USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY09 Final Performance Report
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Cover Page

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Fiscal Year:	2009
USDA-ARS Agreement ID:	59-0206-9-065
USDA-ARS Agreement Title:	Combining Resistance Sources to Produce FHB Resistant Specialty Spring Wheat Varieties.
FY09- USDA-ARS Award Amount:	$ 33,907

USWBSI Individual Project(s)

USWBSI Research Category*	**Project Title**	**ARS Adjusted Award Amount**
VDHR-SPR	Combining Resistance Sources to Produce FHB Resistant Specialty Spring Wheat Varieties.	$ 33,907
	Total Award Amount	**$ 33,907**

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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
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: *Combining Resistance Sources to Produce FHB Resistant Specialty Spring Wheat Varieties.*

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

Fusarium head blight (FHB) causes significant losses in wheat grain yield and its quality due to the accumulation of fungal mycotoxins, such as deoxynivalenol (DON). In the US spring wheat region, these losses are estimated to billions of dollars afflicted to wheat growers, industry, and export market. Hard white spring wheat and specialty low-amylose starch genotypes resistant to FHB are needed by regional producers to remain competitive in domestic and international markets. A successful wheat breeding approach has been to combine different sources of host FHB resistance into a single genotype. This has been done successfully in the hard red spring wheat (HRSW) breeding program and should be implemented in our hard white and specialty wheat (HWSW) breeding program as well.

At NDSU, the HWSW breeding program is addressing this problem by initiating/ reinforcing the development of elite and adapted genotypes/ lines/cultivars and breeding populations that incorporate genetic resistance with desired agronomic and quality traits. The strategy used is based on importing/incorporating/pyramiding several types of genetic resistance to FHB, particularly from our adapted HRSW sources such as Glenn, Alsen, Steele-ND, etc. into adapted HWSW lines using classical breeding methods and appropriate novel technologies such as selected molecular markers. Based on our accomplishments, we strongly believe that genetic resistance is/will provides a strategic long-term, economically, and environmentally sound solution to the problem. During the 2009-2010 growing cycle, our efforts have continued to generate new crosses and generating new populations involving parents with FHB resistance. Our goal is to develop elite HWSW germplasm and cultivars that are adapted to ND in particular, and spring wheat region, in general.

Also, to evaluate the function of types I resistance genes, we will use previously developed reciprocal backcross monosomic lines developed by hybridizing FHB resistant spring wheat 'Frontana' to a set of 'Chris' spring wheat monosomics, which are susceptible to FHB. Significant accomplishments have been achieved and are listed below.

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>

From the past USWBSI funds, several spring wheat lines including NDSW0714 and NDSW0715, were developed such that they contained one and two QTL for FHB resistance, respectively. Also, many HRSW cultivars have been developed in the last decades with excellent agronomic and quality performance and good levels of FHB resistance. These include Glenn, Faller, Steele-ND, Howard, and Barlow. These

genotypes have been used extensively in generating more than 200 crosses and segregating populations. Selections from this material have been advanced in the breeding pipeline.

This current project is in second year. Screening of white/specialty wheat genotypes under scab nursery conditions (artificial inoculation and mist irrigation) at three locations in ND was conducted in 2008 and 2009. Based on 2008 and 2009 data, many genotypes could be easily discriminated and identified. Also, field data was supplemented by the molecular markers information from the USDA-ARS Fargo Genotyping Center to make final selection of resistant genotypes that combine different sources of resistance. This material is being advanced for tests in 2010 nurseries.

Currently, the graduate student has finished the analysis of the two years data of the evaluation of the monosomics lines to determine the function of both type I resistance. These results demonstrate that 3A is a major genomic region for FHB resistance; therefore, mapping and cloning efforts should focus on this chromosome. The results also indicated the involvement of chromosomes 6A and 4D in reducing FHB spread although to a lesser extent than 3A. These results will be submitted for publication in 2010.

Impact:

Developing and making available white and specialty wheat cultivars with FHB resistance to our wheat growers in the spring wheat region is needed allow our wheat growers and industry to remain competitive in domestic and international markets. The results of this study will allow us to identify white and specialty wheat genotypes with good FHB resistance. It will also indicate the importance of the type I FHB resistance from Frontana and its benefits in pyramiding genes for FHB, which will demonstrated by a decrease in the level of disease severity over time. The above results will provide information that will help breeders determine if pyramiding genes will be useful in developing host plant resistance to FHB, and it ultimately will result in the release of a spring wheat germplasm line which combines two different genes for resistance to FHB. It will also demonstrate if molecular markers can be effectively employed to pyramid different genes, despite these genes expressing a similar Type II phenotypic resistance to FHB.

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.

Previously, the NDSW0714 and NDSW0715 were released as germplasm using part of USWBSI funds.

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.

Dalitso Yabawalo1, Mohamed Mergoum1*, and William Berzonsky. 2009. Chromosome Characterization for Fusarium Head Blight Resistance in 'Frontana' Spring Wheat. *In* Canty, S. M., A. Clark, J. Mundell, E. Walton, D. Ellis, and D.A. Van Sanford (Eds), Proceedings of the National Fusraium Head Blight Forum; 2009 Dec 7-9, Orlando, FL. Lexington, KY: University of Kentucky. Pp. 161-164.

Dalitso Yabawalo1, Mohamed Mergoum1*, and William Berzonsky. Further Characterization of the Fusarium Head Blight Resistance of Spring Wheat Cultivar, 'Frontana'. *In preparation* for Crop Sci.