily the same at each location) were used to inoculate the lines and data was collected as to disease severity. Five to 6 lines, of the 40 lines tested, showed significant reduction in disease severity. Phenotypic evaluation has been repeated in the greenhouse yielding similar results.
- FDK and DON analysis was performed on field samples to examine the amount of damage kernel and toxin accumulation. The FDK and DON analysis results coincided with field evaluation indicating 5-6 lines as resistant to FHB infection.
- We have selected two of the most promising lines and proceeded to cross them to their susceptible parental cultivar and then advance them for two generations without selection or screening for resistance. F1, BC1 and F3 plants will be evaluated to examine if the modified resistance gene(s) are stably inherited.
- 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
- Development of durum populations missing portions of chromosome 2A

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3. What opportunities for training and professional development have 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., International Plant and Animal Genome Conference, International Barley Genetics Symposium) 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 (e.g., Combating whitefly with novel fern protein in genetically modified cotton in June 2016 issue of Nature Biotechnology) 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 FY15 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 FY15 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 FY15 award period? NO.**

3.

If yes, how many?

- 4. Have any post docs who worked for you during the FY15 award period and were supported by funding from your USWBSI grant taken faculty positions with universities? NO.**

5.

If yes, how many?

- 6. Have any post docs who worked for you during the FY15 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 FY15 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

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Publications, Conference Papers, and Presentations

Refer to the FY15-FPR_Instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY15 grant. If you did not have any publications or presentations, state 'Nothing to Report' directly above the Journal publications section.

Journal publications.

Zhu, X., Zhong, S., Chao, S., Gu, Y.Q., Kianian, S.F., Elias, E., and Cai, X. (2016) Toward a better understanding of the genomic region harboring Fusarium head blight resistance QTL Qfhs.ndsu-3AS in durum wheat. *Theor. Appl. Genet.* 129(1):31-43. doi: 10.1007/s00122-015-2606-x.

Status: Published manuscript

Acknowledgement of Federal Support: YES

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

Other publications, conference papers and presentations.

Kianian, S.F., Ghavami, F., Pirseyedi, S.M., Kumar, A., Kumar, J. Dill-Macky, R., Xu, S., and Elias, E.M. (2015). Enhancing FHB resistance in durum wheat. In: S. Canty, Clark, S. Vukasovich and D. Van Sanford (Eds.), *Proceedings of the 2015 National Fusarium Head Blight Forum*. East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative. p. 91.

Status: Abstract Published and poster presented

Acknowledgement of Federal Support: YES