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

Cover Page

Principle Investigator (PI):	Yang Yen
Institution:	South Dakota State University
E-mail:	yang.yen@sdstate.edu
Phone:	605-688-4567
Fiscal Year:	2017 (NCE for FY18)
USDA-ARS Agreement ID:	59-0206-4-039
USDA-ARS Agreement Title:	Improving FHB resistance in Hard Winter Wheat by Molecular Breeding/ Manipulation.
FY17 USDA-ARS Award Amount:	$ 19,849
Recipient Organization:	South Dakota State University SAD 133, Box 2201 Brookings, SD 57007
DUNS Number:	929929743
EIN:	46-6000364
Recipient Identifying Number or Account Number:	3F4679
Project/Grant Reporting Period:	6/1/18 - 5/31/19
Reporting Period End Date:	05/31/19

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
HWW-CP	Improving FHB Resistance in Hard Winter Wheat by Molecular Breeding/Manipulation.	$ 19,849
	FY17 Total ARS Award Amount	$ 19,849

06/27/2019

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: *Improving FHB Resistance in Hard Winter Wheat by Molecular Breeding/ Manipulation.*

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

   This project is to develop PCR-based perfect marker for *WFhb1-1*. The objectives are: 1) clone the whole *WFhb1-1* coding sequence from near-isogenic lines contrasting *WFhb1-1*; 2) identify common SNPs between the resistant and the susceptible lines; and 3) develop co-dominant PCR markers that constantly appear in all resistant or susceptible lines tested.

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

   Objective 1
   1) major activities

   2) specific objective - clone the whole WFhb1-1 coding sequence from near-isogenic lines contrasting WFhb1-1

   3) significant results - *WFhb1-1* coding sequence was cloned

   4) key outcomes or other achievements

   Objective 2
   1) major activities

   2) specific objective - identify common SNPs between the resistant and the susceptible lines

   3) significant results - one SNP was found to be common among the lines tested.

   4) key outcomes or other achievements

   Objective 3
   1) major activities

   2) specific objectives - develop co-dominant PCR markers that constantly appear in all resistant or susceptible lines tested.

   3) significant results - Co-dominant PCR markers were designed and tested, but none of them can be universally applied to all lines tested beyond those used for the marker development. This may be due to the fact that *WFhb1-1* has been found to express normally in all wheat lines no matter it is FHB-resistant or susceptible.

   4) key outcomes or other achievements

Our data from related studies showed that what makes the difference between FHB resistance and susceptibility is a yet-to-explore regulatory mechanism that suppresses *WFhb1-1* expression in the susceptible lines shortly after the pathogen infection. We have found that yeast-expressed WFhb1-1 protein has antifungal ability that inhibits *Fusarium graminearum* and yeast growth in culture. Our findings suggest that FHB resistance needs *WFhb1-1* to continue expression after the pathogen infection to at least slow the growth of *F. graminearun in planta*, and that suppressed *WFhb1-1* expression is an established normal for the pathogen-host interaction during FHB pathogenesis. A mutant in FHB resistant lines seems to have disrupted this pathogen-host interaction, allowing continue *WFhb1-1* expression in the resistant lines, which confers FHB resistance. Therefore, a reliable marker for *WFhb1-1*-conferred FHB resistance needs to be found in the coding sequence of the regulator, which is to be identified, but not in *Wfhb1-1* sequence itself.

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

This project provided the opportunity for training one PhD student in molecular plant pathology.

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

The results from this project have been presented in FHB-related professional meetings including the annual FHB forums organized by the USWBSI.

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?**

   N/A

   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?**

   N/A

   If yes, how many?

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 FY17-NCE 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**
N/A				

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 (6/1/18 - 5/31/19). 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.
None.

Books or other non-periodical, one-time publications.
None.

Other publications, conference papers and presentations.

Yen Y. 2018. A Quantitative Proteomic View of Mechanisms of the Qfhb1-controlled FHB Resistance in Wheat. *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: Abstract published and oral presentation made
Acknowledgement of Federal Support: YES (oral presentation), NO (abstract)