USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY11 Final Performance Report
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Cover Page

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Fiscal Year:	FY11
USDA-ARS Agreement ID:	59-0206-9-063
USDA-ARS Agreement Title:	Pedigree Based Association Analysis of Novel Sources of FHB Resistance in Durum Wheat.
FY11 USDA-ARS Award Amount:	$ 51,707

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
DUR-CP	Pedigree Based Association Analysis of Novel Sources of FHB Resistance in Durum Wheat.	$ 51,707
	Total ARS Award Amount	**$ 51,707**

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
DUR-CP – Durum Coordinated Project
HWW-CP – Hard Winter Wheat Coordinated Project
VDHR – Variety Development & Uniform Nurseries – Sub categories are below:
SPR – Spring Wheat Region
NWW – Northern Soft Winter Wheat Region
SWW – Southern Soft Red Winter Wheat Region

Project 1: *Pedigree Based Association Analysis of Novel Sources of FHB Resistance in Durum Wheat.*

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

The objectives of this project are:

1) Characterize a collection of advanced durum wheat breeding lines with known pedigrees for allelic variation in markers distributed throughout the genome;
2) Characterize the same collection of lines in the same environment for reaction to FHB;
3) Associate allelic variation with resistance loci present in FHB resistant lines;
4) Validate marker-FHB resistance loci association; and
5) Develop diagnostic markers for routine and effective screening of breeding populations.

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):

Accomplishment:

During this period we further analyzed 171 BC_1F_7 lines derived from Tunisian 108×Ben and 174 BC_1F_7 lines derived from Tunisian 108×Lebsock. In total we have FHB phenotypic data (FHB infection rate) for these populations from two greenhouse and two field experiments conducted during 2010 to 2012. In addition, we have FDK and DON measurements from grain collected from 2011 field disease screening (the most severe season for FHB infection). Analysis of variance showed significant effect on FHB infection rate for the genotypes and also environments, as well as G×E interactions. Broad sense heritability for FHB infection rate was calculated to be around 40.4%±0.09. The correlation between the two greenhouse seasons and also the two field scab nurseries were positive and significant while there was correlation between the one greenhouse data and the field data. Transgressive segregation for FHB severity was observed and approximately 5% of the lines performed better than the resistant parents in the field and 25-30% while evaluated in the greenhouse. Additionally, those 5% of the lines that showed increased resistance also had the lowest FDK score of all lines examined. A total of 310 polymorphic DArT markers were used for genotyping the populations. However, the highly distorted DArT markers were excluded from the final analysis resulting in a map with 274 markers. These markers mapped to 201 unique loci with coverage of 1555.4 cM, and an average of 7.74 cM between any two marker loci. QTL analysis for FHB resistance revealed six different QTL on 5 different chromosomes (1B, 5A, 5B, 7A and 7B; table 1) in the Tunisian 108×Ben population. To integrate SSR and EST marker, 70 SSR and 1 EST polymorphic marker were used for Tunisian×Ben population. Pyramiding the 5A and 7A QTLs both associated with resistance to severity and incidence may reinforce FHB resistance background in North American adapted durum wheat. Analysis for Tunisian × Lebsock population and DON

analysis for both populations are underway. Twenty two selected lines from Tunisian × Ben and 8 from Tunisian × Lebsock with low FDK are being crossed with 5 NDSU high quality durum lines (D04581, D03028, D03708, D06932 and D06855) this season.

Table 1- QTL analysis of 280 DArT polymorphic markers in Tunisian× Ben population

	Chromosome	Marker interval	Length (cM)	LOD	R^2 (%)
Incidence	1B	wPt1247-wPt1818	0.6	3.0	8.7
	1B	wPt0097-wPt1403	3.2	3.0	8.3
	5A	wPt5309-wPt5231	46.8	3.0	9.1
	7A	wPt1976-wPt3403	0.3	3.0	9.2
	7B	wPt5846-wPt8283	40.2	3.0	7.3
severity	5A	wPt5309-wPt5231	46.8	3.0	5.8
	5B	wPt5928-wPt5604	1.0	3.0	6.2
	7A	wPt1976-wPt3403	0.3	3.0	8.6

Impact:

1. Genetic characterization of a collection of advanced durum wheat breeding lines derived from new sources of FHB resistance from Tunisia for allelic variation in markers distributed throughout the genome
2. Phenotypic characterization of the same collection of lines for reaction to FHB
3. Development and application of a methodology for analysis of important genomic regions associated with FHB resistance in advanced breeding lines based on pedigree, phenotypic, and marker data
4. Identification of possible genomic regions associated with FHB resistance in these same collection of lines

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.

Huhn MR, Elias EM, Ghavami F, Kianian SF, Chao S, Mergoum M, and Yahyaoui A. 2012. Tetraploid Tunisian wheat germplasm as new source of Fusarium head blight resistance. *Crop Science* 12:136-145

Ghavami F, Elias EM, Mamidi S, Ansari O, Sargolzaei M, Adhikari T, Mergoum M, and Kianian SF. 2011. Mixed model association mapping for Fusarium Head Blight resistance in Tunisian-derived durum wheat populations. *G3 (Genes, Genomes, Genetics)* 1:209-218.

S.M. Pirseyedi, F. Ghavami, A. Kumar Gupta, E. Elias, S. Ali, S. Kianian. Fusarium head blight resistance in two durum wheat backcross derived inbred line populations. Fusarium Head Blight Forum Dec. 2011.