

**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:	59-0206-0-059
USDA-ARS Agreement Title:	Development of Wheat with Resistance to Scab Adapted to the Mid-Atlantic.
FY12 USDA-ARS Award Amount:	\$ 60,448*

USWBSI Individual Project(s)

USWBSI Research Category**	Project Title	ARS Award Amount
VDHR-SWW	Development of Wheat with Resistance to Scab Adapted to the Mid-Atlantic.	\$ 54,308
VDHR-SWW	Developing Double Haploids to Expedite Mapping and Enhance FHB Resistance in SRWW.	\$ 6,140
	Total ARS Award Amount	\$ 60,448

Principal Investigator

Date

* Partial funding for this research is under ARS agreement #

** 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: *Development of Wheat with Resistance to Scab Adapted to the Mid-Atlantic.*

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

The major problem being addressed is the need to develop rapidly and effectively host resistance to scab (Fusarium Head Blight) from US native and exotic sources into adapted soft red winter wheat (SRWW) germplasm.

Crosses were made in the greenhouse with US native and exotic resistance sources in 2012. Several advanced MD lines with 3BS, 5A and 2DL resistance QTL were selected in 2012 for further testing. Additionally, screening of other MD (University of Maryland) wheat advanced lines was conducted under field conditions in an inoculated nursery at Salisbury (MD) in 2012. Conditions favorable for disease development were aided with daily misting before and during wheat flowering. The scab inoculum was scabby corn grain spread in the field a month before flowering. Additionally, the Southern wheat scab and Northern Uniform Scab Screening nurseries that include new experimental lines were also screened for resistance at Salisbury (MD) with artificial inoculation and misting. The Mason Dixon and Uniform Southern Soft Red Winter Wheat nurseries were also tested. Data for all nurseries was obtained for scab incidence, scab severity, Fusarium damaged kernels, seed weight, plant height, heading date, and DON levels.

Additionally, the complete set of entries in the MD wheat state test were screened for resistance at Salisbury (MD) with artificial inoculation and misting. Data for the wheat state test was obtained for scab incidence, scab severity, Fusarium damaged kernels, seed weight, plant height, heading date, and DON levels. Results were published online at the UMDcrops website (<http://mdcrops.umd.edu>) and are widely available to wheat growers.

A collaborative project with VA Tech and NC State University is being conducted to map US native resistance to scab in the soft winter wheat genotype MD01W233-06-1. Doubled haploids of the cross MD01W233-06-1/SS8641 were tested under field conditions in North Carolina and Virginia, Salisbury (MD) and in the greenhouse in College Park (MD). A genetic map of the doubled haploid population was made with simple sequence repeat markers with data produced by the USDA National Genotyping Center in Raleigh, NC. A 9K SNP map of this population was developed in collaboration with Dr. Gina Brown Guedira at the USDA Genotyping centers in Raleigh (NC) and Shiaoman Chao (ND). Initial mapping indicates that there is major QTL for scab resistance on the short arm of the 2D chromosome.

Additionally, to map US native resistance in Roane and Jamestown derived lines, we continued our collaboration with Dr. Carl Griffey at VA Tech on an association wheat mapping project by evaluating 294 lines under misting and inoculation in Salisbury, MD. These were evaluated for incidence, severity, Fusarium damaged kernels, seed weight, plant height, heading date, and DON levels. We also collaborated with Dr. Paul Murphy (NC State University) in the Neuse/AGS 2000 population: 400 plots of this population were evaluated under misting and inoculation in Salisbury, MD.

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): Incorporation of the 3BS, 5A and 2DL quantitative trait loci (QTL) of resistance to scab from Sumai3 into adapted soft red winter wheat germplasm such as McCormick and SS8641 by marker-assisted backcrossing. Several advanced lines are being tested in the Mason Dixon yield test and the Southern and Northern Uniform FHB nurseries.

Impact: the availability of these soft red winter wheat lines with scab resistance will reduce scab damage in years favorable to scab development and are being used by other breeding programs to enhance scab resistance in adapted material.

Accomplishment (2): Evaluation of the complete set of genotypes in the MD wheat state test for Fusarium head blight resistance at Salisbury (MD) under misting/inoculation and scab resistance data published online.

Impact: the availability of this information regarding the resistance of currently grown wheat varieties will allow farmers to select varieties based on scab resistance.

