

**USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY12 Final Performance Report
July 16, 2013**

Cover Page

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Fiscal Year:	FY12
USDA-ARS Agreement ID:	59-0206-9-079
USDA-ARS Agreement Title:	Development of FHB Resistant Wheat Genotypes Adapted to the Gulf Coast.
FY12 USDA-ARS Award Amount:	\$ 42,690

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
VDHR-SWW	Development of FHB Resistant Wheat Genotypes Adapted to the Gulf Coast.	\$ 36,549
VDHR-SWW	Developing Double Haploids to Expedite Mapping and Enhance FHB Resistance in SRWW.	\$ 6,141
	Total ARS Award Amount	\$ 42,690



July 15, 2013

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

HW-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 FHB Resistant Wheat Genotypes Adapted to the Gulf Coast.*

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

This project addresses the need for Fusarium Head Blight (FHB) resistant varieties adapted to the Gulf Coast. Wheat from this region goes into large Mississippi River elevators and toxin-contaminated wheat will enter the export channels. FHB can cause significant loss of yield and quality in the region. The unique climate and disease spectrum of the region limits the number of adapted varieties. The LSU AgCenter and Sungrains partners (Universities of Arkansas, Florida, Georgia, NC State, and Texas A&M) release high-yielding disease-resistant varieties that account for much of the wheat acreage in the Gulf Coast and Southeastern states. It is important that these programs develop and release highly productive, scab resistant varieties that are embraced and produced by growers. Scab reaction of commercial varieties should be included in variety trial reports so growers can choose the most resistant ones for production.

Objectives will be accomplished by: (1) participating in regional screening nurseries, (2) evaluating breeding lines, entries in statewide variety trials and uniform nurseries for FHB resistance in scab nurseries, (3) incorporating known resistance genes into adapted germplasm through crossing and marker-assisted selection to develop elite varieties with local adaptation and (4) participating in cooperative mapping studies to develop new markers.

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):

Twenty-four advanced LSU breeding lines that were part of the Jamestown mapping project and four check varieties (including Jamestown) were evaluated in replicated yields trials and misted nurseries in Louisiana and Arkansas. The 24 lines were chosen based on agronomic performance in Louisiana and FHB reaction across the region in the mapping project. Several of these lines out-yielded the checks and have good agronomic performance along with resistance to stripe rust, leaf rust, and other prevalent diseases. Pure seed was produced and these lines will be increased and entered into regional trials for possible release.

Impact (1):

Development of high-yielding, FHB resistant varieties adapted to the Gulf Coast is essential to convince growers to safeguard wheat exports by producing FHB resistant wheat. LSU wheat varieties are widely grown in the region and these are the first LSU advanced breeding lines with a significant level of FHB resistance and variety release potential.

Accomplishment (2):

The LSUAC program participated in collaborative phenotyping of the Jamestown mapping population for marker development. The Jamestown mapping population was completed and yielded several publications and molecular markers.

Impact (2):

The Jamestown/LA97113 (LA05145) population resulted in four consistent markers. Jamestown has been widely used as a parent so these markers should enable pyramiding of multiple sources of FHB resistance and development of highly resistant varieties.

Accomplishment (3):

Breeding lines in the Gulf-Atlantic Wheat Nursery, Uniform Southern Fusarium Headblight Nursery, FHB Observation Prelims, Wheat Variety Trials, and several preliminary yield trials were evaluated in misted, inoculated FHB screening nurseries in Baton Rouge (south) and Winnsboro (north) Louisiana.

Impact (3):

Screening varieties and germplasm in dedicated scab nurseries permits evaluation of the reaction of locally-adapted material to Fusarium Headblight (FHB). Ratings from these trials along with marker data are used in crossing decisions to combine different resistance genes and permits breeders to make informed decisions on advancement of breeding lines. The variety trial and regional nursery data is published on the LSU AgCenter variety trial web site where it is used by growers and consultants when choosing varieties for commercial production.

Accomplishment (4):

Many of the 250 new crosses added in 2013 contained a FHB resistant parent, which included: GK10.2, LA05102C-8-8, ARGE97-1042-4-5-2 (Catbird), VA08W-176, MD08-26-H2-7-12-21, Jamestown, and IL02-18228 sources of Fhb1, Fhb5As, and native resistance. Five of seven LA lines in the 2013 USFHBN, have lower than average FHB incidence based on data from VA and NC, and include 2 of the 5 most resistant lines in the nursery. Several lines in the 2013 USFHBN will be evaluated in yield trials and used as parents. A number of breeding lines in the 186 entry FHB Obs yield trial out-yielded all of the checks, showed good FHB resistance, and will be advanced to replicated yield trials this fall. Marker-assisted selection was used for parental selection for FHB, stem rust, and stripe rust resistance. A field-based male-sterile based recurrent selection program for FHB resistance was expanded with addition of new FHB lines as pollen parents.

Impact (4):

These populations contain a diversity of resistance to FHB and other important diseases of the Gulf Coast. They will produce elite advanced lines with FHB resistance that can be released as varieties and used as parents in breeding programs across the region.

The Catbird source of resistance, incorporated into soft wheat by Gene Milus, has produced several highly resistant lines in the Uniform Southern Scab Nursery but the nature of this resistance has not been characterized. This population will allow mapping and effective utilization of the Catbird resistance source.

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?

This project addresses the need for Fusarium Head Blight (FHB) resistant varieties adapted to the Gulf Coast. The development of new varieties of FHB resistant winter wheat is substantially hindered by the necessity to grow five or six segregating generations in order to obtain pure lines for testing. Unlike spring wheat, winter varieties are not suited for production of several generations per year in a greenhouse so it normally takes about six years from initial cross to the yield testing phase. A rapid system of pure line development is greatly needed for winter wheat.

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:

The LSU program coordinated and grew a summer F1 nursery in Idaho for rapid generation advancement of FHB crosses for the southern VDHR group including: LSUAC, NC State Univ, Univ. of Georgia, Univ. of Arkansas, VA Tech, Univ. of Maryland, and Univ. Kentucky. We also received 225 Catbird derived DH lines back from the Heartland Institute that will be very useful to develop markers for that source of resistance and for development of FHB resistant varieties.

Impact:

The summer nursery saves a year in the variety development programs of the collaborating universities and makes the programs more efficient. The Catbird DH marker project should lead to useful molecular markers and may directly lead to release of a FHB resistant variety since the background is adapted and high-yielding.

FY12 (approx. May 12 – May 13)
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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.

NONE

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.

Mapping of FHB Resistance in SRW Wheat Cultivar Jamestown. E. Wright¹, C. Griffey*, S. Malla, D. Van Sanford, S. Harrison, J.P. Murphy, J. Costa, G. Milus, J. Johnson, A. McKendry⁸, D. Schmale III, A. Clark and N. McMaster. 2012. P 108. Proceeding of the 2012 National Fusarium Headblight Forum.