USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY06 Final Performance Report (approx. May 06 – April 07)
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Cover Page

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USDA-ARS Agreement Title:	Fusarium Head Blight Research.
FY06 ARS Award Amount:	$ 19,602

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Award Amount
HGR	Developing FHB Resistant Soft Wheat Varieties by Accelerated Backcrossing.	$ 19,602
	Total Award Amount	**$ 19,602**

Gina Brown-Guedira

July 9, 2007

Principal Investigator 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
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 US 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 cultivars McCormick and Nuese with the highly FHB resistant lines Ning7840 and VA01W476 (Roane/W14) have been evaluated with molecular markers linked to FHB resistance QTL. Genomic DNA of BC_1 and BC_2 plants having up to three resistance genes from the exotic sources was evaluated with markers distributed throughout the genome. Thirty-seven backcross F_2 plants with 95-99% of the background of the adapted soft wheat parent have been identified that are homozygous for different combinations of resistance QTL on chromosome 3BS, 5AS and 2DL. Seeds of these lines are being increased in the greenhouse during Summer 2007. These $F_{2:3}$ lines that are near-isogenic for QTL combinations will be distributed the cooperating breeding programs for planting in field nurseries in Fall 2007. Evaluation of lines in scab inoculated nurseries will provide important information about the effect of these QTL in moderate soft wheat backgrounds. The backcross lines have potential for release as cultivars. Plants with 2-3 pyramided resistance QTL and high levels of recurrent parent background were also 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 the F_2 progeny homozygous for resistance QTL are being selected. The $F_{2:3}$ lines will be distributed to collaborating breeding programs in Fall 2007. These lines will be a source of new cultivars 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 $BC_2F_{2:3}$ lines similar to the recurrent parent and homozygous for FHB QTL combinations will be ready for distributing to cooperating breeding programs in the Eastern soft wheat growing region during Fall 2007. Evaluation of FHB reaction of the lines that are near-isogenic for QTL combinations will provide valuable information about the effect of these QTL in moderately resistant soft wheat backgrounds. Field selection of lines that have potenetial for release as cultivars will begin within three years of the beginning of the grant. Already, 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?;
This is the first regional project to deploy FHB resistance genes in soft red winter wheat cultivars using molecular markers. 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 use of the selected plants in 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, J. Al-Tukhaim, L, Gal-Edd, N, Wegner, E., and Brown-Guedira, GL. 2006. Development of Scab Resistant Soft Red Winter Wheat Germplasm using Marker-Assisted Selection. Pg. 94. Proceedings of the 2006 National Fusarium Head Blight Forum.