Accomplishment (3): Evaluation of wheat genotypes in the Mason Dixon wheat state test, Uniform Southern Soft Red Winter Wheat nursery for Fusarium head blight resistance at Salisbury (MD) under misting/inoculation and scab resistance: data distributed to other breeders.

Impact: the availability of this information regarding the resistance of advanced wheat lines in the Mason Dixon wheat state test, Uniform Southern and Northern Soft Red Winter Wheat will allow breeders to have this information on lines not specifically bred for scab resistance.

Accomplishment (4): Evaluation of wheat genotypes in the Southern and Northern Winter Wheat Scab nursery for Fusarium head blight resistance at Salisbury (MD) under misting/inoculation and scab resistance: data distributed to other breeders.

Impact: the availability of this information regarding the resistance of advanced wheat lines in the Mason Southern and Northern Winter Wheat Scab nursery will allow breeders to have this information on lines specifically bred for scab 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?

Increase the efficiency of wheat breeding for developing and releasing FHB-resistant varieties by using doubled haploids to allow quick introgression of resistance genes and significantly shorten variety development 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 doubled haploid population of the cross between 2 wheat lines with different sources of scab resistance was developed and the seed is being increased for distribution to the other five breeding programs in the region (AR, GA, LA, NC, VA,). They will receive seed for fall 2013 planting.

Impact:

The availability of doubled haploid lines with a combination of different sources of resistance adapted to the US Southern region will allow breeders to quickly identify adapted lines specifically bred for scab resistance.

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 in 2012.

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.

Conway, B., Murphy, J.P., Brown Guedira, G., Dong, Y., Chao, S., Griffey, C., and J. Costa. 2012. Mapping Resistance to Fusarium Head Blight in a Doubled Haploid Wheat Population from the Cross MD01W233W-06-1/SS8641. Proceedings of the National Fusarium Head Blight Forum; 2012 Dec 4-6. Orlando, FL. Lexington, KY: University of Kentucky. p. 56.

Maloney, P.V., Petersen, S., Navarro, R.A., Marshall, D., McKendry, A., Costa, J.M., and J.P. Murphy. 2012. Comparison of Visual and Digital Image Analysis Methods for Estimation of Fusarium Damaged Kernels in Wheat. Proceedings of the National Fusarium Head Blight Forum; 2012 Dec 4-6. Orlando, FL. Lexington, KY: University of Kentucky. p.66.

Miller, D., Brown Guedira, G., and J. Costa. 2012. Field Evaluation of Exotic Fusarium Head Blight Resistance QTL in Soft Red Winter Wheat. Proceedings of the National Fusarium Head Blight Forum; 2012 Dec 4-6. Orlando, FL. Lexington, KY: University of Kentucky. p.80.

Petersen, S., Maloney, P.V., Navarro, R.A., Lyerly, J.H., Cowger, C., Brown-Guedira, G., Marshall, D., Costa, J.M., Griffey, C., and J.P. Murphy. 2012. QTL Associated with Fusarium Head Blight Resistance in the NC-Neuse x AGS 2000 Recombinant Inbred Population. Proceedings of the National Fusarium Head Blight Forum; 2012 Dec 4-6. Orlando, FL. Lexington, KY: University of Kentucky. p. 93.

Wright, E., Griffey, C., Malla, S., Van Sanford, D., Harrison, S., Murphy, J.P., Costa, J., Milus, G., Johnson, J., McKendry, A., Schmale, D., Clark, A., and N. McMaster. 2012. QTL Mapping of FHB Resistance in SRW Wheat Cultivar Jamestown. Proceedings of the National Fusarium Head Blight Forum; 2012 Dec 4-6. Orlando, FL. Lexington, KY: University of Kentucky. p.108.

Zhou, E., Griffey, C., Malla, S., Van Sanford, D., Harrison, S., Murphy, J.P., Costa, J., Milus, G., Johnson, J., McKendry, A., Schmale, D., Clark, A., and N. McMaster. 2012. QTL Mapping in a Doubled Haploid Population of Wheat to Explore the Relationship between Plant Morphological Traits and Fusarium Head Blight Resistance . Proceedings of the National Fusarium Head Blight Forum; 2012 Dec 4-6. Orlando, FL. Lexington, KY: University of Kentucky. p.109.