

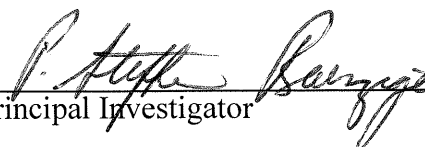
**USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY16 Final Performance Report
Due date: July 28, 2017**

Cover Page

Principle Investigator (PI):	Stephen Baenziger
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Phone:	402-472-1538
Fiscal Year:	2016
USDA-ARS Agreement ID:	59-0206-4-011
USDA-ARS Agreement Title:	Enhance Variety Development of Scab Resistant Hard Winter Wheat Varieties in Nebraska.
FY16 USDA-ARS Award Amount:	\$ 53,981
Recipient Organization:	University of Nebraska Sponsored Programs 2200 Vine St., 151 Whittier Research Center Lincoln, NE 68588-0430
DUNS Number:	55-545-6995
EIN:	47-0049123
Recipient Identifying Number or Account Number:	25-6222-0611-001
Project/Grant Reporting Period:	5/3/16 - 5/2/17
Reporting Period End Date:	05/02/17

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
HWW-CP	Breed Scab Resistant Hard Winter Wheat Varieties for the Northern Great Plains.	\$ 53,981
	FY16 Total ARS Award Amount	\$ 53,981


Principal Investigator

7/18/17
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: *Breed Scab Resistant Hard Winter Wheat Varieties for the Northern Great Plains.*

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

Our major goal is to develop cultivars with improved scab resistance coupled with improved management to reduce the detrimental effects of scab and DON. Our objectives are: 1. Use our newly renovated scab mist and naturally infected nurseries to identify lines with improved scab tolerance and reduced DON with: a) native resistance (e.g. Overland, Lyman, Everest, Art, SY Wolf, Hitch, and new experimental lines), b) known major *Fhb* tolerance QTLs (e.g. Overland *Fhb1* isolines), and the recently developed doubled haploid lines with *Fhb1*, and other new lines from Great Plains breeding programs), 2. Use designed crosses and molecular markers to introgress and pyramid known QTLs (*Fhb1*, *Fhb3*, 5As, etc.) in native resistance backgrounds, and 3. Advance lines through a full range of agronomic, scab and other disease, winter hardiness, and end-use quality tests.

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

- 1) Use our newly renovated scab mist and naturally infected nurseries to identify lines with improved scab tolerance and reduced DON with: a) native resistance (e.g. Overland, Lyman, Everest, Art, SY Wolf, Hitch, and new experimental lines), b) known major *Fhb* tolerance QTLs (e.g. Overland *Fhb1* isolines), and the recently developed doubled haploid lines with *Fhb1*, and other new lines from Great Plains breeding programs), In our research we continued to screen our preliminary, advanced, and elite yield trials for FHB. We screened a total of 997 wheat lines for resistance to FHB in the field. FHB index and DON levels were generally low ($\leq 30\%$ index and ≤ 5 ppm DON for most of the lines) due to unfavorable weather conditions for FHB development for which our mist system was unable to compensate. We continue to find low levels of native resistance which are then recycled as parents lines to make future crosses. The *Fhb1* lines developed via previous backcrossing s are being extensively used as parents and in our preliminary nursery we now have 24 lines with the *Fhb1* marker and 2 that are heterogenous. This represents a very favorable trajectory and is approximately 10% of the lines in the preliminary trial (n=270).

While no new cultivar was released, it is important to note that Overland *Fhb1* (Listed as Overland FHB-10 because we tested many backcross lines) was tested in the Northern Regional Performance nursery (see Table 3.) and was in the top half of the trial. It performed similarly to Overland. It should be a good parent line for those needing a source of *Fhb1* in an adapted winter background. NOTE: Lines highlighted in red font were developed collaboratively by this program.

Table 3. Agronomic Summary of 2016 Northern Regional Performance Nursery

Entry	Line	Grain Yield		Grain Volume Weight		Heading Date		Plant Height	
		Mean (kg/ha)	Rank	Mean (kg/hl)	Rank	Mean (DOY)	Rank	Mean (cm)	Rank
1	Kharkof	3145	32	77.2	24	157	27	110	1
2	Overland	4520	15	76.8	18	154	13	88	11
3	Wesley	4206	26	74.4	5	153	4	77	32
4	Jagalene	4577	13	78.0	28	153	7	83	23
5	Jerry	3597	31	75.1	7	157	28	94	2
6	LJ083 or AAC Elevate	4047	29	75.6	8	157	31	84	22
7	LCH13NEDH-5-59	4581	12	76.3	14	154	17	88	10
8	PSB13NEDH-14-31	4606	8	76.7	17	157	29	81	30
9	PSB13NEDH-14-83	4770	3	78.4	30	154	9	85	18
10	PSB13NEDH-14-71	4692	5	76.9	20	154	11	82	27
11	LCH13NEDH-14-69	4853	1	77.1	22	153	6	78	31
12	LCH13-056	4684	6	76.3	15	153	2	84	21
13	NI12702W	4425	20	79.5	32	155	20	85	19
14	NE12561	4382	21	77.4	26	154	8	82	29
15	NE12589	4311	23	77.2	25	152	1	82	26
16	Overland FHB-10	4583	11	77.1	23	154	12	89	8
17	NE13425	4627	7	78.5	31	154	15	86	15
18	NE13434	4601	9	76.2	12	154	10	87	14
19	NE13604	4584	10	76.6	16	156	23	89	9
20	NW13669	4783	2	76.2	11	156	22	87	13
21	NE13672	3819	30	72.6	1	154	16	82	28
22	NE13625	4048	28	78.0	29	153	3	84	20
23	MTS1224 (Loma)	4282	24	74.2	2	158	32	83	24
24	MT1257	4328	22	74.3	3	156	26	92	4
25	MT1265	4505	17	74.4	4	157	30	92	5
26	SD08200	4439	19	77.0	21	154	19	90	7
27	SD09113	4279	25	74.5	6	155	21	85	17
28	SD09227	4507	16	76.8	19	156	25	90	6
29	SD10257-2	4498	18	77.7	27	154	14	93	3
30	SD110060-7	4722	4	76.1	9	154	18	83	25
31	SD110085-1	4080	27	76.3	13	156	24	88	12
32	SD10W153	4556	14	76.1	10	153	5	86	16
	SAS Mean	4396		76.4		155		87	
	l.s.d. (alpha = 0.05)	229							
	MSE	316193							
	n	47							
	CV	12.8							

