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:	59-0790-4-101
USDA-ARS Agreement Title:	Uniform Nursery for SRWW and Breeding Scab Resistance Varieties for Ohio.
FY08 USDA-ARS Award Amount:	$ 83,413

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Adjusted Award Amount
VDHR-NWW	Uniform Nursery for SRWW and Development Scab Resistance Varieties for Ohio.	$74,209
VDHR-NWW	Mapping QTL for Type I and II FHB Resistance from CIMMYT Germplasm derived from a Synthetic Hexaploid.	$ 6,915
VDHR-NWW	Mapping Fusarium Head Blight Resistance in Truman Wheat.	$ 2,289
	Total Award Amount	**$ 83,413**

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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: *Uniform Nursery for SRWW and Development Scab Resistance Varieties for Ohio.*

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

Planting cultivars with high levels of resistance is essential to controlling FHB and minimizing DON content. We are developing new cultivars adapted to Ohio. We primarily use FHB resistance from adapted SRWW while also doing some marker-assisted selection for QTL from Asian sources. In addition we are coordinating the uniform FHB nurseries for winter wheats adapted to the northern US.

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:

In the 2007-2008 season, we phenotyped 850 OSU breeding lines with all derived from adapted by adapted crosses. Of the most advanced lines, nearly 24% had an FHB Index less than that of Truman (most resistant check) and 50% had a FHB Index less than that of Freedom (the moderate resistance check). Many more were similar to Freedom. Of our less advanced lines, nearly 7% had an FHB Index less than that of Truman (most resistant check) and 39% had a FHB Index less than that of Freedom (the moderate resistance check).

In the 2007-08 season OSU released two new cultivars with FHB resistance. 'Malabar' has and FHB Index similar to Truman and DON levels similar to Freedom. Bromfield has an FHB Index similar to Freedom but a DON level similar to Truman.

We backcrossed Fhb1, and other FHB QTL in 22 BC1F1 populations, 6 BC2F1 populations, and 2 BC3F1 populations.

In the 2007-08 season the uniform scab tests consisted of 120 breeding lines and checks. The seed was distributed to 13 cooperators including one in Canada and one in Romania.

Impact:

Our effective use of the native resistance in adapted SRWW parents greatly enhances developing high yielding cultivars as crosses with even 12.5% exotic parentage are unlikely to produce a high-yielding cultivar. We generated more than 450 breeding lines with acceptable FHB resistance in 2007-08 that can now be evaluated and selected for high-yield. The release of two new FHB resistance cultivars (Bromfield and Malabar) provide growers with great options for selecting a high-yield cultivar with FHB resistance.

Project 2: *Mapping QTL for Type I and II FHB Resistance from CIMMYT Germplasm derived from a Synthetic Hexaploid.*

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

Native SRWW appears to be an excellent sources of FHB resistance. But the resistance is likely controlled by many gees with small effects and the frequency of very strong resistance is still lower than we would like. Complementing the native SRWW with resistance genes from exotic sources may greatly increase the frequency of strong resistance. To that end we have developed a mapping population of 127 RILs from the cross OH685/CASS94-A (CASS94-A = MAYOOR//TK SN1081/AE.SQUARROSA (222) (CASS94-A = CASS94Y00009S-10PR-2M-0M)). CASS94-A was developed by CIMMYT from a synthetic hexaploid. The families were phenotyped in 2006-07 & 2007-08 in Ohio and in 2007-08 in Michigan. They were genotyped with markers from key regions associated with FHB resistance in past studies (*Fhb1* region of 3BS (gwm493, gwm285), 5AS, (gwm293), and 4BC (wmc238)), including a study on a sib of CASS94-A that reported markers on 2D were important. We used 12 SSR from 2D in this study

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:

Nearly 4% of the RILs had an FHB index less than that of Truman while 20% has an FHB Index less than that of Freedom: 28% had a lower index than OH685. This indicates that CASS94-A is providing genes for FHB resistance.

The population showed considerable skewing of marker genotypes. In addition we noted many families remained heterozygous. No markers from the *Fhb1* region of, 5AS, (gwm293), or 4BC were significant. A QTL on 2D, flanked by markers gwm608 and wmc087 accounted for 11%, 5%, and 16% of the phenotypic variation for IND, INC, and SEV, respectively. Given the heritabilities for these traits, this QTL accounted for 22%, 14%, and 36% of the genetic variation for IND, INC, and SEV respectively. Assuming our SEV is an indicator of type II resistance and INC an indicator of type I resistance, then this QTL primarily affected type II resistance as previously reported. More markers are being added in the current year

Impact:

The study confirms the value of the QTL on 2D that was previously reported. We have decided to not pursue further mapping in this population due to its skewedness, heterozygoisty of many families, and the moderate resistance of the CASS94-A parent. We are using the best RILs from this study that have the QTL on 2D and good agronomic value

and plan to use MAS to introgress that QTL into adapted gemrplasm. This germplasm will be distributed to all interested breeders.

