

**USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY13 Final Performance Report
July 15, 2014**

Cover Page

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Fiscal Year:	FY13
USDA-ARS Agreement ID:	59-0206-1-114
USDA-ARS Agreement Title:	FHB Resistant Soft Wheat for Michigan and the Eastern Soft Wheat Region.
FY13 USDA-ARS Award Amount:	\$ 61,429

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Award Amount
VDHR-NWW	Development of FHB Resistant Soft White and Red Wheat Varieties for Michigan and Similar Environments.	\$ 60,370
VDHR-NWW	Coordinated Evaluation of FHB Resistance of Advanced Soft Winter Wheat Lines and Cultivars.	\$ 1,059
	FY13 Total ARS Award Amount	\$ 61,429



Principal Investigator

7/15/2014

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 Soft Winter Wheat Region
 SWW – Southern Soft Red Winter Wheat Region

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

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

Fusarium head blight challenges in Michigan: The soft winter wheat produced in Michigan is used by the milling products and cereal industries to develop food products consumed directly by humans. It becomes critical to prevent DON from entering the wheat value chain in Michigan. Soft white wheat is highly sought after by Michigan milling companies and cereal industries but requires intensive management combined with genetic resistance to control infection and maintain low DON levels.

Providing resistant varieties and information for variety selection: The Michigan State University Wheat Breeding and Genetics program provides Michigan wheat producers with high-yielding, high-quality wheat varieties with exceptional resistance to Fhb and DON. A large number of crosses are made annually with Fhb resistant lines to incorporate resistance alleles into breeding populations. A combination of classical phenotypic and marker assisted selection methods are employed.

2. List the most important accomplishments and their impact (i.e. how are they being used) to minimize the threat of Fusarium Head Blight or to reduce mycotoxins. Complete both sections; repeat sections for each major accomplishment:

Accomplishment (1):

A. Introgression of Fhb resistance into MSU wheat breeding populations. In the Fall 2013 crossing block, 386 F₁ topcrosses were made with 75% of crosses involving parents carrying high levels of Fhb resistance. In the Spring 2014 crossing block, 207 bi-parental F₁ crosses were made. Spring 2014 crosses also included 18 topcrosses from F₁s made from lines of the MPI4 genomic selection project as part of a new effort to transfer multiple Fhb resistance QTL in gametes from F₁s made from parents with different resistance QTL. To expedite selection of populations in the field, F₂ seed is grown during greenhouse cycles and planted the following fall. The F₂ populations from the FY12, Spring 2013, crossing block and the Fall 2013 crossing block were grown out in the greenhouse. From this effort, 588 F₂ populations of 700 to 1000 individuals will be planted in Fall 2014.

Impact: The number of crosses made will introgress numerous QTL for Fhb resistance into soft winter wheat breeding populations under selection for adaptation to Michigan and Great Lakes production environments. Producing large numbers of F₂ populations comprised of 400,000 to 600,000 plants will provide selectable variation for high levels of Fhb resistance in addition to high yield potential and industry quality standards.

Accomplishment (2):

B. Phenotypic evaluation and selection of Fhb resistant breeding lines. In spring 2013, ~3600 headrows were evaluated in two rows at two locations, Mason and Richville, MI. Data were collected on flowering date, heading, plant type and winterkill. Selections were made among these lines and ~700 will be planted in a preliminary yield trial in fall 2014. A subset of 2,496 single headrows were evaluated in the Fhb nursery and rated on a scale of resistant (R), moderately resistant (MR), moderately susceptible (MS), and susceptible (S). Approximately 200 headrows were rated MR or MS indicating that a high percentage of lines entering preliminary yield trials will carry high levels of Fhb resistance. Lines entering preliminary yield trials will be genotyped for major scab resistance QTL to confirm and predict the sources of resistance.

Impact: A substantial number of Fhb resistant lines will be entered into preliminary and advanced yield trials. All lines entering breeding yield trials will have a combination of high yield potential, suitable agronomics and high levels of Fhb resistance. With this preliminary screening of headrows and phenotypic evaluation, preliminary yield trials will be enriched from Fhb resistance alleles.

Project 2: *Coordinated Evaluation of FHB Resistance of Advanced Soft Winter Wheat Lines and Cultivars.*

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

Planting Fhb resistant varieties is critical component of controlling scab. In order for growers to make informed planting decisions to manage their risk, they must have data on the levels of resistance and susceptibility of the varieties available to them. The MSU wheat breeding and genetics program evaluates the Michigan Wheat Variety trials in the inoculated Fhb nursery and provides data on Fhb resistance and susceptibility of wheat varieties tested and grown in Michigan. Knowledge of Fhb resistance and susceptibility of wheat varieties is generated and disseminated to wheat growers and industry stakeholders to enable decision making and promote planting of resistant varieties.

2. List the most important accomplishments and their impact (i.e. how are they 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 2014 Fhb nursery, 3,501 rows of wheat lines from the Michigan Variety Trials, cooperative Fhb nurseries, the uniform red and white nurseries and the MSU breeding program. Data was collected on Fhb incidence and severity and disseminated to collaborators. Data on DON and Fusarium damaged kernels (FDK) will be provided post-harvest. The dissemination of this data will provide wheat farmers with the information necessary to make planting decisions and select disease resistant varieties. Further, breeding

for Fhb resistance is supported by providing wheat breeding programs with information on their advanced materials in the cooperative nurseries.

Impact: The dissemination of this data will provide wheat farmers with the information necessary to make planting decisions and select disease resistant varieties. Breeding for Fhb resistance is supported by providing wheat breeding programs with information on their advanced materials in the cooperative nurseries.

Include below a list of all germplasm or cultivars released with full or partial support of the USWBSI during the FY13 award period. List the release notice or publication. Briefly describe the level of FHB resistance.

E6012 (Caledonia / Pioneer Brand 25W33) will be proposed for release through Michigan Crop Improvement Association. This soft white winter wheat has exceptional Fhb resistance and has good 4 year averages of 40% incidence, 37.8% severity, Fhb index of 6.4 and DON levels of 3.9 ppm. E6012 carries the Ernie 5A Fhb resistance QTL from the P25W33 parent.

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 FY13 grant. Please reference each item using an accepted journal format. If you need more space, continue the list on the next page.

Presentations:

Results from both USWBI projects were presented by Eric Olson at the 2014 Michigan Agri-Business Association meeting, The Michigan Wheat Program Annual winter meeting, and The 2014 Michigan Miller's Association meeting. Lee Siler, supported in part by the USWBSI, presented results at the Michigan Crop Improvement Association meeting.

Publications:

Lee Siler, Sue Hammar, Eric Olson (2012) Michigan State Wheat Variety Trial. Michigan Farm News, <http://www.varietytrials.msu.edu/>.