

**USDA-ARS/  
U.S. Wheat and Barley Scab Initiative  
FY07 Final Performance Report (approx. May 07 – April 08)  
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**Cover Page**

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<b>Fiscal Year:</b>	2007
<b>USDA-ARS Agreement ID:</b>	NA
<b>USDA-ARS Agreement Title:</b>	Developing FHB Resistant Soft Wheat Varieties by Accelerated Backcrossing.
<b>FY07 ARS Award Amount:</b>	\$ 25,000

**USWBSI Individual Project(s)**

<b>USWBSI Research Area*</b>	<b>Project Title</b>	<b>ARS Adjusted Award Amount</b>
HGR	Developing FHB Resistant Soft Wheat Varieties by Accelerated Backcrossing.	\$25,000
	<b>Total Award Amount</b>	<b>\$ 25,000</b>

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Principal Investigator

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Date

\* CBCC – Chemical, Biological & Cultural Control  
EEDF – Etiology, Epidemiology & Disease Forecasting  
FSTU – Food Safety, Toxicology, & Utilization of Mycotoxin-contaminated Grain  
GET – Genetic Engineering & Transformation  
HGR – Host Genetics Resources  
HGG – Host Genetics & Genomics  
IIR – Integrated/Interdisciplinary Research  
PGG – Pathogen Genetics & Genomics  
VDUN – Variety Development & Uniform Nurseries

**Project 1:** *Developing FHB Resistant Soft Wheat Varieties by Accelerated Backcrossing.*

**1. What major problem or issue is being resolved and how are you resolving it?**

Fusarium head blight (FHB) is a devastating disease of wheat that causes reduction in grain yield and quality in the eastern United States where soft wheat is grown. Host resistance is the best method to control losses. Although moderate FHB resistance has been found in soft red winter wheat germplasm in the eastern US, the high levels of resistance needed against this pathogen are not currently available in these cultivars. We are rapidly addressing the needs of the eastern US soft wheat growers using technology at the USDA-ARS Genotyping Lab at Raleigh, NC to combine native resistance in soft red winter wheat cultivars and breeding lines with resistance genes from Chinese sources that are tagged with DNA markers. We are attempting to complement the moderate resistance of soft wheat lines with these exotic resistance genes in an accelerated backcrossing scheme using high-throughput genotyping that should provide timely release of backcross-derived varieties in the eastern wheat region and rapidly supply improved parents for forward breeding.

**2. List the most important accomplishment and its impact (how is it being used?).**

**Complete all three sections (repeat sections for each major accomplishment):**

**Accomplishment:** We are complimenting the level of resistance to FHB that is present in soft red winter wheat cultivars in the eastern US using genes derived from Chinese wheat lines having high levels of resistance. More than 5000 backcross progeny from crosses between the soft red winter wheat (SRWW) cultivars McCormick and NC-Neuse with the highly FHB resistant lines Ning7840 and VA01W476 (Roane/W14) have been evaluated with molecular markers linked to FHB resistance genes. Genomic DNA of backcross plants having up to three resistance genes from the exotic sources was evaluated with markers distributed throughout the genome. Progeny from the backcross plants with 95-99% of the background of the adapted soft wheat parent were identified that are homozygous for different combinations of resistance genes on chromosome 3BS, 5AS and 2DL. These plants were grown in the field during the 2007-2008 growing season to select lines with plant type similar to the SRWW parent. Lines were also advanced in the greenhouse for inbreeding and seed increase. Seeds of more than 100 F<sub>2</sub>- and F<sub>3</sub>-derived backcross lines enriched for the background of the SRWW parent that carry one to three resistance genes from the Chinese sources are being distributed to breeding programs during the summer of 2008 for fall planting. Seeds are available for replicated evaluation of these near-isogenic lines in scab inoculated nurseries that will provide important information about the effect of these resistance genes in moderately resistant soft wheat backgrounds. The backcross lines also have potential for release as cultivars. Plants with 2 to 3 pyramided resistance genes and high levels of recurrent parent background were used as parents in forward breeding by crossing to elite breeding lines adapted to the region. Marker-assisted selection was done on these three-way crosses and progeny were selected that are homozygous for FHB resistance and have genes for resistance to other pests that were segregating in the populations. Seed of the F<sub>2,3</sub> lines from these crosses is being distributed to collaborating breeding programs during summer 2008. These populations are a source of new lines having high levels of FHB resistance in combination with resistance to other diseases including stem, leaf and stripe rust and powdery mildew.

**Impact:** This project brings together the resources of multiple wheat breeding programs and the Eastern USDA Genotyping Lab to rapidly address the need of soft wheat growers in the eastern US. The application of high-throughput marker screening for accelerated backcrossing is allowing us to deploy exotic FHB resistance genes in adapted soft red winter wheat varieties. Seed of BC<sub>2</sub>F<sub>3:4</sub> lines similar to the recurrent parent and homozygous for FHB resistance gene combinations is being distributed to cooperating breeding programs in the region during summer 2008. Evaluation of FHB reaction of the lines that are near-isogenic for resistance gene combinations will be done during the 2008-2009 growing season. This will provide valuable information about the effect of these resistance genes in moderately resistant soft wheat backgrounds. Field selection of lines that have potential for release as cultivars has already begun. In addition, the backcross plants selected with markers are being used as parents in forward breeding strategies to develop improved varieties.

**As a result of that accomplishment, what does your particular clientele, the scientific community, and agriculture as a whole have now that they didn't have before?:** The germplasm being developed represents not only potential new FHB resistant varieties, but also improved parents for forward breeding and near-isogenic lines for genetic studies. The distribution of seed for evaluation and crossing is an important technology transfer event since breeders now have access to a pyramid of exotic resistance genes in an adapted soft winter wheat background.

**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.**

Costa, JM, L Al-Tukhaim, R Brown, N Gal-Edd, A Ku, E Wnger, D Van Sanford, and GL Brown-Guedira. 2007. Development of scab resistant soft red winter wheat germplasm using marker-assisted selection. Proceedings of the 2007 National Fusarium Head Blight Forum, pp 175.