

**USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY11 Final Performance Report
July 13, 2012**

Cover Page

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Fiscal Year:	FY11
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.
FY11 USDA-ARS Award Amount:	\$ 106,487

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.	\$ 84,176
VDHR-NWW	Coordinated Evaluation and Utilization of Marker Assisted Selection.	\$ 9,756
VDHR-NWW	Improved Breeding for FHB Resistance by Advanced Genetic and Phenotypic Characterization of Soft Winter Wheat.	\$ 10,879
VDHR-NWW	Coordinated Evaluation of FHB Resistance of Advanced Soft Winter Lines and Cultivars.	\$ 1,676
	Total ARS Award Amount	\$ 106,487

8/2012

Principal Investigator or Department Head _____ 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 is being placed on combining Type I and Type II FHB resistance, which is more effective than either type of resistance singly.

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:

Commercial release of Lines 05247 and 02444, which were in seed increase for release in 2012 and have both Type I and Type II FHB resistance. Both lines exhibit excellent milling and baking quality. Due to the hot and dry season this year, FHB was not reported. However, based on data obtained from previous years, we are confident that line 05247 has excellent FHB resistance. This line also exhibited excellent grain yield and test weight. Line 05247 also has good frost resistance and resistance to both leaf and stripe rust. Line 02444 was increased at the Purdue Agronomy Farm, and will likely be released 1 year later in seed increase for commercialization. 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 0722 was also in seed increase and exhibits excellent Type I and Type II FHB resistance. This line 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. We need one more season to identify lines that are sufficiently inbred and for which we 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 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. Despite reduced in yield due to frost damage in the state of Indiana, wheat acreage is expected to increase next year. Seed companies in Indiana have indicated substantially higher wheat seed sales which may be due to much earlier corn harvests that will allow a wheat rotation/double crop.

Project 2: *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.

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 of FHB Resistance of Advanced Soft Winter 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.

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 2012, has *Fhb1*, short and strong straw, excellent milling and baking qualities.

05247: will be released in 2012, 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.