

**USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY11 Final Performance Report
July 13, 2012**

Cover Page

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Fiscal Year:	FY11
USDA-ARS Agreement ID:	59-0206-9-083
USDA-ARS Agreement Title:	Breeding for FHB Resistance in the Southeastern U.S. - Uniform Nursery and Marker Characterization.
FY11 USDA-ARS Award Amount:	\$ 46,355

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
VDHR-SWW	Enhancement of Fusarium Head Blight Resistance in the Southeastern U.S. Germplasm.	\$ 46,355
	Total ARS Award Amount	\$ 46,355

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: *Enhancement of Fusarium Head Blight Resistance in the Southeastern U.S. Germplasm.*

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

Fusarium Head Blight (FHB) became an annual feature of wheat production in North Carolina during the past decade. During the past five seasons, serious FHB losses were observed in the northeast region of the state in 2008, and the Piedmont and northeast in 2009. During the past two seasons, dry conditions around anthesis saved us from measureable damage, but isolated outbreaks were reported by growers. Thus, the major problem being resolved is to increase acreage planted with varieties with improved FHB resistance to reduce DON in the US grain supply.

I am resolving this problem by:

1) Conducting variety development research to combine high levels of FHB resistance with overall agronomic and end-use quality in NC State variety releases. We make 500 new crosses annually with the majority containing parents exhibiting moderate levels of FHB resistance. We evaluate 30,000 head rows and several thousand yield plots annually. NC State is a member of the SUNGRAINS breeding cooperative with extensive cooperative testing of advanced lines and sharing of germplasm between the five participant universities. In addition to in-house breeding lines, we evaluate the Gulf Atlantic Nursery and NC Official Variety Test entries in replicated trials in our misted / inoculated scab nursery.

2) Increasing efficiency of Southern breeding programs to develop and release FHB resistant varieties by coordinating the Uniform Southern Soft Red Winter Wheat Scab Nursery involving 13 cooperators in US and Europe. I solicit entries, mail seed to cooperators, compile results, analyze the data and produce hard copy and web based reports annually.

3) Developing new breeding technologies to further enhance short term and long term improvement of FHB resistance and to efficiently introgress effective resistance genes into breeding germplasm. One graduate student (Maloney) is mapping native FHB resistance in NC-Neuse. A second graduate student (Peterson) is validating markers for resistance in NC-Neuse and Bess in a DH population. We cooperated with VA-Tech and Univ. of Maryland in graduate student studies to map native resistances in two other parents. Our doubled haploid program, designed to speed the variety development process, resulted in 66 doubled haploid lines entering advanced yield trials in 2012-13. Ten to twenty three-parent and F₂ populations are sent to the Genotyping Center annually to undergo marker assisted selection.

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:

Collected data on 182 RILs from the NC-Neuse / AGS 2000 population at two locations. Second year of data collection. Constructed map of population containing over 1,000 SSR, DArT, and SNP markers. Collected data on 113 DH lines from the cross of NC-Neuse / Bess at two locations. First year of data collection. Collected data in one NC location for graduate student research projects based in VA and MD.

Impact:

These are ongoing studies to map resistance in NC-Neuse, and validate resistance QTLs in NC-Neuse and Bess. In the interim we have identified DH lines in the NC-Neuse / Bess population that will be entered into our Wheat Observation Yield Test and our Crossing Block in fall 2012.

Accomplishment:

Four NC entries in the 2011-12 Uniform Southern Soft Red Winter Wheat Scab Nursery exhibited among the best levels of FHB resistance in the test. Two lines come from our DH program with one combining *Fhb1* resistance with excellent overall agronomic quality, and adaptation to the southeast. Three other DH lines exhibiting moderate FHB resistance have made it to our in-house Wheat Advanced Test, after making the cut in the SUNGRAINS Preliminary Test in four states.

Impact:

Immediate impact is the availability of these lines as parents to the entire breeding community starting in fall 2012. The doubled haploid materials are coming on-line four years earlier than if they were developed using conventional methods.

Accomplishment:

Coordinated and developed report for the 2012 Uniform Southern FHB Nursery, and I am in the process of coordinating the 2013 Southern FHB Nursery.

Impact:

This nursery is a key component of the overall variety development and germplasm exchange efforts in the southern soft wheat breeding community.

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.

No varieties or germplasms officially released this year.

