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:	59-0206-4-027
USDA-ARS Agreement Title:	Development of FHB Resistant Wheat Genotypes Adapted to the Gulf Coast and use of DHs to Expedite.
FY15 USDA-ARS Award Amount:	$ 61,271
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Project/Grant Reporting Period:	06/01/15-05/31/16
Reporting Period End Date:	05/31/16

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.	$ 51,146
VDHR-SWW	Developing Doubled Haploids to Expedite Variety Development in SRWW.	$ 10,125
	FY15 Total ARS Award Amount	**$ 61,271**

Stephen A Harrison 7-15-2016

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: *Development of FHB Resistant Wheat Genotypes Adapted to the Gulf Coast.*

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

Fusarium Head Blight (FHB) has been a major limiting factor of wheat production in Louisiana and adjacent Gulf Coast states for the past two years and there are few locally adapted varieties with significant resistance to FHB. Persistent rainfall during anthesis in the spring of 2015 and again in 2016 resulted in a severe FHB epidemic across the region with very high losses in yield, test weight, and quality.

The goal of the LSU program is to diminish economic damage caused by FHB in the region and to export markets. Objectives of the program are: 1) to develop and release FHB and other disease and abiotic stress resistant, high-yielding wheat varieties adapted to the Gulf Coast region that contribute to reduced grower loss and lower DON in export grain; 2) to increase efficiency of coordinated breeding programs through development of marker populations, collaborative phenotyping of populations for marker development, introgression of useful genes, and development of GWAS strategies and 3) to evaluate varieties and advanced breeding lines in the USSN, statewide variety trials, and other regional nurseries to determine FHB reaction and provide that information to growers and breeders.

2. What was accomplished under these goals?

1) major activities

The LSU program focused on development of FHB resistant varieties and open collaboration with other programs in the region, including coordination of the Sungrains regional breeding collaborative. There were 254 crosses made by the program in the spring of 2016, 66% of which included at least one parent with characterized and targeted FHB resistance. The number of crosses made was somewhat low due to unfavorable conditions for crossing in the greenhouse and loss of crossing plots and F1s in the field due to December flooding. These crosses combined various combinations of Fhb1, Fhb3 (TA5608), M3BL, 2DL, Fhb5A, and Fhb genes from LA06146, Coker 9511 (NC11-22289) and other sources. A cross of particular interest for MAS pyramiding combines LA06146 (Jamestown Fhb) with NC11-22289 (Coker 9511 Fhb) and FHB1, M3BL, 2D from ARGE07-1347-6-7-9.

A preliminary yield trial consisting of 87 entries with FHB resistant parentage was grown in two locations and also evaluated in misted nurseries and 17 lines were advanced. A second preliminary yield trial (WPH) comprised of DH lines was also evaluated at Baton Rouge and Winnsboro as well as in misted FHB nurseries. Several Fhb1 lines performed well and were advanced from WPH. Misted nurseries were established at three locations.

2) specific objectives

LA06146 was released and licensed as AGS 3000 in August of 2015. Seed of AGS 3000 was increased during the winter and will be commercially available starting in fall of 2016. It has resistance genes from Jamestown (and probably AGS2060) and had an FHB Index that was only 34% of the susceptible check in the 2015 uniform scab nursery. AGS 3000 had excellent yield, test weight, quality, and resistance to other diseases and Hessian Fly across the region. It is the first LSU variety with significant FHB resistance and fulfills objective 1.

Breeding lines in the SunWheat, Gulf-Atlantic Wheat Nursery, Uniform Southern Fusarium Headblight Nursery, Uniform Southern Soft Red Winter Wheat, Wheat Variety Trials, and LSU prelims were evaluated in misted, inoculated FHB screening nurseries in Baton Rouge, Crowley (south), and Winnsboro (north) Louisiana, thus fulfilling objective 3.

FHB resistant lines identified through the collaborative screening nurseries and LSU nurseries were incorporated into the crossing program to develop populations for the breeding program and for use in development of DH lines. DH lines with FHB resistance were shared with other breeding programs across the VDHR group, meeting objective 2. MAS was used to identify 3-way F1s that contained FHB gene pyramids.

3) significant results

The release of LA06146 is a significant milestone as the first FHB resistant variety released by LSU and one of only a few varieties adapted to the region that have a significant level of FHB resistance.

