USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY12 Final Performance Report
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Cover Page

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Fiscal Year:	FY12
USDA-ARS Agreement ID:	59-0206-9-085
USDA-ARS Agreement Title:	Enhancement of Scab Resistant Wheat Cultivars Adapted to the Southeast.
FY12 USDA-ARS Award Amount:	$ 41,618

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
VDHR-SWW	Enhancement of Scab Resistant Wheat Varieties Adapted to the Southeast.	$ 35,477
VDHR-SWW	Developing Double Haploids to Expedite Mapping and Enhance FHB Resistance in SRWW.	$ 6,141
	Total ARS Award Amount	**$ 41,618**

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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 $2B_{Ernie}$ 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 accomplishment and its impact (i.e. how is it 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 (single, three-and four-way) crosses were made involving one or more source of native and exotic FHB resistance (Truman/Bess, Neuse, Jamestown, IL02-18228, IL97-1828, MO 080104) with elite Georgia lines that have moderate FHB resistance. These populations were grown in a mist-irrigated inoculated FHB nursery. Thirty-three 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 (Truman and IN981359C1) and four lines were entered in the Uniform Southern Wheat Nursery.

   Impact:
   These populations and elite lines from a diverse set of sources to FHB offer potential improvement for future varietal releases in the Southeast. These populations and elite lines 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):
   Increase cooperation among USWBI sponsored breeding programs has been improved through the collaborative efforts between cooperators from Louisiana State University, North Carolina State University, Virginia Tech and the USDA-ARS Genotyping Center,

Raleigh, NC by phenotyping of the Jamestown mapping population as a potential source of new scab resistant QTL; developed a validation population F2:6 lines of Jamestown; and the exchange of resistance germplasm, and evaluation and selection of double haploid lines.

Impact:
Derived lines with Jamestown as source of FHB resistance 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):
Using 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. Four recently varietal releases have been backcross (BC2, selected for Fhb1 with MAS and advanced in greenhouse for two generations to accelerated enhancement. Several diverse sources of Fhb1, Baldwin (Fhb1), NC09-20986 (Fhb1), PIO26R32 (Fhb1), and KY 97C-0232 (Fhb1) were used for backcross with recently released GA varieties. Numerous populations and backcross population have also been developed with Truman, IL 97-8228, 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 *Fhb1*, 2DL, and 5AS QTL will enhances the potential of elite germplasm from diverse background with FHB resistance.

Accomplishment (4):
Selection of double-haploid lines from FHB crosses in collaboration with Paul Murphy, NCST, twenty-six double haploid lines were evaluated at two locations in yield trials and another roughly 200 DH lines were evaluated in misted scab nursery.

Impact:
Several DH lines were identified, such as NC 8170, with a high level of FHB resistance and high yield potential. DH accelerates the development and release of potential new varieties.

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?**

   One of the main objectives of the VDHR research area is to increase the efficiency of coordinated project breeding programs at developing and releasing FHB-resistant varieties. 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 accomplishment and its impact (i.e. how is it 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 has been generated by the Heartland, Plant Innovations Facility. This population has been increased and seed will be distributed. 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. List the release notice or publication. Briefly describe the level of FHB resistance.

AGS 2038 was developed and released that is moderately resistant to scab. The elite line, GA051173W-S11, was identified as having moderate FHB resistance from Truman and produced higher yield and test weight than the check AGS2035 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 grant. Please reference each item using an accepted journal format. If you need more space, continue the list on the next page.

J. Johnson, Y.F. Hao and Z.B. Chen. 2012. Evaluation of FHB resistance and agronomic performance in Soft Red Winter Wheat Across Populations. Proceeding of the 2012 National Fusarium Head Blight Forum, Orlanda, Florida.

Mapping of FHB Resistance in SRW Wheat Cultivar Jamestown. 2012. 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. Proceeding of the 2012 National Fusarium Head Blight Forum, Orlanda, Florida.