USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY07 Final Performance Report (approx. May 07 – April 08)
July 15, 2008

Cover Page

PI:	Janet Lewis
Institution:	Michigan State University
Address:	Department of Crop & Soil Sciences 382 PSSB East Lansing, MI 48824-1325
E-mail:	lewisja6@msu.edu
Phone:	517-355-0271 ext. 185
Fax:	517-353-3955
Fiscal Year:	2007
USDA-ARS Agreement ID:	59-0790-6-061
USDA-ARS Agreement Title:	Development of FHB Resistant Soft White Wheat Varieties for Michigan and similar Environments.
FY07 ARS Award Amount:	$ 82,257

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Adjusted Award Amount
VDUN	Development of FHB Resistant Soft White Wheat Varieties for Michigan and similar Environments.	$82,257
	Total Award Amount	**$ 82,257**

Janet M Lewis

July 15, 2008

Principal Investigator Date

* CBCC – Chemical, Biological & Cultural Control
EEDF – Etiology, Epidemiology & Disease Forecasting
FSTU – Food Safety, Toxicology, & Utilization of Mycotoxin-contaminated Grain
GET – Genetic Engineering & Transformation
HGR – Host Genetics Resources
HGG – Host Genetics & Genomics
IIR – Integrated/Interdisciplinary Research
PGG – Pathogen Genetics & Genomics
VDUN – Variety Development & Uniform Nurseries

Project 1: *Development of FHB Resistant Soft White Wheat Varieties for Michigan and similar Environments.*

1. What major problem or issue is being resolved and how are you resolving it?

Soft white winter wheat (SWWW) is a significant element of Michigan agriculture- both on the farm and in the food processing industry. Kellogg's and other major cereal companies use processed soft white wheat with high-bran content in many of their products. The high concentration of wheat in such cereal foods results in lower maximum tolerances for deoxynivalenol (DON) in soft white wheat. In addition, the higher concentration of DON in bran, vs. the flour, makes it even more critical to have low DON levels in soft white wheat. SWWW cultivars with effective resistance to FHB are insufficient. In addition, SRWW is now being grown by a large proportion of MI farmers. MI has also begun working to ensure improved levels of FHB resistance in SRWW varieties that perform well in the state of MI.

We have been working to resolve this problem through regular FHB field screening, exchange of germplasm with other breeders, and crossing to incorporate FHB resistance, including resistance with known QTL. In addition, samples are being collected and sent to MN for deoxynivalenol (DON) testing. Our achievements are highlighted below.

2. List the most important accomplishment and its impact (how is it being used?). Complete all three sections (repeat sections for each major accomplishment):

Accomplishment (1):

Release of MSU Line E2017. E2017 is a high yielding soft white wheat variety with significantly improved resistance to FHB (visual symptoms) and DON contamination, in comparison with the highest yielding soft white winter wheat varieties recently evaluated in MI. In addition, in comparison with Caledonia (a lower yielding variety in MI) the most widely grown soft white wheat variety in MI, E2017 shows improved FHB resistance, and similar DON levels. MSU Line E1009, another soft white wheat line with lower DON levels (though not lower visual symptoms) in comparison with other high yielding MSU releases, was licensed for commercialization.

Impact (1):

The availability of these lines gives farmers in MI the choice of a soft white wheat variety with lower FHB and/or DON contamination.

As a result of that accomplishment, what does your particular clientele, the scientific community, and agriculture as a whole have now that they didn't have before? (1):

The availability of these lines gives farmers in MI the choice of a high yielding soft white wheat variety with lower FHB and/or DON contamination. The production of these lines, especially E2017, will lessen the risk of FHB that the soft white wheat industry is facing.

