

**USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY07 Final Performance Report (approx. May 07 – April 08)
July 15, 2008**

Cover Page

PI:	Steven Xu
Institution:	USDA-ARS
Address:	1307 18th Street North Fargo, ND 58105-5677
E-mail:	Steven.xu@ars.usda.gov
Phone:	701-239-1327
Fax:	701-239-1369
Fiscal Year:	2007
USDA-ARS Agreement ID:	NA
USDA-ARS Agreement Title:	Introgression of Scab Resistance from Emmer and Persian Wheat to Durum Wheat.
FY07 ARS Award Amount:	\$ 30,000

USWBSI Individual Project(s)

USWBSI Research Area *	Project Title	ARS Adjusted Award Amount
HGR	Introgression of Scab Resistance from Emmer and Persian Wheat to Durum Wheat.	\$30,000
	Total Award Amount	\$ 30,000

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
 IIR – Integrated/Interdisciplinary Research
 PGG – Pathogen Genetics & Genomics
 VDUN – Variety Development & Uniform Nurseries

Project 1: Introgression of Scab Resistance from Emmer and Persian Wheat to Durum Wheat.

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

Durum wheat breeding and production in the United States has been seriously threatened by Fusarium head blight (FHB) in recent years. Although host resistance has been considered as the most effective and cost-efficient strategy to combat FHB, progress in breeding resistance cultivars is very limited due to a deficiency of high levels of FHB resistance in durum wheat germplasm. To resolve this major problem, we have been conducting research to search for FHB resistance sources in tetraploid wheat germplasm and to transfer identified resistance to durum cultivars adapted to the Northern Great Plains using doubled haploid (DH) and backcross methods. In the past four years, we have evaluated about 800 tetraploid wheat accessions and identified 16 Persian wheat (*Triticum turgidum* L. subsp. *carthlicum*) and 21 cultivated emmer wheat (*T. dicoccum*) accessions with FHB resistance. We have developed 551 DH and 559 BC₁-derived advanced (F₅) lines from the crosses of five *T. carthlicum* (PI 61102, PI 94748, PI 94749, PI 283888, and PI 352281) and four *T. dicoccum* (PI 41025, CI 14085, CI 14086, and CI 14135) accessions with the four durum cultivars ('Lebsock', 'Ben', 'Mountrail', and 'Maier'). In FY 07 funding period, the DH and BC₁-derived lines were evaluated for Type II resistance in 1-3 seasons in the greenhouse and they were also evaluated in field nurseries (Fargo and Langdon) in the summer of 2007. The resistant DH and BC₁-derived lines were further crossed and backcrossed with the durum cultivars for a second round of introgression. To determine the novelty of the genes for the FHB resistance in *T. carthlicum* and *T. dicoccum*, we haplotyped 135 *T. carthlicum* and *T. dicoccum* accessions with various levels of FHB resistance using 19 microsatellite and STS markers associated with the known FHB-resistance QTLs on chromosomes 2B (*T. carthlicum* 'Blackbird'), 3A (*T. aestivum* 'Frontana' and *T. dicoccoides* 'Israel A'), 3B (*T. aestivum* 'Sumai 3' and 'Wanshuibai'), 5A ('Sumai 3' and 'Frontana'), 6B ('Blackbird' and 'Wangshuibai'), and 7A (*T. dicoccoides* PI 478742).

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: By end of this funding period, we have developed 551 DH and 559 BC₁F₅ lines from the crosses of five *T. carthlicum* (PI 61102, PI 94748, PI 94749, PI 283888, and PI 352281) and four *T. dicoccum* (PI 41025, CI 14085, CI 14086, and CI 14135) accessions with the four durum cultivars ('Lebsock', 'Ben', 'Mountrail', and 'Maier'). A total of 315 DH line and 557 BC₁-derived lines (BC₁F₂, BC₁F₃ and BC₁F₄) have been evaluated in 1-3 greenhouse seasons. Based on the evaluation data, we have selected 62 DH lines and 16 BC₁F₄ lines with resistance or moderate resistance to FHB. Four of the DH lines and three of the BC₁F₄ lines have been crossed and backcrossed with the durum cultivars for second round of introgression. Haplotype analysis revealed that 43 *T. carthlicum* and *T. dicoccum* accessions have different alleles at 19 marker loci associated with the known FHB-resistance QTLs on chromosomes 2B, 3A, 3B, 5A, 6B, and 7A, indicating that these accessions may have novel FHB resistance genes.

Impact: Haplotype analysis showed that some *T. carthlicum* and *T. dicoccum* accessions carry novel FHB resistance genes and could be utilized to enhance FHB resistance of durum wheat. The DH populations developed in this project thus will be useful for developing markers to assist the deployment of those novel resistance genes. The FHB-resistant DH

PI: Xu, Steven

USDA-ARS Agreement #: NA

lines and BC₁F₅ lines from the crosses of *T. carthlicum* and *T. dicoccum* with durum cultivars are useful new durum germplasm and they can be further used for developing elite durum germplasm and cultivars in durum wheat breeding.

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 research results were presented in the 2007 National Fusarium Head Blight Forum. The wheat breeders in several states showed interest in using the resistant tetraploid wheat accessions in their breeding programs. We supplied seed of 20 resistant *T. carthlicum* and *T. dicoccum* accessions to three durum and bread wheat breeders. Introgression of the FHB resistance from *T. carthlicum* and *T. dicoccum* to major ND durum cultivars are currently being conducted in a close collaboration with the ND durum wheat breeder. Two elite lines with FHB resistance developed from this project are being increased in ND durum breeding program.

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.

Xu, S.S., R.E. Oliver, X. Cai, T.L. Friesen, S. Halley, and E.M. Elias. 2007. Searching for new sources of FHB resistance in the relatives of wheat. p. 249. *In*: Proceedings of 2007 National Fusarium Head Blight Forum, December 2-4, 2007, Kansas City, MO.

Oliver, R.E., X. Cai, T.L. Friesen, S. Halley, R.W. Stack, and S.S. Xu. 2008. Evaluation of Fusarium head blight resistance in tetraploid wheat (*Triticum turgidum* L.). *Crop Sci.* 48:213-222.