

**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:	59-0206-4-041
USDA-ARS Agreement Title:	Developing FHB Resistant Wheat Cultivars for Idaho and the Western US.
FY16 USDA-ARS Award Amount:	\$ 39,420
Recipient Organization:	University of Idaho Moscow, ID 83844-3020
DUNS Number:	075746271
EIN:	82-6000945
Recipient Identifying Number or Account Number:	BJKN10
Project/Grant Reporting Period:	6/1/16 - 5/31/17
Reporting Period End Date:	05/31/17

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
VDHR-SPR	Developing FHB Resistant Wheat Cultivars for Idaho and the Western US.	\$ 39,420
	FY16 Total ARS Award Amount	\$ 39,420

Jianli Chen

July 19, 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: *Developing FHB Resistant Wheat Cultivars for Idaho and the Western US.*

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

The overall goal of this project is to develop FHB resistant spring cultivars that have high grain yield and good end-use quality and resistance to other predominant diseases and insects. The specific objectives are: 1) Increase and document acreage planted for UI Stone, FHB tolerant soft white spring wheat cultivar; 2) Optimize local scab nurseries and evaluate FHB resistance for Spring Wheat Parents in the Uniform regional Scab Nursery and materials developed by the proposed program; 3) Conduct association mapping of FHB resistance in spring wheat lines adapted in Pacific North West (PNW) and collect data for training population of future genomic selection; and 4) Develop and release new spring wheat cultivars pyramided *Fhb1* with resistance genes to stripe rust, stem rust, cereal cyst nematodes, Hessian Fly, and end-use quality via MAS and field testing in local disease nurseries.

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

1) Increase and document acreage planted for UI Stone, FHB tolerant soft white spring wheat cultivar

- a. major activities: UI stone was evaluated for agronomic performance in state variety trials in ID, WA, OR, MT, CO and MI in 2015, 2016, and 2017. UI Stone was also evaluated in Scab Uniform Nurseries in MN, SD, ND, ID, CAN in 2016.
- b. significant results: UI Stone has high grain yield and excellent end-use quality in state variety trials since it was released in 2014. FHB resistance of UI Stone was on average in the Scab Uniform nurseries.
- c. key outcomes or other achievements: UI Stone seeds sales was increased from 1,600 bushes in 2015 to 35,165 bushes in 2016. The increase was driven by industry interest on end-use quality and agronomic performance.

2) Optimize local scab nurseries and evaluate FHB resistance for Spring Wheat Parents in the Uniform regional Scab Nursery and materials developed by the proposed program major activities

- a. Major activities: We purchased new irrigation heads providing fine misting water.
- b. significant results: A nice misting field nursery was established in Aberdeen, ID and 840 lines/3,040 headrows were inoculated.
- c. key outcomes or other achievements: The misting nursery allowed us to increase number of lines being evaluated in 2017. This nursery was further improved and installed with a solar-panel supported timer control.

3) Conduct association mapping of FHB resistance in spring wheat lines adapted in Pacific North West (PNW)

- a. major activities: we continued collaboration with UMN and assessed FHB resistance the second year in St. Paul, MN for the association panel, at the same time we assessed this panel in greenhouse and field nursery in Aberdeen, ID. We also evaluated one bi-parental

population in greenhouse and field nursery in Aberdeen. The bi-parental population was derived from one resistant line PI 610750 from the panel.

