

USDA-ARS
U.S. Wheat and Barley Scab Initiative
FY18 Performance Report
Due date: September 23, 2019

Cover Page

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Fiscal Year:	2018
USDA-ARS Agreement ID:	58-3020-8-027
USDA-ARS Agreement Title:	Breed Scab Resistant and Low DON Hard Winter Wheat Varieties for the Northern Great Plains.
FY18 USDA-ARS Award Amount:	\$ 69,218
Recipient Organization:	University of Nebraska Sponsored Programs 312 N 14th, Alexander West Lincoln, NE 68588-0430
DUNS Number:	55-545-6995
EIN:	47-0049123
Recipient Identifying Number or Account Number:	25-6222-0913-001
Agency PI:	Guihua Bai
Project/Grant Reporting Period:	9/1/18 - 8/31/19
Reporting Period End Date:	08/31/19

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
HW-CP	Breed Scab Resistant and Low DON Hard Winter Wheat Varieties for the Northern Plains.	\$ 69,218
FY18 Total ARS Award Amount		\$ 69,218



Principal Investigator

9/18/2019

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
HW-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: *Breed Scab Resistant and Low DON Hard Winter Wheat Varieties for the Northern Plains.*

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

1. *Increase efficiency of individual breeding programs by developing phenotypic and genomic selection models through coordinated efforts of pyramiding major and minor genes leading to the development and release FHB resistant varieties with lower levels of DON,*
2. *Characterize genotype x fungicide “specific” treatment responses for enhancing FHB resistance and the reduction of DON so information can be given to the MGMT group, and*
3. *Enhance communication and end-user education/outreach relating to resistant varieties and effective management practices.*

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

1) **major activities:** This proposal is for our main breeding program, hence our activities are related to hard winter wheat breeding and line advancement. We are expanding our backcrossing efforts to incorporate *Fhb1* and other major QTL for FHB tolerance.

2) **specific objectives:** We tested approximately ~1000 unique lines on our mist screening nursery. We made ~1100 crosses, of which ~170 were directly related to improved FHB tolerance. We tested all of our F2, F4 through F12 generations at our main breeding location which had a major FHB epidemic this year. Our elite nursery was grown with and without fungicide treatments (including a treatment to reduce scab). Finally, numerous field days in the scab prone areas were presented to inform growers of best management practices for reducing the effect of FHB.

3) **significant results:** We had a major natural scab infection in our main nursery site and approximately 900 lines out of 1600 lines in the preliminary observation nursery were dropped due to the effects of FHB. This level of FHB is generally rare in eastern NE, but it was a great opportunity to raise the level of FHB tolerance throughout the breeding program, especially for lines with native resistance. In our elite nursery, the fungicide treated plots averaged 81.1 bu/a, whereas the untreated plots averaged 66.4 bu/a. The two main diseases in the nursery were leaf rust and FHB with FHB having a major effect on test weight. Three major field days were held in our scab prone areas. In addition, as FHB seems to be expanding to the drier parts of NE, three major field days were held in the less scab prone areas.

4) **key outcomes or other achievements:** We released two lines and have a third line which will need a licensing agreement that is under development. The two released lines are LCS Valiant and NuPride Genetics Siege. Both lines have marketing organizations, but both are widely available through their respective marketing groups. LCS Valiant is an early wheat

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that is adapted to western KS and throughout Nebraska including our scab-prone areas. It has good tolerance to FHB and low DON (similar to Overland). In addition, by being an early wheat, it provides some diversity in our cultivars, most of which are later, to temporal aspects of scab infection. The second line, Nu Pride Genetics Siege unfortunately is susceptible to FHB and to DON. We are making sure our growers know and understand this limitation. It is adapted to the scab-prone areas and where fungicides are routinely used. It will need a fungicide treatment at flowering to control FHB. The third line is NW13493, a white winter wheat, that can be grown across Nebraska. White winter wheat cultivars need to have a developed market before they can be released, hence the need for a licensing agreement. It has good tolerance to FHB and low DON (similar to Overland).

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

Ms. Fang Wang (Ph.D. student) who is partially supported by the USWBSI has continued to lead our backcrossing efforts to improve FHB tolerance in our parental and released lines. She will also be critical to our efforts in genomic selection. She attended the 2018 ASA meeting and also attended the 24th Summer Institute in Statistical Genetics (SISG) in July, 2019 on “Mixed models in quantitative genetics” (July 17 - July 19) and “Advanced quantitative genetics”(July 22 - July 24) modules. Her skills have permeated our research group and she is quite helpful with molecular markers with other students (Mr. Nick Garst, Ms. Hannah Stoll, and Ms. Betul Centindere).

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

We present our results at field days directly to growers, to the annual meeting of the Nebraska Crop Improvement Association directly to seed producers, and at the Wheat Quality Council directly to millers and bakers. We also use twitter and social media to further reach our wheat community.

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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?** None this year.

If yes, how many? 0

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?** None this year

If yes, how many? 0

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 posdoc is supported by USWBSI funding

If yes, how many? 0

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 posdoc is supported by USWBSI funding

If yes, how many? 0

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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 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
LCS Valiant	HRWW	MR	3	2018
NuPride Genetics Siege	HRWW	S	8	2019
NW13493	HWWW	MR	3	2020 (?)

Add rows if needed.

NOTE: List the associated release notice or publication under the appropriate sub-section in the ‘Publications’ section of the FPR. **NOTE I AM ASSUMING 0 IS RESISTANT AND 9 IS SUSCEPTIBLE.**

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 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 (09/08/18 - 09/07/19). 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.

Wegulo, S. N., Valverde-Bogantes, E., Bolanos-Carriel, C., Hallen-Adams, H., Bianchini, A., McMaster, N., Schmale III, D. G. 2018. First report of *Fusarium boothii* causing head blight of wheat in the United States. Plant Dis. 102:2646. <https://apsjournals.apsnet.org/doi/10.1094/PDIS-04-18-0696-PDN>.

Status: Published

Acknowledgement of Federal Support: NO

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

Other publications, conference papers and presentations.

C. Bolanos-Carriel, S. N. Wegulo, H. Hallen-Adams, P. S. Baenziger, K. Eskridge and D. Funnell-Harris. 2018. Determining the optimum Inoculum concentration and spike bagging period for discriminating between FHB-susceptible and –resistant wheat cultivars under greenhouse conditions. Pages 106-107 in: Proceedings of the 2018 National Fusarium Head Blight Forum. Hyatt Regency St. Louis at the Arch, St. Louis, Missouri, USA. December 2-4, 2018.

Status: Published,

Acknowledgement of Federal Support: Yes

F. Wang, V. Belamkar, S. Wegulo and P. S.n Baenziger. 2018. Evaluation for Fusarium head blight (scab) resistance by detached leaf assay in backcross populations of wheat. Page 140 in: Proceedings of the 2018 National Fusarium Head Blight Forum. Hyatt Regency St. Louis at the

Arch, St. Louis, Missouri, USA. December 2-4, 2018.

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Acknowledgement of Federal Support: Yes