

**USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY12 Final Performance Report
July 16, 2013**

Cover Page

PI:	Joseph Anderson
Institution:	Purdue University
Address:	Department of Agronomy 915 West State Street West Lafayette, IN 47907-1150
E-mail:	janderson@purdue.edu
Phone:	765-494-4774
Fax:	765-496-2926
Fiscal Year:	FY12
USDA-ARS Agreement ID:	59-0206-9-081
USDA-ARS Agreement Title:	Improvement of Soft Winter Wheat is Resistant to FHB and Adapted to Indiana.
FY12 USDA-ARS Award Amount:	\$ 92,642

USWBSI Individual Project(s)

USWBSI Research Category *	Project Title	ARS Award Amount
VDHR-NWW	Improvement of Soft Winter Wheat that is Resistant to FHB and Adapted to Indiana.	\$ 83,019
VDHR-NWW	Coordinated Evaluation of FHB Resistance of Advanced Soft Winter Wheat Lines and Cultivars.	\$ 1,674
VDHR-NWW	Improved Breeding for FHB Resistance by Advanced Genetic and Phenotypic Characterization of Soft Winter Wheat.	\$ 5,219
VDHR-NWW	Coordinated Evaluation and Utilization of Marker Assisted Selection.	\$ 2,048
	Total ARS Award Amount	\$ 92,642


Principal Investigator

7-15-2013
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: *Improvement of Soft Winter Wheat that is Resistant to FHB and Adapted to Indiana.*

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) is a devastating disease of wheat in Indiana, which has become more frequent and significant with the adoption of reduced soil tillage for soil conservation and reduced costs of crop management. I continue to develop soft winter wheat varieties that are adapted to Indiana and that have resistance to FHB as well as other important diseases. Emphasis has been placed on combining Type I and Type II FHB resistance, which is more effective than either type of resistance singly as well as combining the Type II *Fhb1*, and *Qfhs.pur-7EL* resistance loci

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:

Line 05247 and 02444 had seed increases in 2012 and 2013. These two lines have both Type I and Type II FHB resistance as well as exhibiting excellent milling and baking quality. FHB was not reported in 2012 due to the hot and dry season. Based on data obtained from previous years, we are quite sure that line 05247 has excellent FHB resistance. However, to be completely confident of the level of FHB resistance this line was reevaluated in 2013 and again showed excellent resistance under this year's more conducive FHB infection conditions. Line 05247 also has good frost resistance and resistance to both leaf and stripe rust. Line 02444, is under serious consideration for release for commercialization this year. Line 02444 has *Fhb1*, and is a selection from the same parental line as INW1021. This line is a shorter, higher yielding line than INW1021. Line 0762 was also in seed increase and exhibits excellent Type I and Type II FHB resistance and has excellent grain yield.

Significant progress has been made combining *Fhb1*, and *Qfhs.pur-7EL* together with combinations of Type I resistance from Goldfield, Truman/Bess, and INW0412. Resistance is significantly augmented with combinations of these resistance factors. In 2011 we phenotyped a recombinant inbred population that is segregated for the Type I resistance of INW0412 to identify and map the resistance factor(s). The combination of *Fhb1* and *Qfhs.pur-7EL* typically limits the spread of the disease after point inoculation to the inoculated spikelet, as determined in multiple greenhouse and field tests. We have developed lines with *Fhb1*, *Qfhs.pur-7EL* and the Type I resistance of Goldfield using marker genotyping and phenotyping, and hopefully combining these factors with Type I resistance of Truman and INW0412 by phenotyping. The hot and very dry environmental conditions in 2012 did not permit any consistent evaluation of this material. This 2013 season has permitted a phenotypic evaluation of this material from which lines have been identified that are sufficiently inbred and for which we now have sufficient seed supply to enter into regional FHB nurseries.

We used marker genotyping to select populations resistant to regional important diseases and pests, including Stagonospora/Septoria leaf blotch, leaf, stem and stripe rusts, Hessian fly, yellow dwarf viruses, and soilborne mosaic virus and incorporate this resistance into elite lines that have multiple resistance factors for FHB.

