USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY17 Final Performance Report
Due date: July 31, 2018

Cover Page

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Fiscal Year:	2017
USDA-ARS Agreement ID:	N/A
USDA-ARS Agreement Title:	Identification and Deployment of FHB Resistance QTL in US Hard Winter Wheat.
FY17 USDA-ARS Award Amount:	$ 75,000

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
HWW-CP	Identification and Deployment of FHB Resistance QTL in US Hard Winter Wheat.	$ 75,000
	FY17 Total ARS Award Amount	**$ 75,000**

7/31/2018

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: *Identification and Deployment of FHB Resistance QTL in US Hard Winter Wheat.*

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

a). Map QTL from moderately resistant cultivar Lyman and CI13227
b). Pyramid QTLs on chromosome 5A from PI 277012 with Fhb1 in Overland and Everest backgrounds

2. What was accomplished under these goals?

1) major activities

a). Completed phenotyping of Lyman/CI13227 F7 population and Lyman/Overley RIL F7 population in both greenhouse and field experiments and data analysis is in progress

b). For QTL pyramiding project, 200 Bc_2F_2 plants were marker-selected and phenotyped for one season in a greenhouse experiment. About 200 Bc_1F_3 lines with different combinations of genes were evaluated for FHB resistance in field experiment.

c). Evaluated Overland/Overley F6 population in both greenhouse and field experiment for type I and Type II resistance. Crosses were made between selected Garrison-Fhb1 lines and Everest-Fhb1 contrasting in type I resistance for type I resistance characterization.

2) specific objectives

a) Identify QTLs in Lyman and CI 13227 and SNP markers linked to these QTLs for marker-assisted selection
b) Pyramid Fhb1 and other QTLs with both major and minor effects using marker-assisted selection and evaluate their individual and combined effects.

3) significant results

a). We collected phenotypic data for Lyman/CI13227 from three field and three greenhouse experiments. Linkage map was constructed with GBS-SNPs. For Lyman/Overley population, GBS-SNP data were used for map construction and phenotyping was done for two field and three greenhouse experiments.

b). Two 5AS QTLs were successfully pyramided with *Fhb1* in Everest and Overland backgrounds by marker-assisted backcrossing and their phenotypes were evaluated in one greenhouse and one field experiment.

4) key outcomes or other achievements

We evaluated selected Fhb1 lines in 10 hard winter wheat genetic backgrounds for FHB resistance. A total of 60 lines were evaluated in FHB nursery for FHB resistance and for agronomic performance in a mini yield trial, and we selected two to five lines per background that had yield similar to or higher than their recurrent parents. Those lines will be released as Fhb1 germplasm after further yield testing.

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

Five graduate students (Ms. Yaoguang Li, Ms.Umara Rena, Ms.Ruolin Bian, Mr. Abdul Hashimi and Mr. Yuzhou Xu) have worked on these projects. They learned Fusarium inoculum production, FHB inoculation and disease note taking, and marker data generation and analysis.

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

- Fhb1 lines from all 11 backgrounds have been distributed to breeding programs for further evaluation of FHB resistance or used as parents for further crosses
- One manuscript on development of diagnostic markers for Fhb1 has been resubmitted to Theoretical and Applied Genetics after first review.
- Gave an invited talk in 2017 FHB Forum

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY17 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 FY17 award period?**
   No.

2. **Did any graduate students in your research program supported by funding from your USWBSI grant earn their Ph.D. degree during the FY17 award period?**
   Yes.

   If yes, how many?
   Four.

3. **Have any post docs who worked for you during the FY17 award period and were supported by funding from your USWBSI grant taken faculty positions with universities?**
   Yes.

   If yes, how many?
   Two.

4. **Have any post docs who worked for you during the FY17 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 FY17 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 FY17-FPR_Instructions for detailed instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY17 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.

Journal publications.

1. Bai, G.H, Z. Su, and J. Cai, 2018. Wheat Resistance to Fusarium Head Blight. Can J Plant Pathol. https:/doi.org/10.1080/07060661.2018.1476411
   Status: Published (online)
   Acknowledgement of Federal Support: Yes

2. Zhang, H.J., Z.Q. Su, G.H. Bai, X Zhang, H.Q. Ma, T. Li, Y. Deng, C.Y. Mai, L.Q. Yu, H.W. Liu, L. Yang, H.J. Li, and Y. Zhou. 2018. Improvement of resistance of wheat cultivars to Fusarium head blight in the Yellow–Huai Rivers Valley Winter Wheat Zone with functional marker selection of *Fhb1* gene. Acta Agron. Sin. 44: 505-511
   Status: Published
   Acknowledgement of Federal Support: No

3. Su, Z., A. Bernardo, B. Tian, S. Wang, H. Ma, S. Cai, D. Liu, D. Zhang, T. Li, H. Trick, P. St. Amand, J. Yu, Z. Zhang, G. Bai. 2018. A loss-of-function mutation in an HRC-like gene confers Fhb1 resistance to Fusarium head blight in wheat. Nat. Genet.
   Status: revised version in peer-review
   Acknowledgement of Federal Support: Yes

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

Other publications, conference papers and presentations.

- Su, Z., A. Bernardo, B. Tian, S. Wang, H. Ma, S. Cai, D. Liu, D. Zhang, T. Li, H. Trick, P. St. Amand, and G. Bai. 2018. Loss function of *TaHRC* in the *Fhb1* region increased wheat FHB resistance. National Fusarium Head Blight Forum • December 2017, page 53.
  Status: Published
  Acknowledgement of Federal Support: Yes.

- Amy Bernardo, Paul St. Amand and Guihua Bai. 2017. Multiplex restriction amplicon sequencing (MRASeq), a new next generation sequencing-based marker platform for wheat and barley breeding. Fusarium Head Blight Forum • December 2017, page 79.
  Status: Published
  Acknowledgement of Federal Support: Yes.

- Abdul Hashimi and Guihua Bai. 2017. Mapping quantitative QTL for Fusarium head blight resistance in winter wheat. Fusarium Head Blight Forum • December 2017, page 86.
  Status: Published
  Acknowledgement of Federal Support: Yes.