

**USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY15 Final Performance Report
Due date: July 15, 2016**

Cover Page

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Fiscal Year:	2015
USDA-ARS Agreement ID:	59-0206-4-033
USDA-ARS Agreement Title:	Development of Scab Resistant Soft Wheats adapted to the Southeast.
FY15 USDA-ARS Award Amount:	\$ 59,969
Recipient Organization:	University of Georgia Research Foundation, Inc. Contracts & Grants 240A Riverbend Road, Box 5333 Athens, GA 30602-5333
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Project/Grant Reporting Period:	06/21/15-06/20/16
Reporting Period End Date:	06/20/16

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
VDHR-SWW	Enhancement of Scab Resistant Wheat Varieties Adapted to the Southeast.	\$ 49,844
VDHR-SWW	Developing Doubled Haploids to Expedite Variety Development in SRWW.	\$ 10,125
	FY15 Total ARS Award Amount	\$ 59,969

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: *Enhancement of Scab Resistant Wheat Varieties Adapted to the Southeast.*

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

During 4 consecutive years (2013-2016) in Georgia and Southeast, scab epidemics have resulted in significant loss revenue due to low grain production and unacceptable toxin levels (DON). Resistant varieties that are adapted to the Southeast with the level of FHB resistance from native resistance (Jamestown, Neuse, Truman/Bess) or Fhb1- derived lines are needed. Populations with broadly adaptive cultivars or their derivatives with (Fhb1) and native resistant sources are being evaluated to developed FHB resistant varieties.

Our objectives are to enhance the development of high yielding soft red winter wheat (SRWW) varieties with improved FHB resistance and end-use quality; to generate populations for marker assisted selection with QTL associated with both native and exotic FHB resistance; and to introgress two or more known FHB resistance QTL into adapted SRWW background by using marker assisted selection. This project is a collaborative effort with cooperators from University of Arkansas, Louisiana State University, North Carolina State University, Virginia Tech, and the USDA-ARS Genotyping Center, Raleigh, NC. Marker Assisted Selection accelerates the development of adapted FHB resistant cultivars by the selections within populations containing Fhb1, 2DL, 5AS, 3BSc, and 3BLMassey, Jamestown (1B, 6A), Neuse (1A, 4A), and Bess (2B and 3B) in the UGA molecular lab and in cooperation with Gina Brown-Guedira, USDA Genotyping Center. Data and DON samples from the Uniform Southern FHB nursery grown in Georgia are being submitted.

2. What was accomplished under these goals?

Four hundred and fifty-six (single, three-and four-way) crosses were made involving one or more source of native and exotic FHB resistance such as (derived lines from Jamestown , Neuse, and Truman/Bess), IL07-4415, MD08-27-E9-26, and MD07026-F2-19-3) with elite Georgia lines that have moderate FHB resistance. These populations were grown in a mist-irrigated inoculated FHB nursery. Two hundred and eighteen elite lines along with 550 preliminary lines were evaluated at two locations for FHB, yield, and disease resistance. Over 10,000 headrows were evaluated under high scab severity. Eight elite lines that were identified in the field with FHB resistance were entered in the Uniform Southern FHB nursery of which two lines had a high level of resistance from two different sources (Jamestown and IN0411) and four lines were also entered in the Uniform Southern Wheat Nursery.

Collaborative efforts between University of Georgia and cooperators from North Carolina State University, Virginia Tech and the USDA-ARS Genotyping Center, Raleigh, NC has increase among USWBI sponsored breeding programs through the phenotyping of germplasm sources as a potential lines with resistance, the exchange of resistance germplasm, and evaluation and selection of double haploid lines.

Marker Assisted Selection was employed to accelerate the development of adapted FHB resistant cultivars. Selection within FHB populations are being conducted for several FHB

QTL such as Fhb 1, 2DL, 5AS, 3BLMassey, Jamestown (1B, 6A), Neuse (1A, 4A), and Bess (2B and 3B) in the UGA molecular lab and in cooperation with Gina Brown-Guedira, USDA Genotyping Center. Over thousand lines with different combination of QTL have been identified. Recently varietal releases have been backcross (BC2, selected for Fhb1 with MAS and advanced in greenhouse for three generations to accelerated enhancement. Several diverse sources of Fhb1 (NC09-20986 (Fhb1), MD 07026-F2-13-3, and KY 97C-02-32) were used for backcross with recently released GA varieties. Numerous populations and backcross population have also been developed with combination of several QTL from Truman/Bess, Jamestown, and Neuse.

Fungicide trials were performed to determine the best management and fungicide effectiveness for scab improvement. Scab Smart was discussed at producers meeting. Fusarium head blight and DON data for entries in the State Official Variety Trial was reported along with agronomic performance data in the varietal characteristics table of the GA Small Grain Performance Trials.

Elite lines and populations from a diverse set of sources to FHB offer potential improvement for future varietal releases in the Southeast. These elite lines, preliminary lines, and populations are available to other breeders in the region. These lines will provide additional moderate FHB resistant as new varieties with high yield for Georgia's producers and potentially as parents to develop new varieties. Derived lines with FHB resistance from diverse sources are being evaluated for agronomic and FHB resistance. These derived lines will provide new varieties for producers in the region with an improved level of FHB resistance. Two elite lines, GA071171-14E64 and GA051207-14E53 were identified as having moderate FHB resistance and produced higher yield and test weight than the check AGS2035. These two lines were increased for possible release.