- b. significant results: we obtained uniform disease data for association mapping panel (170 lines) in our greenhouse and field nurseries in Aberdeen and St. Paul, MN under collaboration with Dr. Jim Anderson. Using this and previously generated data, we conducted a genome-wide association analysis. QTL on chromosomes 1B, 2B, 4B, 5A, 5B, and 6A were identified for resistance to FHB incidence, severity, and DON content. The locus on chromosome 5B for reduced DON content may be novel. We established another collaboration with Dr. Shaobin Zhong and currently evaluating the bi-parental population in both greenhouse and field nursery in 2017.
 - c. key outcomes or other achievements: From association panel evaluation, we identified 14 lines with consistent, high level of resistance to FHB compared to the resistant checks and known resistance source “W14”. These lines were crossed with elite lines in the spring of 2017. A paper derived from this panel was published in Phytopathology. The panel was planted in three yield trials in 2017 to apply genomic selection in FY18 and FY19.
- 4) Develop and release new spring wheat cultivars pyramided *Fhb1* with resistance genes to stripe rust, stem rust, cereal cyst nematodes, Hessian Fly, and end-use quality via MAS and field testing in local disease nurseries.
- a. major activities: A total of 280 lines, which previously pyramided *Fhb1* (based on UMN10 from Lassik) with resistance genes to stripe rust, stem rust, cereal cyst nematodes, Hessian Fly, and end-use quality via MAS, were assessed in FHB nursery in summer 2016. The selected lines with *Fhb1* and without *Fhb1* are being evaluated for the impact of *Fhb1* on yield in summer 2017. Additional 960 lines were selected out of 4000 headrows based on agronomic performance in 2016, which were derived from known Chinese resistance sources W14 and Ning 9016 and unknown sources. These lines are being assessed in FHB nurseries in summer 2017. Around 100 crosses were made between elite lines with the identified FHB resistant lines in objective 3 either in greenhouse in winter 2016 or in field in summer 2017. All line selections were not only based on phenotypic data but also genotyping data generated by the Western Genotyping Center and the breeding program.
 - b. significant results: We have two elite lines in the production of breeder seeds. IDO1405S, soft white spring wheat, showed very good FHB resistance in Dr. Marshall variety trials, in my nursery, and nurseries in Michigan of two years. IDO1603S, hard red spring wheat, combined UMN 10 resistant allele has excellent bread-baking quality, resistance to stripe rust and hessian fly
 - a. key outcomes or other achievements: IDO1405S and IDO1603S have potential to be released in 2018. W14 derived breeding lines are showing good resistance to FHB in 2017 nursery.

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

We provided training to one undergraduate student on nursery set-up, inoculation, and disease assessment in summer of 2016 and 2017.

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

The FHB research progress and activities were presented to wheat growers at field days, professionals at the 2016 Annual FHB Forum, the Idaho Wheat Commission research review (Feb. 2017), the Western Wheat Workers meeting (Mar. 2017), and the Pacific Northwest Wheat Quality Council meeting (Mar. 2017).

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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?

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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

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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 (6/1/16 - 5/31/17). If you did not have any publications or presentations, state 'Nothing to Report' directly above the Journal publications section.

Journal publications.

Wang, R., Chen, J., Anderson, J. A., Zhang, J., Zhao, W., Wheeler, J., Klassen, N., See, D. R., and Dong, Y. 2017. Genome-Wide Association Mapping of Fusarium Head Blight Resistance in Spring Wheat Lines Developed in the Pacific Northwest and CIMMYT. *Phytopathology*. doi: 10.1094/PHYTO-02-17-0073-R.

Acknowledgement of Federal Support: YES.

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

Nothing to Report

Other publications, conference papers and presentations.

Wang, R., Chen, J., Zhang, J., Zhao, W., Wheeler, J., Klassen, N., Anderson, J. A., See, D. R., and Dong, Y. 2016. Genome-Wide Association Mapping of Resistance QTL to Fusarium Head Blight in Spring Wheat Lines Grown in Pacific Northwest and CIMMYT. In: Proceedings of the 2016 National Fusarium Head Blight Forum. St. Louis, MI.

Status: Abstract Published and 5-minute talk & Poster Presented

Acknowledgement of Federal Support: YES (poster), NO (abstract).

Wang, R., Chen, J., Zhang, J., Zhao, W., Wheeler, J., Klassen, N., Anderson, J. A., See, D. R., and Dong, Y. 2016. Genome-Wide Association Mapping of Resistance QTL to Fusarium Head Blight in Spring Wheat Lines Grown in Pacific Northwest and CIMMYT. In: Proceedings of the 2016 ASA/CSSA/SSSA Annual Meeting. Phoenix, AZ.

Status: Abstract Published and Poster Presented

Acknowledgement of Federal Support: YES (poster), NO (abstract).