Accomplishment (2):

Crossing to Develop High Yielding FHB Resistant Varieties:

In the spring of 2008, 151 crosses two and three-way crosses were made to develop high yielding lines with improved FHB resistance. In each cross, at least one of two/three parents had moderate to high levels of resistance to FHB visual symptoms and/or reduced DON levels. Approximately 50% (seventy-three) of these crosses had at least one of three parents with FHB resistance associated with known QTL (see table below for parents with known QTL for resistance). Other parents used as FHB resistance donors include Truman, MO 050699, and VA03W-409, MSU Line E2017, MSU Line E2043, and MSU Line E6039.

FHB resistant parent in simple crosses, 2007	Grain color	Pedigree Information (Known source of FHB resistance in bold)	QTL identified (small grains genotyping center)	DON levels (ppm), 2006 MSU harvest.	Years in NUWWSN
MSU Line E6001	Red	Pioneer 25W60/**CJ9306**	3BS, hetero for 2DL	0.43	06/07, 07/08
MSU Line E6002	White	VA96W-403-WS/**CJ9403**	2DL	0.32	06/07, 07/08
MSU Line E6003	White	VA96W-403-WS/**W14**	3BS and 2DL	0.25	06/07, 07/08
FHB12 (developed by Mark Sorrells)	White	Caledonia with **3BS** gene added by MAS	3BS (according to Mark Sorrells)		

Results of testing of E6001, E6002 and E6003 in the 2006/07 NUWWSN confirmed, on a regional level, that these lines have good resistance to FHB (lines E6002 and E6003 ranked first and third, respectively, for FHB Index among 60 entries from multiple collaborators - Truman was ranked 2nd).

Impact (2):

The use of FHB resistant lines with known QTL for resistance will allow us to use Marker Assisted Selection (MAS) as early as possible (F1 for 3-way crosses, F2 for 2-way crosses) to identify the most likely FHB resistant lines. In addition, it is known that mapping efforts are underway for Truman, and therefore MAS will likely be possible for Truman crosses in the near future. Other lines, such as MSU E2017, E2043, E6039, VA03W-409 and MO 050699 are more likely to produce a large number of lines with good agronomic qualities, since these have been selected for performance in addition to FHB resistance.

As a result of that accomplishment, what does your particular clientele, the scientific community, and agriculture as a whole have now that they didn't have before? (2):

As a result of these crosses, our development and selection of FHB resistant lines is more rapid. Therefore, we are more likely to produce with FHB resistance from these crosses.

Accomplishment (3):

Field Evaluations for FHB resistance (2008).

Many different nurseries are being evaluated for FHB resistance in an artificially inoculated (grain spawn and misted) field at Michigan State University. In addition to elite MSU germplasm, we are evaluating the state variety trial, regional nurseries, and MSU early generation germplasm.

Trial Name	# Entries	# Replication Evaluated
State Performance Trial	76	3
Advanced Yield Trial	20	3
Preliminary Yield Trials (combined)	77	2
Northern Uniform Winter Wheat Scab Nursery	64	3
Northern Preliminary Winter Wheat Scab Nursery	64	3
Uniform Eastern Soft Red Winter Wheat Nursery	45	2
Uniform Eastern Soft White Winter Wheat Nursery	25	2
F4 White MSU Breeding Germplasm	354	1
F4 Red MSU Breeding Germplasm	64	1
F3 Red MSU Breeding Germplasm	165	1

Our FHB symptoms this year were very good. Disease levels between the genotypes varied from less than 10% to greater than 95% at 21 days post anthesis. Preliminary examination of the MSU germplasm suggests that 37 MSU genotypes (in addition to E2017 and E1009 discussed above) between the Preliminary, Advanced, and State Performance Trials showed moderate levels of resistance, 25 of which are soft white lines. Regarding the early generation materials, single plot data suggests that 23 (6.5%) showed very good levels of resistance, while 69 (19.5%) showed moderate levels of resistance. For the F4 and F3 red varieties combined, 38 (16.5%) showed very good levels of resistance, while an additional 75 (33%) showed moderate levels of resistance. All these genotypes (early generation and elite) are also planted in MSU's breeding nursery, where they are evaluated for agronomic performance. In addition to the data shown above, 22 lines with good FHB performance were identified previously, and are now in the breeding nursery field for selection based on agronomic performance.

