USDA-ARS
U.S. Wheat and Barley Scab Initiative
FY17 Final Performance Report – NCE for FY18
Due date: July 12, 2019

Cover Page

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Fiscal Year:	2017 (NCE for FY18)
USDA-ARS Agreement ID:	59-0206-4-013
USDA-ARS Agreement Title:	Development of Hard Spring Wheat Cultivars Resistant Scab Disease.
FY17 USDA-ARS Award Amount:	$ 119,943
Recipient Organization:	North Dakota State University Office of Grant & Contract Accouting NDSU Dept 3130, PO Box 6050 Fargo, ND 58108-0650
DUNS Number:	80-388-2299
EIN:	45-6002439
Recipient Identifying Number or Account Number:	FAR0022046
Project/Grant Reporting Period:	5/5/18 - 5/4/19
Reporting Period End Date:	05/04/19

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
VDHR-SPR	Development of Hard Spring Wheat Cultivars Resistant to Scab Disease.	$ 119,943
	FY17 Total ARS Award Amount	$ 119,943

27 June 2019

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Principal Investigator   Date

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* 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) Continue developing adapted HRSW cultivars that have resistance to FHB and other disease such as rusts combined with good agronomic and quality attributes
      a. Major Activities: We conducted FHB screening of every experimental line in the program at three misted, inoculated nurseries. Yield trial experiments for agronomic and quality traits were completed at ten locations across ND.
      b. Specific Objectives: Regarding FHB resistance, we aim to only advance lines which show moderate resistance. This is determined by a combination of visual disease ratings, test weight of grain, and Deoxynivalenol accumulation. Because we screen all experimental lines in inoculated nurseries, there is an increased likelihood of identifying materials which are both moderately resistant and agronomically desirable.
      c. Significant Results: Our results in 2017 were good enough to make advancement decisions in the breeding program, and publicize the results from released varieties in the annual variety trial results and variety selection guide.
      d. Key Outcomes/Achievements: Experimental lines advanced through the breeding program had a lower mean FHB disease rating than the average of the check varieties in our nurseries.
   2) Identify and introgress novel FHB resistance that reduces disease infection and DON accumulation into adapted HRSW germplasm base
      a. Major Activities: Populations which are 50% 'Truman' soft wheat were advanced to the F5 generation. These populations are attempting to increase "Type-II" resistance as well as FDK/DON resistance in the program. Crosses containing PI270112, a novel source of resistance on chromosome 5AL were also advanced.
      b. Specific Objectives: To identify genotypes from these crosses which
      c. Significant Results:
      d. Key Outcomes/Achievements:
   3) Use novel tools such as molecular markers to facilitate screening of FHB resistant genotypes
      a. Major Activities: Genotyping for FHB1, FHB2, and 3A QTL.
      b. Specific Objectives: Identify and advance experimental lines containing these genes, which also exhibit good field resistance, through Marker Assisted Selection.

(Form – FPR17-18)

      c. Significant Results: The frequency of these alleles continues to increase in the breeding program, likely due to the implementation of Marker Assisted Selection.

      d. Key Outcomes/Achievements: 28% of tested lines in first year yield trials appeared to be homozygous for Fhb1. Considering the level of Sumai-3 based resistance in our program which does not amplify for Fhb1 (from 'Glenn'), this is a good percentage.

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

We employ 3-5 temporary student workers at various times throughout the school year, most of which were supported in some way by this project. They assist with all aspects of the breeding program, from harvest, threshing, cleaning, processing kernel samples, DON grinding, crossing, planting preparation, and seed lab data collection.

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

Results from our misted, inoculated nurseries are used to produce the FHB ratings in the annual variety trial results and variety selection guide. At approximately 6 field days and multiple winter meetings each year, the PI discuses FHB resistance of relevant varieties using this data. One of the top priorities of our program is genetic resistance to important diseases, and we communicate this goal, along with the importance of FHB resistance every time there is an opportunity.

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY17-NCE 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-NCE 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 FY17-NCE period?**

   No.

   If yes, how many?

3. **Have any post docs who worked for you during the FY17-NCE 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 FY17-NCE 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 <u>full or partial</u> support through the USWBSI during the <u>FY17-NCE period</u>. 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

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-NCE_FPR-Instructions for detailed instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY17-NCE grant period. Only include citations for publications submitted or presentations given during your award period (5/5/18 - 5/4/19). 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. See example below for a poster presented at the FHB Forum:

> Conley, E.J., and J.A. Anderson. 2018. 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)

Journal publications.

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

Other publications, conference papers and presentations.