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:	$ 19,363

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Award Amount
HGG	Analysis of FHB Resistance QTL Derived from Triticum dicoccoides.	$ 19,363
	Total Award Amount	**$ 19,363**

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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: *Analysis of FHB Resistance QTL Derived from Triticum dicoccoides.*

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

Fusarium head blight (FHB) is one of the most devastating diseases of wheat. Resistant sources of hexaploid bread wheat have been identified and are currently being employed in breeding programs, but development of resistant tetraploid durum wheat has met with less success. Moderate levels of resistance have been identified in *Triticum dicoccoides,* a wild tetraploid relative, which readily hybridizes with durum wheat. In the T. dicoccoides accession 'Israel A', QTLs for FHB resistance have been identified on chromosomes 3A and 6B. A different accession of *T. dicoccoides* (PI478742) with moderate levels of FHB resistance has also been identified. PI478742 was used to create disomic chromosome substitution lines in the Langdon durum background. Screening of the substitution lines for FHB resistance indicated that chromosome 7A contained factors that contribute to resistance. Using Langdon and the 7A (LDN-DIC 7A) substitution line as parents, recombinant inbred chromosome line (RICL) mapping populations were produced for genetic analysis of the 7A FHB resistance factor(s). This has led to the identification of a QTL on chromosome 7A for FHB resistance. The markers linked to the QTL should expedite the introgression of *T. dicoccoides*-derived resistance genes into elite durum lines using marker-assisted selection. Combining the FHB resistance genes from *T. dicoccoides* chromosomes 3A, 6B, and 7A along with genes identified by others from different sources should lead to a highly resistant durum cultivar.

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: A genetic linkage map of chromosome 7A consisting of 20 markers spanning 173 cM (marker density = 8.6 cM) was developed in the LDN x LDN-DIC 7A RICL population. The entire population was screened for reaction to FHB in three greenhouse experiments consisting of four replications each. QTL analysis revealed a single QTL on the long arm of chromosome 7A, which explained 19% of the phenotypic variation for resistance in this population. The markers linked to the QTL will be useful for marker-assisted selection. In addition, we used markers associated with the 3A and 6B QTLs derived from the *T. dicoccoides* accession Israel A to select F_2 plants derived from a cross between the LDN-DIC 3A and LDN-DIC 6B substitution lines that were homozygous for *T. dicoccoides* alleles at both QTLs. These lines together with parents and checks were evaluated for reaction to FHB in one greenhouse experiment with six replications. The two most resistant LDN-DIC 3A/6B lines will be used in crosses to the most resistant LDN-DIC 7A recombinant line containing the 7A QTL to pyramid the three QTLs into a single background.

Impact: The identification of sources of FHB resistant tetraploid wheat is very limited. Furthermore, the identification of tetraploid wheat-derived resistance QTLs is limited to those identified on chromosomes 3A and 6B derived from Israel A. Incorporation of the 7A QTL identified in this research together with the 3A and 6B QTLs will lead to higher levels of FHB resistance in tetraploid wheat. The markers associated with the 7A QTL provide valuable tools for breeders and geneticists to use in marker-assisted selection schemes for the development of FHB resistant germplasm and varieties. The combination of the 3A and 6B

T. dicoccoides derived QTLs into a single background provides a necessary starting point for pyramiding all three QTLs into the background of an adapted tetraploid variety. Now that molecular markers have been identified for all three QTLs, pyramiding the QTLs will be much more efficient than would be otherwise.

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 project led to the identification of a novel FHB resistance QTL in tetraploid wheat and associated molecular markers. The resistance QTL will be useful in durum and hexaploid wheat breeding programs, and the markers identified will expedite introgression and deployment of the QTL. The pyramiding and evaluation of the 3A and 6B QTLs in a common background provide a starting point for the pyramiding of all three QTLs in a common durum variety background, which is work that is ongoing in our lab.

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.

Kumar, S., Stack, R.W., Friesen, T.L., and **Faris, J.D**. 2007. Identification of a novel Fusarium head blight resistance QTL on chromosome 7A in tetraploid wheat. Phytopathology 97:592-597