Project 3: *Mapping Fusarium Head Blight Resistance in Truman Wheat.*

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

Native resistance from SRWW is effective for controlling FHB. One of the most resistant wheat lines is the cultivar Truman that does not have any non-SRWW genes for resistance. Presently we know very little about the genetics of FHB resistance in SRWW. This study maps the FHB resistance genes in Truman in the cross Truman/MO94-317. The University of Missouri in the lead on the project with Ohio State, University of Kentucky, and Purdue providing phenotypic data. In 2007-08 we phenotyped 247 RILs along with the parents and checks.

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:

The 2007-08 phenotyping was very successful with the RILs having a range of FHB index values from 4 to 100% and DON values from 2.5 to 38.3 ppm. Truman has an Index of 14.2% and DON of 8.1 ppm while MO940317 had an index of 68% and DON of 16.0 ppm. Nearly 40% of the RILs had lower DON than Truman while 13% had lower index than Truman. All data was sent to the University of Missouri.

Impact:

The real impact will come when the phenotypic data is co-analyzed with the genetic data. That analysis should identify the genes from Truman that confer its resistance. Most SRWW breeders have used Truman (or its sibs Bess, MO980829) as parents so the Truman genes are already in their populations. Thus breeders will quickly be able to use MAS in breeding for FHB resistance derived from these sources.

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.

Sneller, C.H., P. Paul, and M. Guttieri. 2009. Characterization of Fusarium head blight resistance in an Eastern US soft wheat population. Crop Sci: in press.

Souza, E., C. Sneller, P. Paul, L. Sweets, and M.J Guttieri. 2008. Wheat quality evaluation of Fusarium Head Blight (Fusariun graminearum) resistant soft wheats and the effects of fungicide management on wheat quality. In: Canty, S.M, A. Clark, E. Walton, D. Ellis, J. Mundell, and D. Van Sanford (Eds), Proceedings of the 2008 National Fusarium Head Blight Forum; 2008 Dec 2-4; Indianapolis, IN. Lexington KY: university of Kentucky. Pp 213, 2-4 December, 2008

Phillips, A., C.H. Sneller, J.Lewis, P. Paul, and M. Guttieri. 2008. The effect of key chromosome segments on FHB resistance in a cross of soft-winer by hard spring parents. In: Canty, S.M, A. Clark, E. Walton, D. Ellis, J. Mundell, and D. Van Sanford (Eds), Proceedings of the 2008 National Fusarium Head Blight Forum; 2008 Dec 2-4; Indianapolis, IN. Lexington KY: university of Kentucky. Pp 193, 2-4 December, 2008

Guttieri, M.J., R. Jackwood, P. Paul, and C.H. Sneller. 2008. Resistance to accumulation of deoxynivalenol in soft red winter wheat. In: Canty, S.M, A. Clark, E. Walton, D. Ellis, J. Mundell, and D. Van Sanford (Eds), Proceedings of the 2008 National Fusarium Head Blight Forum; 2008 Dec 2-4; Indianapolis, IN. Lexington KY: university of Kentucky. Pp 166, 2-4 December, 2008

Sneller, C.H., P. Paul, and M. Guttieri. 2008. Ten years of uniform FHB testing of soft winter wheat from the Northern US. In: Canty, S.M, A. Clark, E. Walton, D. Ellis, J. Mundell, and D. Van Sanford (Eds), Proceedings of the 2008 National Fusarium Head Blight Forum; 2008 Dec 2-4; Indianapolis, IN. Lexington KY: university of Kentucky. Pp 208-212, 2-4 December, 2008

Sneller, C.H, P. Paul, L. Herald, B., Sugerman, and A. Johnston. 2008. Report on the 2007-8Northern Uniform Winter Wheat Scab Nurseries (NUWWSN and PNUWWSN). In: Canty, S.M, A. Clark, E. Walton, D. Ellis, J. Mundell, and D. Van Sanford (Eds), Proceedings of the 2008 National Fusarium Head Blight Forum; 2008 Dec 2-4; Indianapolis, IN. Lexington KY: university of Kentucky. Pp 203-207, 2-4 December, 2008

Griffey, C., G. Brown-Guedira, S. Liu, J.P. Murphy, and C.H. Sneller. 2008. Characterization and development of FHB resistant soft winter wheat cultivars in the Eastern US. In: Canty, S.M, A. Clark, E. Walton, D. Ellis, J. Mundell, and D. Van Sanford (Eds), Proceedings of the 2008 National Fusarium Head Blight Forum; 2008 Dec 2-4; Indianapolis, IN. Lexington KY: university of Kentucky. Pp 162-165, 2-4 December, 2008

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.

The SRWW public cultivar Malabar.
The SRWW public cultivar Bromfield.

Table 1. Data from the 2006, 2007, and 2008 PNUWWSN or NUWWSN.

	Index (%) 2006, 07, 08	DON (ppm) 2007, 08
Truman	12.4	3.3
Freedom	18.3	4.8
Bromfield	17.0	3.5
Malabar	14.4	5.2
No. envs.	27	16