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.

Kang, J., A. Clark, D. Van Sanford, C. A. Griffey, G. Brown-Guedira, Y. Dong, J. P. Murphy and J. Costa. 2011. Exotic scab resistance quantitative trait loci effects on soft red winter wheat. *Crop Sci.* 51:924-933.

Griffey, C. A., W. E. Thomason, R. M. Pitman, B. R. Beahm, P. G. Gundrum, S. Y. Liu, J. Chen, J. J. Paling, D. W. Dunaway, W. S. Brooks, M. E. Vaughn, J. E. Seago, B. C. Will, E. G. Hokanson, H. D. Behl, R. A. Corbin, T. R. Lewis, M. D. Hall, J. T. Custis, D. E. Starner, S. A. Gulick, S. R. Ashburn, D. L. Whitt, H. E. Bockelman, J. P. Murphy, R. A. Navarro, E. J. Souza, G. L. Brown-Guedira, J. A. Kolmer, D. L. Long, Y. Jin, X. Chen, and S. E. Cambron. 2011. Registration of 'SW049029104' Wheat. *J. Plant Reg.* 5:91-97.

E. Flemmig, G. Brown-Guedira, J. P. Murphy and D. Marshall. 2011. Using molecular markers to detect favorable linkages between Sr2 and Fhb1 in SRWW germplasm. p187. In: R. McIntosh (Ed). *Proceedings of the Borlaug Global Rust Initiative 2011 Technical Workshop June 13-16 Saint Paul, Minnesota, U.S.A.*

Maloney, P. V., J. Lyerly, R. Navarro, G. Brown-Guedira, D. Marshall and J. P. Murphy. 2011. Genetic control of *Stagonospora nodorum* blotch in the AGS2000 x NC-Neuse recombinant inbred population. *AnMtgsAbsts2010.* 221-16. ASA, Madison WI.

Conway, B, J. Gao, Y. Wang, J. P. Murphy, G. Brown-Guedira, C. Griffey, Y. Dong and J. Costa. 2011. Mapping scab resistance in the winter wheat line MD01W233-06-1. In: S. Canty, A. Clark, A. Anderson-Scully, D. Ellis and D. Van Sanford (Eds.), *Proceedings of the 2011 National Fusarium Head Blight Forum* (pp 15). East Lansing MI/Lexington KY: U.S. Wheat & Barley Scab Initiative.

Maloney, P. V., J. Lyerly, R. Navarro, G. Brown-Guedira, D. Marshall and J. P. Murphy. 2011. Genetic control of Fusarium Head Blight in the AGS2000 x NC-Neuse recombinant inbred population. In: S. Canty, A. Clark, A. Anderson-Scully, D. Ellis and D. Van Sanford (Eds.), *Proceedings of the 2011 National Fusarium Head Blight Forum* (pp 35). East Lansing MI/Lexington KY: U.S. Wheat & Barley Scab Initiative.

Murphy, J. P., and R. A. Navarro. 2011. The 2010-11 Uniform Southern Soft Red Winter Wheat Scab Nursery. In: S. Canty, A. Clark, A. Anderson-Scully, D. Ellis and D. Van Sanford (Eds.), Proceedings of the 2011 National Fusarium Head Blight Forum (pp 37-41). East Lansing MI/Lexington KY: U.S. Wheat & Barley Scab Initiative.

Wright, E., C. Griffey, S. Malla, D. Van Sanford, S. Harrison, J. P. Murphy, J. Costa, G. Milus, J. Johnson, A. McKendry, D. Schmale III and N. McMaster. 2011. Family based mapping of Fusarium Head Blight resistance in soft wheat cultivars Roane and Jamestown. In: S. Canty, A. Clark, A. Anderson-Scully, D. Ellis and D. Van Sanford (Eds.), Proceedings of the 2011 National Fusarium Head Blight Forum (pp 60). East Lansing MI/Lexington KY: U.S. Wheat & Barley Scab Initiative.

Costa, J., J. Kang, A. Clark, D. Van Sanford, C. Griffey, G. Brown-Guedira, Y. Dong and J. P. Murphy. 2011. Exotic scab resistance quantitative trait loci (QTL) effects on soft red winter wheat. Proceedings of the Eastern Wheat Workers/ southern Small Grain Workers Conference, April 17th-20th, Grapevine, TX.