USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY10 Final Performance Report
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Cover Page

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Fiscal Year:	FY10
USDA-ARS Agreement ID:	59-0206-0-059
USDA-ARS Agreement Title:	Development of Wheat with Resistance to Scab Adapted to the Mid-Atlantic.
FY10 USDA-ARS Award Amount:	$ 60,278

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.	$ 60,278
	Total ARS Award Amount	**$ 60,278**

M A Costa 7-15-2011

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
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. Several advanced MD lines with 3BS, 5A and 2DL resistance QTL were selected in 2010 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 2010. 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 genotypes 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 and were widely available to wheat growers.

A collaborative project with VA Tech and NC State University was initiated 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, and both under field and greenhouse conditions in Salisbury, Maryland. A preliminary 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.

To map US native resistance in Roane and Jamestown derived lines, started a collaboration with VA Tech on an association wheat mapping project by evaluating 294 lines under misting and inoculation in Salisbury, MD. These will be evaluated for incidence, severity, Fusarium damaged kernels, seed weight, plant height, heading date, and DON levels.

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): Discovery that the combination of scab-resistant QTLs in 3BS and 2DL conferred the lowest deoxynivalenol (DON) content among near-isogenic lines of wheat.

Impact (1): This information regarding combination of QTLs that will aid breeders developing low DON wheat germplasm was published in the journal Crop Science in May 2011 and is now widely available to other wheat breeders.

Accomplishment (2): 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. F6 selections were made in 2010-2011.

Impact (2): the availability of these soft red winter wheat lines with scab resistance will reduce scab damage in years favorable to scab development.

Accomplishment (3): 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 (3): the availability of this information regarding the resistance of currently grown wheat varieties will allow farmers to select varieties based on scab resistance.

Accomplishment (4): Evaluation of wheat genotypes in the Mason Dixon wheat state test and 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 (4): the availability of this information regarding the resistance of advanced wheat lines in the Mason Dixon wheat state test and Uniform Southern Soft Red Winter Wheat will allow breeders to have this information on lines not 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

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.

Cardwell, L., Souza, E., Brown-Guedira, G., Dong, Y., and **J. Costa**. Evaluation of Scab resistance QTL on agronomic and quality traits of soft red winter wheat. 2010. In: S. Canty, A. Clark, A. Anderson-Scully, D. Ellis, and D.A. Van Sanford. Proceedings of the Fusarium Head Blight Forum; 2010 Dec 7-9; Milwaukee, WI. Lexington, KY: University of Kentucky p. 137.

Gao, J., Wang, Y., Werner, T., Cardwell, L., Murphy, J.P., Brown-Guedira, G., Griffey, C., Dong, Y., and **J. Costa**. 2010. Mapping Scab resistance in the winter wheat line MD01W233-06-1. In: S. Canty, A. Clark, A. Anderson-Scully, D. Ellis, and D.A. Van Sanford. Proceedings of the Fusarium Head Blight Forum; 2010 Dec 7-9; Milwaukee, WI. Lexington, KY: University of Kentucky p. 138-141.

Kang, J., Clark, A., Van Sanford, D., Griffey, C., G. L. Brown-Guedira, Dong, Y., J. P. Murphy and **J. Costa**. 2011. Exotic Scab Resistance Quantitative Trait Loci (QTL) Effects on Soft Red Winter Wheat. *Crop Science* 51:924-933.

Shoots, J., Guttieri, M., Kolb, F., Lewis, J., McKendry, A., Ohm, H., Sneller, C., Sorrells, M., Souza, E., Van Sanford, D., **Costa, J**., Griffey, C., Harrison, S., Johnson. J. and P. Murphy. Development and Distribution of Male-Sterile Facilitated Recurrent Selection Populations. 2010. In: S. Canty, A. Clark, A. Anderson-Scully, D. Ellis, and D.A. Van Sanford. Proceedings of the Fusarium Head Blight Forum; 2010 Dec 7-9; Milwaukee, WI. Lexington, KY: University of Kentucky p. 165-166.