MAS selection has assisted in the acceleration of new FHB resistant varieties adapted to the Southeast with improved disease and insect resistance. Marker assisted selection for the one to three QTL combination of Fhb1, 2DL, 5AS, and Jamestown (1B, 6A), Neuse (1A, 4A), and Bess (2B and 3B) will enhances the potential of elite germplasm from diverse background with FHB resistance.

Producers have been presented with educational information to use the best tools to control FHB. Information has been provided on the best time for fungicide application (few days after flowering) and the best fungicide (Prosaro and Caramba) to use for the control of FHB. Producers are better informed on the importance of fungicides to control FHB has greatly increased. Use of Scab Smart has been promoted to producers to allow for the improvement in the timing of fungicide applications. Producers can made better decisions in the selection of FHB resistant varieties for planting with information provided in the GA State Varietal Performance Trial bulletin. With the use of Scab Smart and improved application of fungicides, producers will have a chance to reduce scab severity and DON levels in their wheat crop.

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

One student and two technicians were provided training in the evaluation of breeding germplasm for scab resistance in the field.

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

Presentations have been given at the Annual Forum of the Wheat and Barley Scab Initiative, Small Grain and Soybean Expo, county agent training meeting, and producers small grain meeting. FHB data has been published in the GA Small Grain Performance Trial bulletin.

Project 2: *Developing Doubled Haploids to Expedite Variety Development in SRWW.*

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

Our goal is to increase the efficiency of coordinated project breeding programs in developing and releasing FHB-resistant varieties. Doubled haploids (DH) shorten variety development time in fall-sown small grains by approximately four years. Our objective is to expand the use of this technique for the whole Southern Winter Wheat region by the coordinated development of at least five breeding populations and one mapping population through DH production followed by collaborative phenotyping across the region once the DH lines are developed and seed is increased for testing. This proposal will quickly provide inbred breeding lines having several diverse FHB resistance genes (exotic and native) to six breeding programs for testing in the Southern Winter Wheat (SWW) region and also provide useful markers for selecting the Catbird resistance that has been one of the most effective sources of FHB resistance in the SWW region. The doubled haploid facility at Kansas State University (Plant Innovations Facility) will be used to produce the approximately 200 DH lines per cross.

2. What was accomplished under these goals?

A DH population, GA13220, (MD08-26-H2-7-12-9 / GA031257-10E34), was generated by the Heartland, Plant Innovations Facility with over 200 DH plants obtained. MD08-26-H2-7-12-9 has three QTL (Fhb 1, 2DL, and 5AS). MAS were performed on DH lines and several lines were identified with major QTL. The DH lines were selected in the field based upon yield potential and MAS data. Over 400 DH lines were evaluated in the field. A DH population, GA14031, (MD08-26-H2-7 (FHB 1, 5AS, 2DL) / GA031293-10LE34//LA05102-C9-8-8 (1B Jamestown), was sent to the Heartland Plant Innovations Facility. Over 400 DH lines were generated with potential of combinations of 4 QTL (*Fhbl*, 2DL, and 5AS) and 1B (Jamestown). These DH lines will be planted in Fall of 2016. Another four DH populations are presently being developed.

Double Haploid technique has allowed for FHB resistant lines to be tested two year earlier than traditional breeding methodology. This will result in the delivery of high-impact FHB resistant varieties in a short period of time. Over 250 DH lines will be tested for FHB and yield and agronomic performance next year.

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

Nothing to Report.

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

Presentations have been given at the Annual Forum of the Wheat and Barley Scab Initiative, Small Grain and Soybean Expo, county agent training meeting, and producers small grain meeting. FHB data has been published in the GA Small Grain Performance Trial bulletin.

Training of Next Generation Scientists

Instructions: Please answer the following questions as it pertains to the FY15 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 FY15 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 FY15 award period? NO**

If yes, how many?

- 3. Have any post docs who worked for you during the FY15 award period and were supported by funding from your USWBSI grant taken faculty positions with universities? Yes**

If yes, how many? ONE

- 4. Have any post docs who worked for you during the FY15 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?

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 FY15 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
AGS 2033	SRW	MS	6	2015

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

Refer to the FY15-FPR_Instructions for listing publications/presentations about your work that resulted from all of the projects included in the FY15 grant. If you did not have any publications or presentations, state 'Nothing to Report' directly above the Journal publications section.

Journal publications.

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

Other publications, conference papers and presentations.

Mohamed Mergoum, Jerry Johnson, James Buck, Zhenbang Chen and Y. Hao. 2015. FHB Resistance and Agronomic performance in Georgia Soft Red Winter Wheat Germplasm. *In: S. Canty, Clark, S. Vukasovich and D. Van Sanford (Eds.), Proceedings of the 2015 National Fusarium Head Blight Forum.* East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative. p. 95.

Status: Published

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