USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY09 Final Performance Report
July 15, 2010

Cover Page

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Fiscal Year:	2009
USDA-ARS Agreement ID:	59-0790-5-078
USDA-ARS Agreement Title:	Screening and Developing Wheat Germplasm with Resistance to Scab.
FY09- USDA-ARS Award Amount:	$ 27,542

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Adjusted Award Amount
VDHR-SWW	Development of Wheat with Resistance to Scab Adapted to the Mid-Atlantic.	$ 27,542
	Total Award Amount	**$ 27,542**

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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 Winter Wheat Region
SWW – Southern Sinter 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 exotic sources into adapted soft red winter wheat (SRWW) germplasm. The approach to address this problem is to backcross, and to three-way cross the Sumai 3 allele and other exotic resistance alleles into adapted SRWW lines and varieties. Marker-assisted selection (MAS) is being used to rapidly incorporate Sumai 3 (from Ning7840) resistance into SRWW lines such as McCormick, that have wide adaptation in the Southern and Eastern US wheat growing regions and moderate resistance to scab. Additionally, selected BC-1F1s were derived from the wheat cultivar SS 8641 that has wide adaptation as well as leaf and stripe rust resistance. The BC1 F1 seeds were screened with markers and the BC1-F3s selected progenies were advanced in the growth chamber in 2009. Selected homozygous BC1F4s for the 3BS, 5A and 2DL genomic regions, were planted in the field in the fall of 2009. Several selections have been made with additional screening for leaf rust and mildew resistance for harvest in July 2010.

Furthermore, screening of MD (University of Maryland) wheat advanced lines was conducted under field conditions in an inoculated nursery at Salisbury (MD) in 2008-2009. 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. 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. 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 in 2009.

Furthermore, because scab was widespread in the state in 2009, the MD wheat state test grown at three locations (Clarksville, Quantico, and Queenstown), was screened for Fusarium damaged kernels and DON. These data were shared with Dr. Pierce Paul (Ohio State University) and Dr. Arvydas Grybauskas (UMD) who are working on modeling of DON.

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. F5 selections were made in 2009-2010.

Impact (1): the availability of these germplasm with scab resistance will reduce scab damage in years favorable to scab development.

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

Impact (2): 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): Release of a MD germplasm breeding line with low DON (MD01W233-06-1).

Impact (3): MD01W233-06-1is widely available to other breeding program for the development of low DON germplasm.

Accomplishment (4): discovery that the combination of scab-resistant QTLs in 3BS and 2DL conferred the lowest deoxynivalenol (DON) content among isogenic lines of wheat.

Impact (4): A wheat line that combines 3BS and 2DL scab resistant QTLs is available to other breeding program for the development of low DON germplasm and the availability of this information regarding combination of QTLs will also aid breeders developing low DON germplasm. Submitted for publication in the journal Crop Science.

Include below a list 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.

Costa, J.M., Bockelman, H.E., Brown-Guedira, G., Cambron, S.E., Chen, X., Cooper, A., Cowger, C., Dong, Y., Grybauskas, A., Jin. Y., Kolmer, J., Murphy, J.P., Sneller, C., and E. Souza. 2010. Registration of the Soft Red Winter Wheat Germplasm MD01W233-06-1 Resistant to Fusarium Head Blight. Journal of Plant Registrations. Accepted.

MD01W233-06-1 has moderate resistance to incidence and severity and low DON.

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., and J. M. Costa. 2009. Scab Resistance QTLs Have an Effect on Agronomic and Quality Traits of Soft Red Winter Wheat. Proceedings of the 2009 Fusarium Head Blight Forum p. 113. Orlando, FL.

Kang, J., Clark, A., Van Sanford, D., Griffey, C., Brown-Guedira, G., Dong, Y., and J.M. Costa. 2009. Evaluation of Exotic Scab Resistance Quantitative Trait Loci (QTL) Effects on Soft Red Winter Wheat. Proceedings of the 2009 Fusarium Head Blight Forum p. 128. Orlando, FL.