USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY08 Final Performance Report (approx. May 08 – April 09)
July 15, 2009

Cover Page

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Fiscal Year:	2008
USDA-ARS Agreement ID:	NA
USDA-ARS Agreement Title:	Introgression of Scab Resistance from Emmer and Persian Wheat to Durum Wheat.
FY08 USDA-ARS Award Amount:	$ 41,210

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Adjusted Award Amount
DUR-CP	Introgression of Scab Resistance from Emmer and Persian Wheat to Durum Wheat.	$41,210
	Total Award Amount	**$ 41,210**

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

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

A deficiency of high levels of resistance to Fusarium head blight (FHB) in durum wheat (*Triticum durum*) germplasm is a major problem limiting breeders to develop durum cultivars with FHB resistance. To resolve this major problem, we have been conducting research to transfer FHB resistance from emmer (*T. dicoccoides* and *T. dicoccum*) and Persian (*T. carthlicum*) wheat to the durum cultivars adapted to the Northern Great Plains.

In transferring FHB resistance from *T. dicoccum* and *T. carthlicum* to the durum cultivars, 96 doubled haploid (DH) lines and 66 BC_1F_5 derived lines from the crosses of five *T. carthlicum* (PI61102, PI94748, PI94749, PI283888, and PI352281) and three *T. dicoccum* (PI41025, CI14085, and CI14086) accessions with the four durum cultivars (Lebsock, Ben, Mountrail, and Maier) were evaluated in field nurseries in Prosper and Langdon during the summer of 2008. Based on the field evaluation, we selected 54 DH and BC_1F_6 lines with FHB resistance for further testing in a FHB field nursery in Jianyang, China in spring 2009. Forty-four of the DH and BC_1F_6 lines were also tested in the greenhouse in Fargo during the winter of 2008. Fifteen lines (8 DH and 7 BC_1F_7 lines) have been selected and included for testing in the Uniform Regional Scab Nursery in Langdon. The DH lines and BC_1F_4-derived lines with FHB resistance were used for the second cycle of introgression. In addition, the introgression of the FHB resistance from an additional 19 *T. dicoccum* accessions with a high level of FHB resistance was initiated. The selected DH and BC_1F_4-derived lines and 19 *T. dicoccum* accessions were crossed and backcrossed with the durum cultivars Alkabo, Grenora, Maier and Divide.

For transferring the FHB resistance from *T. dicoccoides* to durum, PCR-based markers suitable for marker-assisted selection (MAS) were previously identified for three QTLs on chromosome arms 3AS, 6BS, and 7AL. To pyramid the three *T. dicoccoides* derived FHB resistance QTLs into the durum cultivar Divide, the lines possessing both the 3AS and the 6BS QTLs were crossed with a Langdon- *T. dicoccoides* (LDN-DIC) 7A recombinant line harboring the 7A QTL. The 3A-6B/LD7A-28 F_1 plants have been crossed to Divide and the selected BC_1F_1 plants have been backcrossed to Divide. About 1,500 BC_2F_2 plants were genotyped to identify plants harboring individual QTLs, all three QTLs, and plants that have combinations of two of the three QTLs. A total of 52 plants homozygous for one or more QTLs were identified and will be advanced to the BC_2F_3 generation for phenotyping.

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):

<u>Accomplishment:</u>

Fifteen DH and BC_1F_7 lines derived from crosses of *T. dicoccum* and *T. carthlicum* to durum cultivars with FHB resistance have been selected based on evaluation in greenhouse and field nurseries. They have been included for testing in the Uniform Regional Scab Nursery

in Langdon in the summer of 2009. The promising lines with FHB resistance will be released for use in durum wheat breeding or genetic studies.

A total of 6,300 BC_1F_1 plants, derived from 106 new crosses of the DH and BC_1F_4-derived lines and *T. dicoccum* accessions with the durum cultivars Alkabo, Grenora, Maier and Divide, were advanced to BC_1F_2 generations. About 2,000 BC_1F_2 plants were evaluated in the greenhouse in the spring of 2009 and 295 BC_1F_2 plants with FHB resistance have been selected.

Impact:

A total of 13,000 BC_1F_2 plants derived from crosses of the DH and BC_1F_4-derived lines and *T. dicoccum* accessions with the durum cultivars have been planted in an F_2 nursery of the NDSU durum wheat breeding program. The progenies from the plants with FHB resistance and good agronomic traits will be directly used in durum wheat breeding.

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.

Chu, C.-G., Chao, S., Cai, X., Zhong, S., Xu, S.S. 2008. Haplotype analysis of genes for Fusarium head blight resistance in tetraploid wheat germplasm. In: Canty, S.M., E. Walton, A. Clark., D. Ellis. J. Mundell, and D.A. Van Sanford (Eds.), Proceedings of the National Fusarium Head Blight Forum; 2008 Dec 2-4; Indianapolis, IN. Lexington, KY: University of Kentucky. pp.156.

Cai, X., Xu, S.S., Oliver, R.E., Zhang, Q., Stack, R.W., Zhong, S., Friesen, T.L., Halley, S., Elias, E.M. 2008. Alien introgression for FHB resistance in wheat - Challenges and strategies. p716-718. In: R. Appels, R. Eastwood, E. Lagudah, P. Langridge, M. Mackay, L. McIntye, and P. Sharp (Eds.), Proceedings of 11th International Wheat Genetics Symposium, 24-29 August 2008, Brisbane, QLD, Australia. Sydney University Press. ISBN: 9781920899141

If your FY08 USDA-ARS Grant contained a VDHR-related project, 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. If this is not applicable (i.e. no VDHR-related project) to your FY08 grant, please insert 'Not Applicable' below.