

**USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY09 Final Performance Report
July 15, 2010**

Cover Page

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| Fiscal Year: | 2009 |
| USDA-ARS Agreement ID: | 59-0790-8-067 |
| USDA-ARS Agreement Title: | Identification and QTL Mapping of Fusarium Head Blight Resistance in Wheat and Durum Wheat. |
| FY09- USDA-ARS Award Amount: | \$ 30,087 |

USWBSI Individual Project(s)

| USWBSI Research Category* | Project Title | ARS Adjusted Award Amount |
|----------------------------------|--|----------------------------------|
| VDHR-SPR | Mapping QTLs for Resistance to Fusarium Head Blight in a Synthetic Hexaploid Wheat Line TA4152-60. | \$ 22,282 |
| DUR-CP | Identify Sources of Resistance to Fusarium Head Blight in Durum Wheat. | \$ 7,805 |
| | Total Award Amount | \$ 30,087 |

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 Winter Wheat Region
 SWW – Southern Sinter Wheat Region

Project 1: *Mapping QTLs for Resistance to Fusarium Head Blight in a Synthetic Hexaploid Wheat Line TA4152-60.***1. What major problem or issue is being resolved relevant to Fusarium head blight (scab) and how are you resolving it?**

FHB resistance is a quantitative trait, which is controlled by multiple genetic loci (QTLs), making resistance selection based on phenotyping a big challenge. Furthermore, the resistance sources that have been commonly used are genetically very similar. Identification of new resistance sources and DNA markers associated with QTL for the resistance is essential for diversifying the resistance sources and for facilitating the use of the resistance in the breeding program. We attempted to identify QTLs for the FHB resistance and identify DNA markers associated with the QTLs in the synthetic hexaploid wheat (SHW) line TA4152-60, which exhibits a high level of Type II resistance to FHB. A mapping population, which consists of 120 double haploid (DH) lines from the cross between a hard spring wheat line ND 495 (highly susceptible to FHB) and TA4152-60, was established and a genetic map was developed for this population using 643 DNA markers. The DH population was phenotyped for FHB resistance in greenhouse (GH) for three seasons from 2008-2009; two seasons were successful and one season failed due to unfavorable conditions. The population was also planted in the scab nursery at Prosper, ND for FHB evaluation during the summer of 2008. However, half of the population didn't survive during the vernalization and transplanting and thus the data were not used in the QTL mapping analysis. We repeated the field experiments at two locations (Prosper and Fargo) in the summer of 2009 and collected the data for FHB severity and DON levels for the whole population.

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:**

With the FHB data from the previous GH experiments and the molecular genetic linkage map constructed from the mapping population, we identified three QTLs localized on chromosome 5A, 5B and 7D, respectively. The 2009 field experiments from Fargo and Prosper appeared to confirm the QTL on 5A. A QTL was identified on 7D from the field data, but the position is different from the one identified based on the greenhouse data. In the Fargo location, QTL for resistance to FHB and DON were detected, which overlap on 2BS. QTL for DON reduction was also found on 3AL although the effect is not significant.

Impact:

The QTLs identified will be useful for marker-assisted selection to develop FHB resistant wheat varieties and to reduce the impact of DON on wheat production.

Project 2: *Identify Sources of Resistance to Fusarium Head Blight in Durum Wheat.*

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

Durum wheat has a relative lower level of FHB resistance compared to hard red spring wheat. Therefore, identification of a high level of FHB resistance resources in durum wheat germplasm has become a number one priority. In the past years, the NDSU durum wheat breeding program has screened approximately 8000 durum accessions from worldwide collections for reactions to Fusarium head blight (FHB), but only a small number of accessions were found to be moderately resistant. Screening other durum sources for a higher level of resistance is needed. To identify good resistance sources of durum wheat and ultimately introgress the resistance genes into the cultivated durum wheat varieties, we continued to screen diverse durum accessions for reaction to FHB in disease nurseries. Further evaluation was also conducted in the greenhouse experiments using a point injection inoculation method.

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:

We inoculated 60 durum wheat lines provided by Dr. Elias's breeding program in the greenhouse in spring of 2010. Approximately 85% of the durum lines showed a disease severity of more than 40% and only a few durum lines showed moderate resistance with a disease severity less than 40%.

Impact:

The durum materials with moderate FHB resistance are being used in the NDSU durum breeding program.

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.

Not Applicable

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., Friesen, T. L., Chu, C. G., Halley, S., Zhong, S., Cai, X., and Elias, E. M. 2009. Development of durum wheat germplasm with enhanced resistance to *Fusarium* head blight derived from emmer wheat. Proceedings of the 2009 National Fusarium Head Blight Forum, Dec 7-9, 2009, Orlando, FL. Pp160. (Poster)

Ali, S., McMullen, M., Zhong, S. 2009. Aggressiveness and DON production of *Fusarium graminearum* 3ADON and 15ADON populations as affected by wheat cultivar resistance and fungicide treatment, under ND field conditions, 2009. Proceedings of the 2009 National Fusarium Head Blight Forum, Dec 7-9, 2009, Orlando, FL. Pp19-21.