

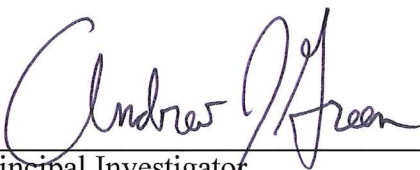
**USDA-ARS/  
U.S. Wheat and Barley Scab Initiative  
FY16 Final Performance Report  
Due date: July 28, 2017**

**Cover Page**

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<b>Fiscal Year:</b>	2016
<b>USDA-ARS Agreement ID:</b>	59-0206-4-013
<b>USDA-ARS Agreement Title:</b>	Development of Hard Spring Wheat Cultivars Resistant Scab Disease.
<b>FY16 USDA-ARS Award Amount:</b>	\$ 120,176
<b>Recipient Organization:</b>	North Dakota State University Office of Grant & Contract Accounting NDSU Dept 3130, PO Box 6050 Fargo, ND 58108-0650
<b>DUNS Number:</b>	80-388-2299
<b>EIN:</b>	45-6002439
<b>Recipient Identifying Number or Account Number:</b>	FAR0022046
<b>Project/Grant Reporting Period:</b>	5/5/16 - 5/4/17
<b>Reporting Period End Date:</b>	05/04/17

**USWBSI Individual Project(s)**

<b>USWBSI Research Category*</b>	<b>Project Title</b>	<b>ARS Award Amount</b>
VDHR-SPR	Development of Hard Spring Wheat Cultivars Resistant to Scab Disease.	\$ 120,176
	<b>FY16 Total ARS Award Amount</b>	<b>\$ 120,176</b>

  
Principal Investigator

10 July 2017  
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:** *Development of Hard Spring Wheat Cultivars Resistant to Scab Disease.*

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

The specific objectives of this project are to (1) continue developing adapted HRSW cultivars that have resistance to FHB and other diseases such as rusts combined with good agronomic and quality attributes; (2) identify and introgress novel FHB resistance that reduces disease infection and DON accumulation into adapted HRSW germplasm base; and (3) use novel tools such as molecular markers to facilitate screening of FHB resistant genotypes

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

1) Developing Adapted HRSW Cultivars with FHB Resistance

- a) major activities- 400-1000 new crosses made each year, with 150-200 targeting introducing FHB resistance into MS breeding lines. Segregating materials and every experimental line in the testing program screened in three FHB nurseries each year.
- b) specific objectives- screening for FHB resistance through negative selection for F3-F5 populations, as well as experimental lines. Superior resistance identified through visual ratings of inoculated materials, as well as DON testing of grain. This scheme enhances FHB resistance in the breeding population overall, and we advance 200-300 experimental populations each year which remain under heavy selection each year in the FHB nursery. Coupled with selection against DON accumulation, we expect this to raise the base level of resistance in our program.
- c) significant results- We are identifying an increasing number of lines and populations which show good resistance relative to the susceptible check, indicating that this strategy is beginning to enrich the population.
- d) key outcomes or other achievements- ND VitPro was released, which has shown excellent resistance to FHB under natural and inoculated conditions. This variety has good end-use quality, and is adapted to growing regions where FHB is an annual problem.

2) Identify and Introgress Novel FHB Resistance Reducing Infection and DON

- a) major activities- We collaborate with Dr. Xu, USDA-ARS geneticist, and Dr. Cai, NDSU Professor of Cytogenetics, to receive materials containing novel resistance sources. We use these materials to advance breeding populations and screen that material in the misted, inoculated nursery. Collaboration with our breeding program is essential so that lines developed not only contain FHB resistance, but also positive agronomic and end-use quality traits.
- b) specific objectives- 15-20 breeding populations each year are advanced with the goal of moving the novel resistance into an adapted background. This begins a long process of moving that material into a desirable HRS background. These materials are advanced through winter nursery and screened in misted, inoculated FHB nurseries during the summer.
- c) significant results- Lines will be tested in yield trials in 2018 which were the result of these efforts. The goal is a cultivar with pyramided resistance genes, but if these lines result in breeding parents, we will be one step closer to utilizing this pre-breeding work from our colleagues.

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d) key outcomes or other achievements- None in FY16, as this is a long-term goal.

3) Use Novel Tools such as Molecular Markers to facilitate screening of FHB

- a) major activities- Collaboration with the USDA Genotyping Lab and Dr. Shiaoman Chao to use molecular markers in experimental lines. Initial work to collaborate with Dr. Xuehi Li on genomic selection for FHB resistance was begun during this period.
- b) specific objectives- Screening of all experimental lines, including preliminary trials for three known molecular markers for FHB resistance. Our goal is to couple this information with phenotypic data to ultimately enrich the population and decrease the amount of phenotyping required.
- c) significant results- This marker screening is now a fixed part of our breeding pipeline.
- d) key outcomes or other achievements- Nothing significant to report during FY16.

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

Students in Crop and Weed Science, including two graduate Ph.D students and 4-6 undergraduate workers and interns, were trained on the project.

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

Since the project leader began in July 2016, results have been disseminated through public presentations including statewide expos, wheat commission meetings, research and extension center field days, and state extension variety circulars.

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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? Yes**

**If yes, how many? One.**

- 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
ND VitPro	HRS	MR	3	2017

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 (5/5/16 - 5/4/17). 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. See example below for a poster presented at the FHB Forum:

Conley, E.J., and J.A. Anderson. 2016. Accuracy of Genome-Wide Prediction for Fusarium Head Blight Associated Traits in a Spring Wheat Breeding Program. In: Proceedings of the XXIV International Plant & Animal Genome Conference, San Diego, CA.

Status: Abstract Published and Poster Presented

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

Nothing to Report.

**Journal publications.**

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

**Other publications, conference papers and presentations.**