USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY09 Final Performance Report
July 15, 2010

Cover Page

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Fiscal Year:	2009
USDA-ARS Agreement ID:	59-0206-9-081
USDA-ARS Agreement Title:	Improvement of Soft Winter Wheat is Resistant to FHB and Adapted to Inidiana.
FY09- USDA-ARS Award Amount:	$ 102,172

USWBSI Individual Project(s)

USWBSI Research Category*	Project Title	ARS Adjusted Award Amount
VDHR-NWW	Improvement of Soft Winter Wheat that is Resistant to FHB and Adapted to Indiana.	$ 99,866
VDHR-NWW	Mapping Fusarium Head Blight Resistance in Truman Wheat.	$ 2,306
	Total Award Amount	**$ 102,172**

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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 Winter Wheat Region
SWW – Southern Sinter 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?**

   FHB causes significant wheat grain yield losses and produces a vomitoxin that causes grain to be toxic as a food or feed. We are developing soft winter wheat cultivars that are adapted to Indiana and that have effective type I and type II resistance to *Fusarium graminearum*, as well as other important agronomic, disease resistance and milling and baking qualities.

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:
   We have combined type I resistance from Truman, Ernie, Goldfield and/or INW0412 with combinations of several genes/QTLs for type II resistance (*Fhb1*, *Qfhs.pur-7EL*, F201R, Xing117 selection) and have phenotyped F_3 and F_4 lines in the field and greenhouse, verifying that a high level of FHB resistance can be achieved. We have also combined *Bdv3* and *Qfhs.pur-7EL* in coupling on 7DL in adapted wheat lines. Several lines with some type I and type II resistance will be entered in regional nurseries in fall 2010. Additional lines with higher levels of resistance, unfortunately some with *Qfhs.pur-7EL*, proved to be segregating yet, so they were re-selected and will be entered in regional trials in fall 2011.

   We released the new soft red winter wheat cultivar INW1021, which has *Fhb1*and is adapted to Indiana and surrounding regions.

   We collaborated in growing and phenotyping the regional wheat nurseries: NUWWSN, PNUWWSN, UEWN, 5-state advanced and 5-state preliminary nurseries (type I and type II, FDK) and carried out multilocation performance nurseries in Indiana; and the Septoria Stars nursery and the eastern septoria nursery.

   -Selected among and within head rows in the misted area for agronomic type and FHB resistance, and also in larger non-misted head row nurseries that had moderately severe natural FHB.
   -Marker-genotyped head row selections to identify lines with various combinations of FHB resistance QTL.
   -Made 654 new crosses in two cycles in the greenhouse, combining type I and type II FHB resistance with resistance to other important diseases as well as agronomic performance and soft wheat milling and baking qualities.

   Impact:
   The high levels of FHB resistance, combining Type I and multiple genes for Type II resistance are consistently highly effective, as shown by repeated field and greenhouse tests. Eventually, when high levels of FHB resistance are incorporated into elite, highly productive cultivars, FHB will be largely controlled.

Project 2: *Mapping Fusarium Head Blight Resistance in Truman Wheat.*

1. **What major problem or issue is being resolved relevant to Fusarium head blight (scab) and how are you resolving it?**
   Type I resistance of the cultivar Truman, characterized as reduced initial infection compared to susceptible wheat genotypes, is moderately effective. Type I resistance of Truman is quantitatively inherited and is tedious to phenotype in segregating wheat populations. Having DNA markers that co-segregate with this resistance will enable wheat breeders to more efficiently develop improved wheat cultivars that have type I 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:
   We characterized a recombinant inbred population of 250 lines with two replications of the population. We measured the percentage of spikes within the 1-meter row plot of each of the two replicates of each RI line and the parent lines that were FHB diseased. The test in 2010, the 3rd year of the phenotyping, is very informative with consistency between the two replications.

   Impact:
   The phenotyping results are being submitted to Dr. Anne McKendry, University of Missouri to be combined with the two previous years of phenotyping data together with phenotyping data from other cooperators, for marker screening, genomic mapping of the type I resistance factors, and identification of co-segregating markers that are useful for selection for this type I resistance.

Include below a list 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.

INW1021: Fhb1

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.

Rinehart K. 2009. Characterizing disease and pest resistance introgressed from related species into wheat. PhD thesis. 83p. Purdue University, August.

Shen X, L Kong, H Sharma and H Ohm. 2010. Marker-assisted reduction of a chromosome segment of *Thinopyrum ponticum* carrying Fusarium head blight resistance. (Plant Breeding, in review).

Zhang X, X Shen, Y Hao, J Cai, HW Ohm, and L Kong. 2010. A genetic map of *Lophopyrum ponticum* 7E harboring resistance genes to Fusarium head blight and leaf rust. TAG (In press).