Impact (2):

We have identified 264 MSU genotypes (both white and red), between the elite yield trials and early generation germplasm that have good potential for the development of varieties with improved FHB resistance. These genotypes must still be selected for agronomic performance. In addition, we have evaluated genotypes from multiple breeding programs, both private and public.

As a result of that accomplishment, what does your particular clientele, the scientific community, and agriculture as a whole have now that they didn't have before? (2):

Valuable data on FHB performance in MI for regional and state trials. In addition, genotypes evaluated in MI can be selected by the MI breeder as parents for crossing. Germplasm development shows that varieties with improved FHB resistance are in the pipeline at MSU and previous crossing efforts have effectively incorporated FHB resistance into the breeding populations at MSU.

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.

Presentations were made in various venues (mostly industry and extension/farmer meetings) by the PI during FY07 regarding the MSU breeding program, with emphasis on development of varieties with improved FHB resistance. These include:

Scientific Meetings:

J. Lewis, L. Siler, S. Hammar, (2008). MSU's Wheat Breeding Program; Current Status and Future Outlook. Soft Wheat Quality Laboratory 55th Research Review Conference. March 11-12. Wooster, OH.

Industry Meetings, invited presentations (overviews/updates of wheat program to date):

J. Lewis, L. Siler, S. Hammar (2008) MSU Wheat Breeding Program Update. Michigan State Miller's Association 143rd Summer Meeting. June 15-16. Mackinac Island, MI.

J. Lewis, L. Siler, S. Hammar (2008) MSU Wheat Breeding Program Update. Soft White Wheat Endowment Meeting, June 11. Michigan State University, East Lansing, MI.

J. Lewis, L. Siler, S. Hammar (2008) MSU Wheat Breeding and Genetics Program. Michigan Crop Improvement Association Annual Meeting. March 6. Bath, MI.

J. Lewis, L. Siler, S. Hammar (2008) MSU Wheat Breeding and Genetics Program. Michigan State Miller's Association, 143rd Winter Meeting, January 29, 2008. Michigan State University, East Lansing, MI

L. Siler, G-L. Jiang, J. Lewis (2007) MSU Wheat Breeding Program. Michigan Farm Bureau Feed Grain, Oilseeds, and Wheat Advisory Committee Meeting. August 1. Eaton County, MI.

L .Siler, G-L. Jiang, J. Lewis (2007) MSU Wheat Breeding Program Report. Michigan State Miller's Association, 142nd Summer Meeting. June 16. Traverse City, MI.

Extension Meetings, invited presentations (overviews/updates of wheat program to date):

J. Lewis, L. Siler. MSU Wheat Breeding Program Yield Trials. Lenawee/Monroe County, MI, Extension Meeting. June 23. Hosted by Ned Birkey, MSU Extension Agent.

J. Lewis, L. Siler, S. Hammer (2008) FHB Sceening Nursery Field Presentation. Ingham County, MI Extension Meeting. June 25. Hosted by Dan Hudson, MSU Extension Agent.

J. Lewis, L. Siler, S. Hammar (2008). Visit of Dr. Jonas Mugabe Debute Director Istitut des sciences agronomiqes du Rwanda to the MSU FHB screening nursery. June 20. East Lansing, MI.

J. Lewis. L. Siler. S. Hammar. (2008) Wheat; A Look Into the Crystal Ball**,** MSU Wheat Breeding and Genetics Program. Progressive Farmer Winter Program Series. February 27. Clinton County, MI. Hosted by Marilyn Thelen, MSU Extension Agent.

J. Lewis, L. Siler, S. Hammar. (2008) MSU Wheat Breeding and Genetics Program. Lenawee/Monroe County, MI, Extension Meeting. February 12. Hosted by Ned Birkey, MSU Extension Agent.

J. Lewis, L. Siler (2007) Wheat Breeding for Michigan. 2007 Agronomy Update Meeting. December 19, Michigan State University, East Lansing, MI