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

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Fiscal Year:	2008
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.
FY08 USDA-ARS Award Amount:	$ 30,226

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.	$ 7,944
	Total Award Amount	**$ 30,226**

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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: *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?

Use of host resistance is the most efficient and environmentally sound control method for Fusarium head blight (FHB). However, the 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 and identification of new resistance sources is essential for diversifying the resistance sources. The overall goal of this grant is 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 was generated, which consists of 210 double haploid (DH) lines from the cross between a hard spring wheat line ND 495 (highly susceptible to FHB) and TA4152-60. A genetic map was also developed from the cross using 643 DNA markers. Therefore, the specific objectives of this project are to: 1) obtain phenotype data of the DH population derived from TA4152-60/ ND 495; 2) understand the inheritance and action mode of the FHB resistance in TA4152-60; 3) identify QTLs for the FHB resistance based on the genetic map developed. We phenotyped the DH population for FHB resistance in greenhouse (GH) for three seasons; 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. One more season of phenotyping is in progress at three locations (China, Prosper, Fargo) in the summer of 2009.

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 GH experiments and the molecular genetic linkage map constructed from the mapping population, we identified three QTLs, which were localized on chromosome 5A, 5B and 7D, respectively. The three QTLs have similar effect (all about 11%). When the QTLs were analyzed using data from separate replicates (4 reps were used), we found the largest effect could be as high as 17%. Also, The QTLs on 5A and 7D seemed more consistent and the one on 5B showed more variation among the replicates.

Impact:

The QTLs on 5B and 7D have not been reported and they might represent novel FHB resistant genes. These QTLs will be used in breeding wheat varieties for FHB resistance.

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. Our overall goal is to screen the ICARDA durum wheat germplasm and other sources in order to identify good resistance sources of durum wheat and ultimately introgress the resistance genes into the cultivated durum wheat varieties to reduce the threat of the FHB disease. We screened diverse durum accessions for reaction to FHB in disease nurseries located in China and North Dakota and 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 have screened over 200 durum wheat lines and 47 Langdon-*Triticum diccocoides* chromosome substitution lines for FHB resistance in the greenhouse and filed. Few durum lines showed a disease severity of less than 30% in the field. However, we found that the Langdon-*T. diccocoides* subsitution line 4B derived from Langdon/PI481521 showed a significant low severity (11%) compared to the parent Langdon (30% severity), indicating that chromosome 4B from *Triticum diccocoides* carries the FHB resistance.

   Impact:

   The resistant materials identified above will be useful in the durum breeding program to develop durum varieties with better resistance to FHB.

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.

Extension Bulletin

McMullen, M., **Zhong, S**., Neate, S. M. 2008. Fusarium head blight (Scab) of small grains. North Dakota State University Extension Service PP-804 (revised).

Proceedings/Abstracts

Mergoum, M., Frohberg, R., Stack, R. W., and **Zhong, S**. 2008. Developing spring wheat cultivars to combat Fusarium head blight (Scab) disease in the North Central Plains of the USA. Cereal Res. Comm 36 (suppl.B):139-142.

Ali, S., Adhikari, T., **Zhong, S**. 2008. Effects of host resistance level and inoculation timings on Fusarium head blight (FHB) development and deoxynivalenol (DON) production in the field in North Dakota. Proceedings of the 2008 National Fusarium Head Blight Forum, Dec 2-4, 2008, Indianapolis, IN. pp3-7.

Chu, C., Chao, S., Cai, X., **Zhong, S**., Xu, S. S. 2008. Haplotype analysis of genes for Fusarium head blight resistance in tetraploid wheat germplasm. Proceedings of the 2008 National Fusarium Head Blight Forum, Dec 2-4, 2008, Indianapolis, IN. pp156.

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.

Not Applicable