

**USDA-ARS/  
U.S. Wheat and Barley Scab Initiative  
FY13 Final Performance Report  
July 15, 2014**

**Cover Page**

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| <b>Fiscal Year:</b>                | FY13   |
| <b>USDA-ARS Agreement ID:</b>      | 59-0206-9-085  |
| <b>USDA-ARS Agreement Title:</b>   | Enhancement of Scab Resistant Wheat Cultivars Adapted to the Southeast.  |
| <b>FY13 USDA-ARS Award Amount:</b> | \$ 41,577  |

**USWBSI Individual Project(s)**

| <b>USWBSI Research Category*</b> | <b>Project Title</b>   | <b>ARS Award Amount</b> |
|----------------------------------|--|-------------------------|
| VDHR-SWW                         | Enhancement of Scab Resistant Wheat Varieties Adapted to the Southeast.            | \$ 35,443               |
| VDHR-SWW                         | Developing Double Haploids to Expedite Mapping and Enhance FHB Resistance in SRWW. | \$ 6,134                |
|                                  | <b>FY13 Total ARS Award Amount</b>   | <b>\$ 41,577</b>        |

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Principal Investigator

\_\_\_\_\_  
Date

\* MGMT – FHB Management  
 FSTU – Food Safety, Toxicology, & Utilization of Mycotoxin-contaminated Grain  
 GDER – Gene Discovery & Engineering Resistance  
 PBG – Pathogen Biology & Genetics  
 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 major problem or issue is being resolved relevant to Fusarium head blight (scab) and how are you resolving it?**

Significant economic losses due to epidemics of FHB have occurred in Georgia that has resulted in lower grain yield and quality (high DON levels). The development of resistant varieties with the level of FHB resistance from native resistance (Truman/Bess) or *Fhb1*-derived lines is needed that are adapted to the Southeast. Populations with broadly adaptive cultivars or their derivatives with (*Fhb1*) and native resistant sources are being evaluated to developed FHB resistant varieties. Phenotyping, marker assisted selection (MAS), and Double Haploid (DH) are all being employed to identify and incorporate resistant germplasm that combine improved FHB resistance with leaf and stripe rust, wheat soil-borne mosaic virus and Hessian fly resistance. Marker Assisted Selection accelerates the development of adapted FHB resistant cultivars by the selections within populations containing *Fhb1*, 2DL, 5AS, 3BSc, and 2B<sub>Ernie</sub> 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 were submitted.

**2. List the most important accomplishments and their impact (i.e. how are they being used) to minimize the threat of Fusarium Head Blight or to reduce mycotoxins. Complete both sections; repeat sections for each major accomplishment:**

**Accomplishment (1):**

Breeding program: One hundred thirty-nine (single, three-and four-way) crosses were made involving one or more source of native and exotic FHB resistance (Truman/Bess, Neuse, Jamestown, GA051173W (derived from Truman), IL02-18228, IL97-1828, MO 080104, INW0411,) with elite Georgia lines that have moderate FHB resistance. These populations were grown in a mist-irrigated inoculated FHB nursery. Thirty-two elite lines were evaluated at two locations for yield and disease resistance. 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 IN981359C1) and four lines were entered in the Uniform Southern Wheat Nursery.

**Impact:**

These 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 and populations are available to other breeders in the region. These lines will provide additional moderate FHB resistant as parent with high yield and potentially as new varieties for Georgia's producers.

**Accomplishment (2):**

Collaborative efforts between cooperators from Louisiana State University, North Carolina State University, Virginia Tech and the USDA-ARS Genotyping Center, Raleigh, NC has increase cooperation among USWBI sponsored breeding programs through the by phenotyping of the mapping population as a potential source of new scab resistant QTL, the exchange of resistance germplasm, and evaluation and selection of double haploid lines.

**Impact:**

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. Development of markers of Jamestown that is adapted to the Southeast will improved the selection of a novel QTL for FHB resistant lines.

**Accomplishment (3):**

The introgression of FHB resistance with Marker Assisted Selection is being 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, or 5AS in the UGA molecular lab and in cooperation with Gina Brown-Guedira, USDA Genotyping Center. 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, Baldwin (Fhb1), NC09-20986 (Fhb1), PIO26R32 (Fhb1), and KY 97C-02-32 (Fhb1) were used for backcross with recently released GA varieties. Numerous populations and backcross population have also been developed with Truman, IL 97-8228, IL 02-18228, and Jamestown for future MAS.

**Impact:**

MAS selection will assist 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, and 5AS will enhances the potential of elite germplasm from diverse background with FHB resistance.

**Project 2:** *Developing Double Haploids to Expedite Mapping and Enhance FHB Resistance in SRWW.*

**1. What major problem or issue is being resolved relevant to Fusarium head blight (scab) and how are you resolving it?**

Doubled haploids (DH) allow quick introgression of resistance genes and can significantly shorten variety development time. Six breeding programs from the Southern Winter Wheat region collaborated through DH production of selected FHB resistant crosses and one mapping population. Single Nucleotide Polymorphism (SNP) genotyping will be conducted at the USDA-ARS North Dakota genotyping lab using an Illumina Infinium SNP assay. Seed of each DH line will be increased and distributed to cooperators. This project was developed through the cooperation of the six breeding programs in the Southern region and will be a source of outstanding breeding SRWW lines selected for FHB resistance that will be available and freely shared with other wheat breeders and has great potential to deliver high-impact FHB resistant varieties in a short period of time.

**2. List the most important accomplishments and their impact (i.e. how are they being used) to minimize the threat of Fusarium Head Blight or to reduce mycotoxins. Complete both sections; repeat sections for each major accomplishment:**

**Accomplishment:**

A DH population, (PIO25R32 (Fhb1)/GA001138-8E36//VA09W-73), was generated by the Heartland, Plant Innovations Facility. This population was increased and seed was distributed to cooperators. Another DH population is presently being developed by Heartland Innovations Facility.

**Impact:**

Double Haploid technique has great potential to deliver high-impact FHB resistant varieties in a short period of time.

**Include below a list of all germplasm or cultivars released with full or partial support of the USWBSI during the FY13 award period. List the release notice or publication. Briefly describe the level of FHB resistance.**

GA 031134-10E29 was developed and released that is moderately resistant to scab. Two elite lines were identified as having moderate FHB resistance from Jamestown that produced higher yield and test weight than the check AGS2035. These two lines will be increased for possible release.

**Include below a list of the publications, presentations, peer-reviewed articles, and non-peer reviewed articles written about your work that resulted from all of the projects included in the FY13 grant. Please reference each item using an accepted journal format. If you need more space, continue the list on the next page.**

Jerry Johnson, Zhenbang Chen and James Buck. 2013. FHB Resistance and Agronomic Performance in Soft Red Winter Wheat. Proceeding of the 2013 National Fusarium Head Blight Forum, Milwaukee, WI.

E. Wright, C. Griffey, S. Malla, D. Van Sanford, S. Harrison, J.P. Murphy, J. Costa, G. Milus, J. Johnson, A. McKendry, D. Schmale III, A. Clark and N. McMaster. 2014. Characterization of FHB Resistance in SRW Roane and Jamestown NAM Populations. Proceeding of the 2013 National Fusarium Head Blight Forum, Milwaukee, WI.