

**USDA-ARS/  
U.S. Wheat and Barley Scab Initiative  
FY14 Final Performance Report  
July 15, 2015**

**Cover Page**

<b>PI:</b>	Steve Harrison
<b>Institution:</b>	Louisiana State University Agricultural Center
<b>Address:</b>	School of Plant, Environmental, & Soils Sciences 104 MB Sturgis Hall Baton Rouge, LA 70803-2110
<b>E-mail:</b>	sharrison@agctr.lsu.edu
<b>Phone:</b>	225-578-2110
<b>Fax:</b>	225-578-1403
<b>Fiscal Year:</b>	FY14
<b>USDA-ARS Agreement ID:</b>	59-0206-4-027
<b>USDA-ARS Agreement Title:</b>	Development of FHB Resistant Wheat Genotypes Adapted to the Gulf Coast and use of DHs to Expedite.
<b>FY14 USDA-ARS Award Amount:</b>	\$ 48,193

**USWBSI Individual Project(s)**

<b>USWBSI Research Category*</b>	<b>Project Title</b>	<b>ARS Award Amount</b>
VDHR-SWW	Development of FHB Resistant Wheat Genotypes Adapted to the Gulf Coast.	\$ 42,064
VDHR-SWW	Developing Doubled Haploids to Expedite Variety Development in SRWW.	\$ 6,129
	<b>FY14 Total ARS Award Amount</b>	<b>\$ 48,193</b>

\_\_\_\_\_  
Principal Investigator

\_\_\_\_\_  
Date

\* MGMT – FHB Management  
 FSTU – Food Safety, Toxicology, & Utilization of Mycotoxin-contaminated Grain  
 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  
 WES-CP – Western 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?**

There are very few wheat varieties with a significant level of resistance to Fusarium Head Blight (FHB) that are adapted to the Gulf Coast. Persistent rainfall during anthesis in the spring of 2015 resulted in a severe FHB epidemic across the region with very high losses in yield, test weight, and quality. Many grower fields were completely abandoned.

Wheat from this region goes into large Mississippi River elevators and toxin-contaminated wheat will enter the export channels. The unique climate and disease spectrum of the region limits the number of adapted varieties and prevents production of most FHB resistant varieties not developed in the region. 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 misted, inoculated 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 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):** LA06146E-P4 was evaluated in the Gulf-Atlantic Wheat Nursery (GAWN) across seven locations and in USSN. LA06146 had a mean FHB of only 16% across four (currently reported) locations, less than the test mean and less than 1/3<sup>rd</sup> of the susceptible check (Coker 9835 = 51%). It had the third-lowest FHB Index in Louisiana of the 15 early-heading lines (strong confounding of FHB with maturity prevents comparison across all lines). In the GAWN LA06146 had above average yield with excellent test weight and resistance to all diseases and insects. A large seed increase of LA06146 was produced by Georgia Seed Development Commission and it is scheduled for release in 2015. This line has 'Jamestown' FHB resistance and perhaps additional resistance from AGS2060.

**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):** Breeding lines in the SunWheat, Gulf-Atlantic Wheat Nursery, Uniform Southern Fusarium Headblight Nursery, Uniform Southern Soft Red Winter Wheat, FHB Observation Prelims, Wheat Variety Trials, and several LSU prelims were evaluated in misted, inoculated FHB screening nurseries in Baton Rouge, Crowley (south), and Winnsboro (north) Louisiana.

**Impact (2):** 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 (3):** About 65% of the 323 new crosses made in the spring of 2015 contained a known/targeted FHB resistant parents. These included: Bagette 11, LA05102C-8-8 (Catbird), LA6146E-P04 (Jamestown), NC09-20986 (Fhb1), MD08-26-H2-7-12-21 (Fhb1, 2DL, 5AS), NC11-22289 (FHB-CK9511), KS14WGRC61 (Fhb6), LANC8170-41-2 (Fhb5AE), TA5608-2 & 3 (Fhb3), uncharacterized native resistance, and numerous F1s used for topcrosses. Wheat prelim-F with ~300 entries was screened in FHB nurseries and in yield plots at Baton Rouge. It was also genotyped. 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 (3):** These populations and breeding lines contain a diversity of resistance sources for FHB and other important diseases of the Gulf Coast. Many of the FHB resistance sources also have excellent yield potential and agronomic characteristics. 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. It is likely that FHB will continue to be a major problem for Louisiana producers and therefore resistance must remain a significant focal point of the long-term breeding effort.

**Project 2:** *Developing Doubled Haploids to Expedite Variety Development 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 slow because it takes about five generations to develop pure lines for yield testing and only one generation can be grown per year. Unlike spring wheat, winter varieties are not suited for production of several generations per year in a greenhouse or off-season nursery 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, which includes off-season nurseries and use of doubled haploids.

**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:** The LSU program coordinated and grew a Sungrains 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, Univ. of Florida, and Texas A&M Univ. The nursery includes F1 of many FHB crosses and a FHB mapping population that is being increased for regional testing. Several additional crosses were submitted to the Heartland Institute for DH development so permit rapid development of FHB resistant varieties with new combinations of genes. A number of Dh lines with Fhb1 and other resistance genes were evaluated in headrows and observation plots and advanced to replicated yield trials.

**Impact:** The summer nursery saves a year in the variety development programs of the collaborating universities and makes the programs more efficient. Doubled Haploids, while expensive, provide a means to quickly incorporate FHB QTL into adapted germplasm to develop resistant varieties.

### **Training of Next Generation Scientists**

**Instructions:** Please answer the following questions as it pertains to the FY14 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 FY14 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 FY14 award period? NO**

**If yes, how many?**

- 3. Have any post docs who worked for you during the FY14 award period and were supported by funding from your USWBSI grant taken faculty positions with universities? None**

**If yes, how many?**

- 4. Have any post docs who worked for you during the FY14 award period and were supported by funding from your USWBSI grant gone on to take positions with private ag-related companies or federal agencies? None**

**If yes, how many?**

FY14 (approx. May 14 – May 15)  
PI: Harrison, Steve  
USDA-ARS Agreement #: 59-0206-4-027

FY14 Final Performance Report

**Include below a list of all germplasm or cultivars released with full or partial support of the USWBSI during the FY14 award period. List the release notice or publication. Briefly describe the level of FHB resistance. *If not applicable because your grant did NOT include any VDHR-related projects, enter N/A below.***

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 FY14 grant. Please reference each item using an accepted journal format. If you need more space, continue the list on the next page.**

Wright, E., C. Griffey, S. Malla, D. Van Sanford, S. Harrison, J.P. Murphy, J. Costa, E. Milus, J. Johnson, A. McKendry, D. Schmale III, A. Clark, N. McMaster, S. Chao and G. Brown-Guedira. 2014. "Identification of New QTL for Native Resistance to FHB in SRW Wheat." In: S. Canty, A. Clark, N. Turcott and D. Van Sanford (Eds.), *Proceedings of the 2014 National Fusarium Head Blight Forum*. East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative. p. 101.