Impact: Lines 05247 and 02444 and possibly 0762 will have significant acreage in the next year or two, reducing the threat of FHB losses. These lines will provide more options for FHB resistance to Indiana growers. Wheat acreage substantially increase this past year. The May USDA United States Department of Agriculture National Agricultural Statistics Service reported in their July 2013 Indiana Agriculture Report that winter wheat seeded acres of 470,000 are up 34 percent from a year earlier. Area expected to be harvested for grain, at 430,000 acres, is up 43 percent from a year ago and up 2 percent from the May 1 forecast.

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?

Testing and identification of the agronomically highest performing and widely adapted lines that also have consistently effective FHB resistance takes many years and is not as reliable when done in individual breeding programs due to limitations on number and diversity of locations of testing.

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: This research initiative has significantly enhanced the regional collaboration of wheat improvement and of phenotyping and genotyping for resistance to FHB and other important diseases.

Impact: New cultivars are more widely adapted and have more reliable and effective resistance to FHB and other diseases.

Project 3: *Improved Breeding for FHB Resistance by Advanced Genetic and Phenotypic Characterization of Soft Winter Wheat.*

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

Individual breeding programs may not be as efficient as possible with collaborative efforts by multiple breeding programs to identify the most elite lines that also have the most effective resistance to FHB.

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:

Identification of FHB resistance and lower DON is being done more effectively and with fewer years of testing due to the multiple locations of testing.

Impact:

FHB resistance that is consistently effective across the region is being identified.

Project 4: *Coordinated Evaluation and Utilization of Marker Assisted Selection.*

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

Marker genotyping across research programs involving diverse adapted/elite wheat germplasm would be more efficient than the typical approach of the various research programs operating largely independently. This project enhances the regional collaboration of genotyping and selection of elite germplasm with enhanced FHB resistance.

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:

Markers/resistance factors that are effective in diverse germplasm have been identified, suggesting which combinations of resistance factors to focus on in selection programs.

Impact:

More efficient development of elite lines with enhanced FHB resistance.

Include below a list of 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.

INW0304: released in 2003, has moderate Type I and Type II FHB resistance.
INW0411: released in 2004, has *Fhb1*.
INW0412: released in 2004, has moderate Type I and Type II FHB resistance and effective tolerance to barley yellow dwarf virus disease.
INW0803: released in 2008, has moderate Type II FHB resistance, is very early, has *Bdv3*.
INW1021: released in 2010, has *Fhb1*.
INW1131: released in 2011, has very effective Type I resistance.
02444: will be released in 2013, has *Fhb1*, short and strong straw, excellent milling and baking qualities.
05247: will be released in 2013, has Type I and Type II FHB resistance.
0262: may be released in 2014, has Type I and Type II FHB resistance.

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.

Xiao, X, Liu Y, and Ohm H.W. 2011. Combining genes from related grass species for resistance to wheat disease, 2011 National Fusarium Head Blight Forum. poster #38, page 61.

Sun, J., Liu Y., and Ohm H. W. 2011. Map type I and Combine type I and type II FHB resistance, poster # 35, page 58.

Ohm, H.W. 2012. 05247A1-7-7-3-1 and 02444A1-23-1-3, Two Soft Winter Wheat Lines with High Yield Potential. 2011 National Fusarium Head Blight Forum.

Herb W. Ohm, H.W. 2012. Breeding for Fusarium Head Blight (FHB), rust and barley yellow dwarf (BYD) resistance in Purdue soft winter wheat lines 05247 and 02444. 2012 National Fusarium Head Blight Forum.

C.H. Sneller, CH., A. Cabrera¹, P. Paul, D. Van Sanford², A. Clark, A. Mckendry, F. Kolb, H. Ohm, R. Freed and M.E. Sorrells. 2012. Phenotypic analysis of a soft wheat population that will be used for association analysis and genomic selection. 2012 National Fusarium Head Blight Forum.