2) Use designed crosses and molecular markers to introgress and pyramid known QTLs (Fhb1, Fhb3, 5As, etc.) in native resistance backgrounds. Our emphasis has been on *Fhb1* but as other sources are being pyramiding by Dr. Bai's group we are incorporating those sources in to our breeding effort. Our belief is that it is best to begin with pyramided sources to create our pyramids in locally adapted lines.

and

3) Advance lines through a full range of agronomic, scab and other disease, winter hardiness, and end-use quality tests. In this research, our fungicide treated (three fungicide treatments) vs. untreated trials have proved to be very valuable. Most of our diseases are very visual and many are controlled by fungicides (the exceptions being wheat soilborne mosaic virus and bacterial streak). Wheat soilborne mosaic virus

resistance is very common in our lines, so this confounding disease is rare. Bacterial streak can be common but it is less so in the past three years. Hence using the fungicide treated plots we can compare grain yields and other agronomic traits with fully controlled diseases to those that are visually scored in the untreated plots. The first year of this effort identified scab as causing a 20% yield loss and very high DON (> 4ppm) levels. The second year, scab was less common and important. This year scab was also infrequent. However, this research is giving us very useful information to provide to growers and the Management Group on which genotypes respond to fungicide applications.

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

The main graduate student training activity has been for Mr. Javed Sidiqi, a Fulbright Scholar from Afghanistan, who has been studying the effect of disease and disease management on grain yield in eastern Nebraska. In his first year, Fusarium head blight was a major disease coupled with stripe rust. In the second year, stripe rust was a major disease. The third year is underway now, but Fusarium head blight has been minor, while stripe and leaf rust have been major concerns. All of the graduate students assist (5 additional students) with the Fusarium misting nurseries, hence all are familiar with the disease and the protocols to measure the disease and its affects on plants.

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

We have disseminated the results via field days, radio interviews, newspaper interviews, extension circular, and social media (mainly twitter). In addition, our improved cultivars have been disseminated through our certified seed industry. Our crop management protocols have been refined and improved and disseminated using the above approaches.

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 graduate student was supported by the USWBSI in 2016-2017. However other students on the project who have tangentially worked on scab did complete their M.S.

If yes, how many? 1. Nicholas Garst.

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 graduate student was supported by the USWBSI in 2016-2017. However other students on the project who have tangentially worked on scab did complete their Ph.D.

If yes, how many? 1. Wasseem Hussain.

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?

FY16 Final Performance Report
 PI: Baenziger, Stephen
 USDA-ARS Agreement #: 59-0206-4-011
 Reporting Period: 5/3/16 - 5/2/17

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
No New Cultivar 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 (5/3/16 - 5/2/17). If you did not have any publications or presentations, state ‘Nothing to Report’ directly above the Journal publications section.

Journal publications.

None

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

None.

Other publications, conference papers and presentations.

Council for Agricultural Science and Technology (CAST). 2017. Plant Breeding and Genetics—A paper in the series on The Need for Agricultural Innovation to Sustainably Feed the World by 2050. Issue Paper 57. CAST, Ames, Iowa. Writing Committee: P.S. Baenziger and R. H. Mumm (Cochairs), R. Bernardo, E.C. Brummer, P. Langridge, P. Simon, and S. Smith. CAST Liaison: W. Srnica, W. Srnica,
Status: Published.
Acknowledgement of Federal Support: No.

Proceedings Abstracts:

Bolanos-Carriel, C., Wegulo, S.N., Hallen-Adams, H., Baenziger, P.S., Eskridge, K.M., and Funnell-Harris, D. “Effects of cultivar resistance, fungicide application timing, and fungicide chemical class on FHB and DON in winter wheat.” *Proceedings of the 2016 National Fusarium Head Blight Forum*, December 4-6, 2016. Hyatt Regency St. Louis, MO. Ed. S. Canty, K. Wolfe, D. Van Sanford. East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative. 2016. 9-10. Digital Print.
Status: Published.
Acknowledgement of Federal Support: Yes.

Bolanos-Carriel, C., Wegulo, S.N., Hallen-Adams, H., Baenziger, P.S., Eskridge, K.M., Funnell-Harris, D., McMaster, N., and Schmalle III, D. G. “Effects of fungicides, time, and grain moisture content on postharvest accumulation of DON in winter wheat.” *Proceedings of the 2016 National Fusarium Head Blight Forum*, December 4-6, 2016. Hyatt Regency St. Louis, MO. Ed. S. Canty, K. Wolfe, D. Van Sanford. East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative. 2016. 11-12. Digital Print.
Status: Published.
Acknowledgement of Federal Support: Yes.