

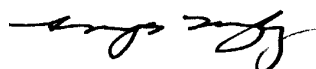
**USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY13 Final Performance Report
July 15, 2014**

Cover Page

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Fiscal Year:	FY13
USDA-ARS Agreement ID:	59-0206-0-059
USDA-ARS Agreement Title:	Development of Wheat with Resistance to Scab Adapted to the Mid-Atlantic.
FY13 USDA-ARS Award Amount:	\$ 60,389

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.	\$ 54,255
VDHR-SWW	Developing Double Haploids to Expedite Mapping and Enhance FHB Resistance in SRWW.	\$ 6,134
	FY13 Total ARS Award Amount	\$ 60,389



Principal Investigator

6/11/14

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: *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.

Several advanced MD lines with 3BS, 5A and 2DL resistance QTL were selected in 2013 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 2013. 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 Uniform 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, plant height, and heading date. Fusarium damaged kernels was only obtained for the Southern Uniform test. The level of Fusarium damaged kernels was very high and the genetic differences were minimal, so these data was not collected for the other studies.

Additionally, the complete set of entries in the MD wheat state test were screened for resistance at Upper Marlboro (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 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 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). Four FHB resistance quantitative trait loci (QTL) were mapped to chromosomes 3B (3 QTL) and 1A (1 QTL). Several QTL of SRWW have already been mapped in these chromosomal regions.

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 94 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 in 2013.

- 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: 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: Evaluation of the complete set of genotypes in the MD wheat state test for Fusarium head blight resistance at Upper Marlboro (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: 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: 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 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:

A doubled haploid population of the cross between 2 wheat lines with different sources of scab resistance was developed and the seed was increased for distribution to the other five breeding programs in the region (AR, GA, LA, NC, VA,). Seed was distributed 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 during the FY13 award period. 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 FY13 grant. Please reference each item using an accepted journal format. If you need more space, continue the list on the next page.

- Benjamin Conway, J. Paul Murphy, Gina Brown-Guedira, Yanhong Dong, Shiaoman Chao, Carl Griffey and Jose Costa. 2013. "Mapping Wheat Fusarium Head Blight Resistance QTL In The MD01W233-06-1/SS8641 Doubled Haploid Mapping Population". In: S. Canty, A. Clark, Y. Salat and D. Van Sanford (Eds.), *Proceedings of the 2013 National Fusarium Head Blight Forum* (pp. 14). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative.
- S. Malla, C. Griffey, E. Milus, J.P. Murphy, A. Clark, D. Van Sanford, J. Costa, N. McMaster and D. Schmale. 2013. "Mapping FHB Resistance in Native SRW Wheat Cultivar Tribute". In: S. Canty, A. Clark, Y. Salat and D. Van Sanford (Eds.), *Proceedings of the 2013 National Fusarium Head Blight Forum* (pp. 25). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative.
- Daniela Miller, Gina Brown-Guedira, David Van Sanford, Anthony Clark, Shiaoman Chao and Jose Costa. 2013. "Mapping Fusarium Head Blight Resistance QTL in a Mid-Atlantic-Adapted Breeding Population". In Native SRW Wheat Cultivar Tribute". In: S. Canty, A. Clark, Y. Salat and D. Van Sanford (Eds.), *Proceedings of the 2013 National Fusarium Head Blight Forum* (pp. 32). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative.
- S. Petersen, P.V. Maloney, J.H. Lyerly, R.A. Navarro, C. Cowger, G. Brown-Guedira, J.M. Costa and J.P. Murphy. 2013. "QTL Associated With Fusarium Head Blight Resistance in the NC-NEUSE X AGS 2000 Recombinant Inbred Population". In: S. Canty, A. Clark, Y. Salat and D. Van Sanford (Eds.), *Proceedings of the 2013 National Fusarium Head Blight Forum* (pp. 38). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative.
- 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. 2013. "Characterization of FHB Resistance in SRW Roane and Jamestown NAM Populations". In: S. Canty, A. Clark, Y. Salat and D. Van Sanford (Eds.), *Proceedings of the 2013 National Fusarium Head Blight Forum* (pp. 45). East Lansing, MI/Lexington, KY: U.S. Wheat & Barley Scab Initiative.