

**USDA-ARS/  
U.S. Wheat and Barley Scab Initiative  
FY10 Final Performance Report  
July 15, 2011**

**Cover Page**

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| <b>Fiscal Year:</b>                | FY10   |
| <b>USDA-ARS Agreement ID:</b>      | 59-0206-9-081  |
| <b>USDA-ARS Agreement Title:</b>   | Improvement of Soft Winter Wheat is Resistant to FHB and Adapted to Indiana.     |
| <b>FY10 USDA-ARS Award Amount:</b> | \$ 102,791   |

**USWBSI Individual Project(s)**

| <b>USWBSI Research Category*</b> | <b>Project Title</b>   | <b>ARS Award Amount</b> |
|----------------------------------|--|-------------------------|
| VDHR-NWW                         | Improvement of Soft Winter Wheat that is Resistant to FHB and Adapted to Indiana.                              | \$ 84,176               |
| VDHR-NWW                         | Development and Distribution of Male Sterile Facilitated Recurrent Selection Populations.                      | \$ 1,951                |
| VDHR-NWW                         | Mapping QTL in Biparental Populations.   | \$ 2,305                |
| 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. | \$ 2,927                |
| VDHR-NWW                         | Coordinated Evaluation of FHB Resistance of Advanced Soft Winter Lines and Cultivars.                          | \$ 1,676                |
|                                  | <b>Total ARS Award Amount</b>  | <b>\$ 102,791</b>       |

*Herbert W. Ohm*

July 11, 2011

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  
 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 Fusarium head blight 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 improved cultivar INW1021, and Lines 99751 and 02444 which are in seed increase for release in 2011 that have Type I and Type II FHB resistance. INW1021 has Fhb1 and is high yielding, has very good soft wheat milling and baking qualities. Its acreage is expanding significantly. 99751 has effective Type I resistance and moderate Type II resistance. Purple Ribbon Seed Company, Reynolds, IN, had two 50-acre fields of seed increase, one in northeast Indiana (fungicide not applied, averaged 94 bu/a) and one in NW OH (applied Prosaro, averaged 89 bu/a). Incidence of FHB was 5 – 7% in the field in NE Indiana and fields in the vicinity had 15-25% incidence; I visited the field in NE IN, but did not see the field in NW OH, but was told that it had negligible FHB. The seed company is very satisfied with the field performance and grain quality, and will insist that we release the line this year. Line 02444 was increased at the Purdue Agronomy Farm, will likely be released also, but 1 year later in seed increase for commercialization. 02444 has Fhb1, is a selection from the same parental line as INW1021, but is 10cm shorter and higher yielding than INW1021.

Significant progress has been made combining Fhb1, 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 are selecting, using marker genotyping, populations to incorporate resistance to regional important diseases, including SNB, STB, new effective genes for resistance to leaf, stem and stripe rusts, Hessian fly, yellow dwarf viruses, and soilborne mosaic virus; into elite lines that have multiple resistance factors for FHB.

**Impact:** Commercial acreage of INW1021 is significantly expanding. 99751 will have a significant acreage in the next year or two, reducing the threat of FHB losses.

**Project 2:** *Development and Distribution of Male Sterile Facilitated Recurrent Selection Populations.*

- 1. What major problem or issue is being resolved relevant to Fusarium head blight (scab) and how are you resolving it?** Cyclical crosses and selection of progeny from crosses among diverse elite wheat lines with diverse sources of Type I and II FHB resistance are being effected on a larger scale than typical in a wheat crossing program to combine more effective resistance in lines that are elite for improved yield, milling and baking qualities and resistance to other important diseases.
- 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:**

Effected a second cycle of crosses among a diverse set of elite wheat lines in the field in 2011.

**Impact:**

None to-date, but impacts are expected in the next several years.

**Project 3:** *Mapping QTL in Biparental Populations.*

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

A number of soft winter wheat elite lines from research programs throughout the Eastern soft wheat region have moderate Type I and or Type II FHB resistance, but combinations of these resistance factors have not been effectively exploited in breeding programs because we lack DNA markers associated with individual resistance factors. I have participated for 3 seasons in phenotyping a recombinant inbred (RI) population to map the Type I resistance of the cultivar Truman.

**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 RI population has been extensively phenotyped and the marker genotyping and mapping of the resistance factor(s) is in progress.

**Impact:**

Markers that co-segregate with the resistance will enhance the selection efficiency of lines with this resistance in breeding programs.

**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.

**Project 5:** *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 6:** *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*.

99751: will be released in 2011, has very effective Type I resistance.

02444: will be released in 2011, has *Fhb1*, short and strong straw, excellent milling and baking qualities.

**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.**