Useful data on FHB, leaf rust, stripe rust, stem rust and general phenotype was collected from the Crowley and Winnsboro misted nurseries. Samples were collected at harvest for FDK determination. A major setback to the program was the loss of approximately 20,000 wheat headrows and other Fhb germplasm due to Mississippi River flooding.

4) key outcomes or other achievements

LA06146 will be available to growers starting in the fall of 2016 and should help reduce economic loss and DON levels in wheat exports. The breeding program has numerous lines with FHB QTL in advanced stages of testing and evaluates varieties in statewide performance trials for FHB resistance.

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

Four graduate students were involved in setting up mist systems, inoculating nurseries, and rating field symptoms for FHB. They also rated FDK in the lab. This provided them with experience and some degree of proficiency in screening for scab resistance in wheat lines.

Ag Consultants and extension agents were trained in the identification and control of FHB as part of talks preceding the annual Wheat Field Day. They were exposed to Scab Smart and given presentations on fungicide efficacy and application methods. The use of varietal resistance and status of currently available varieties was also presented.

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

The LSU wheat breeding programs maintains two websites for dissemination of data generated as part of this project. The first website (http://wheat.lsu.edu/index.shtml), the 'LSU Wheat Breeding Data Site' is used as a repository for trial data tables and variety trial information to facilitate timely release of that information to growers, consultants, seedsmen, and extension agents. The second website (shttp://sungrains.lsu.edu/index.shtml) serves the Sungrains breeding group as a public and breeder-only repository of data from Sungrains breeding programs. Completed variety trial reports are posted on the LSU AgCenter variety trial website. Data on FHB severity, FDK, and DON for the regional nurseries are published in the official reports for those nurseries.

Growers, agricultural consultants, extension agents and seedsmen were presented with the latest information on variety reaction to FHB as well as Scab Smart and fungicide efficacy data at the annual wheat field day. The official variety trial report contained information on FHB field symptoms and FDK from statewide trials.

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

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

The goal of the collaborative FHB project is accelerate the development of FHB resistant varieties containing complementary FHB resistance genes in the region through utilization of MAS for population enrichment of three-way F1s followed by development of doubled haploids from selected F1 plants. The use of doubled haploids in winter wheat decreases variety development time by approximately four years which brings resistant varieties to the grower sooner. Use of DH's also effectively turns the region into a large recurrent selection program that rapidly recombines superior FHB resistant germplasm across programs. The objective is to utilize DH's to rapidly develop and release FHB resistant wheat varieties for the region.

2. What was accomplished under these goals?

1) major activities

Crosses were made that target specific combinations of FHB resistance genes moved into in an adapted background. DH populations were developed through the Heartland Institute and other channels not funded through this initiative.

2) specific objectives

A separate preliminary yield trial was established to evaluate FHB resistance and yield potential of lines coming through the DH program. Entries in this yield trial were also evaluated in inoculated, misted nurseries at two locations.

3) significant results

Two sets of F1's were sent to Heartland in August of 2015 for doubling with funding from the UWBSI. One of these combined Fhb1 with the Jamestown resistance in LA06146E-P4 (AGS3000). The second combined the FHB resistance of Coker 9511 (NC11-22289) with high yield and disease resistance of GA041052-11E51. DH seed of these should be planted this winter for evaluation. Four other FHB crosses were doubled using other funding and numerous DHs were evaluated in yield trials in 2015-16.

4) key outcomes or other achievements

The use of DH's in the FHB breeding program has resulted in significantly more advanced yield trials lines coming through the FHB program. It is significant that these lines combine recently characterized FHB QTL due to the shortened period between crossing and initial yield trial. The coupling of MAS to enrich F1s used to develop DH lines has increased the proportion of DH lines containing key FHB QTL.

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

Four graduate students received exposure to the concepts and practice of population enrichment using Marker Assisted Selection and doubled haploids.

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

Not Applicable – see project 1

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?**

   Yes

   If yes, how many? One

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?**
   No

   If yes, how many?
   No

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 3000 (LA06146)	SRW	MR	3	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

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.

Nothing to Report

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

Nothing to Report

Other publications, conference papers and presentations.

Harrison, et.al. 2015 SMALL GRAIN PERFORMANCE TRIALS. LAES Research Summary No. 206. August 2015. http://www.lsuagcenter.com/~/media/files/2015-mimeo.pdf.
Status: Published
Acknowledgement of Federal Support: Not applicable for this publication