

**USDA-ARS / USWBSI
 FY03 Final Performance Report (approx. May 03 – April 04)
 July 15, 2004**

Cover Page

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| Year: | FY2003 (approx. May 03 – April 04) |
| FY03 ARS Agreement ID: | 59-0790-9-057 |
| FY03 ARS Agreement Title: | Breeding FHB Resistant Soft Winter Wheat. |
| FY03 ARS Award Amount: | \$ 88,940 |

USWBSI Individual Project(s)

| USWBSI Research Area * | Project Title | ARS Adjusted Award Amount |
|---------------------------------------|--|--------------------------------------|
| VDUN | Breeding FHB Resistant Winter Wheat by Marker-Assisted Selection. | \$ 14,634 |
| VDUN | Improvement of Soft Winter Wheat for Resistance to Fusarium Head Blight. | \$ 74,306 |
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| | Total Amount Recommended | \$ 88,940 |

Principal Investigator

Date

 * BIO – Biotechnology
 CBC – Chemical & Biological Control
 EDM – Epidemiology & Disease Management
 FSTU – Food Safety, Toxicology, & Utilization
 GIE – Germplasm Introduction & Enhancement
 VDUN – Variety Development & Uniform Nurseries

Project 1: *Breeding FHB Resistant Winter Wheat by Marker-Assisted Selection.*

1. What major problem or issue is being resolved and how are you resolving it?

Fusarium head blight continues to be an important disease of wheat in Indiana. In 2004 it is estimated that throughout northern Indiana farmers will lose 5-10 % and in southern Indiana farmers will lose 10-20 % of wheat production due to Fusarium infection. The disease is severe throughout eastern US and the Midwest in 2004. Associated with these production losses, harvested grain is also contaminated with the toxin, deoxynivalenol, which results in severe marketing losses. We are developing wheat varieties that have multiple genes for resistance/protection against the disease. We are pyramiding genes for type 2 resistance, inhibition of disease spread after infection, and we are pyramiding genes for type 2 resistance and for low incidence, having flowers that open less during flowering than those of varieties that have higher incidence of the disease.

2. What were the most significant accomplishments?

A recombinant inbred population from a cross of cv. Goldfield (low-FHB incidence) X cv. Patterson (higher FHB incidence) was characterized in multiple year-location tests and multiple tests in a greenhouse for flower opening and incidence of FHB. Advanced lines in the breeding program derived from various crosses that have Goldfield as a parent were also characterized as having low FHB incidence. The DNA markers, Xgwm210 and Xbarc 200, were associated with reduced flower opening and low FHB incidence in the RI population and were present in the advanced lines characterized as having low FHB incidence and derived from crosses of Goldfield with other parent lines.

Wheat lines with low incidence and/or type 2 resistance derived from cv. Freedom or Ernie were recurrent parents and/or in single crosses to pyramid, using DNA markers, resistance of 201R or the Qfhs.ndsu-3BS from Ning 7840. Lines are being recovered that have reduced FHB disease spread compared to lines with only one or another of these resistance QTLs. These results demonstrate that it is possible to achieve more effective protection from FHB by pyramiding various resistance genes, each of which results in only partial host plant protection against the disease.

Project 2: *Improvement of Soft Winter Wheat for Resistance to Fusarium Head Blight.*

1. What major problem or issue is being resolved and how are you resolving it?

Fusarium head blight continues to be an important disease of wheat in Indiana. In 2004 it is estimated that throughout northern Indiana farmers will lose 5-10 % and in southern Indiana farmers will lose 10-20 % of wheat production due to Fusarium infection. The disease is severe throughout eastern US and the Midwest in 2004. Associated with these production losses, harvested grain is also contaminated with the toxin, deoxynivalenol, which results in severe marketing losses. We are developing wheat varieties that have multiple genes for resistance/protection against the disease.

2. What were the most significant accomplishments?

We released the variety, INW0304, which has reduced incidence, typically 1/3 the percentage of infected spikes compared to the variety Patterson; and typically the disease spreads to 20-30 % of spikelets after a single flower is infected compared to disease spread to 80-90 % of spikelets in susceptible varieties. In addition, INW0304 is very early maturing, fitting into double cropping with soybeans after wheat harvest in southern Indiana; it also has resistance to Hessian fly, leaf rust, stripe rust, glume blotch, powdery mildew, and tolerance to yellow dwarf viruses. In 2004, breeder seed of two advanced lines was produced for likely release. Line 97397 has closed flowering like INW0304 and it has more effective type 2 resistance; in replicated tests at Lafayette, IN, 2004, the FHB index for INW0304 was 10 and the index for P97397 was 3. Data received to date in 2004 for FHB from regional trials outside of Indiana support our Lafayette data. P97397 is similar to INW0304 for plant type and disease resistance, but has resistance to soilborne mosaic virus and is consistently higher yielding. The second line for likely release is P981359; the FHB index was 7 in replicated trials at Lafayette in 2004. P981359 has excellent cold tolerance like cv. Patterson and consistently ranks near the top in yield trials, but is tall.

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

Bourdoncle, W and HW Ohm. 2003. Quantitative trait loci for resistance to Fusarium head blight in recombinant inbred wheat lines from the cross Huapei 57-2/Patterson. *Euphytica* 131:131-136.

Bourdoncle, W and HW Ohm. 2003. Fusarium head blight-resistant wheat line ‘Bizel’ does not contain rye chromatin. *Plant Breeding* 122:281-282.

Gilsinger, JJ and HW Ohm. 2003. Flowering characteristics and incidence of Fusarium infection in a RI population. In: Canty, SM, Lewis J, Siler L, and Ward, RW (Eds.), *Proceedings of the 2003 National Fusarium Head Blight Forum*. 2003 Dec 13-15; Bloomington, MN. East Lansing: Michigan State University. pp. 255.

Shen, X, M Ittu, and HW Ohm. 2003. Quantitative trait loci conditioning resistance to Fusarium head blight in wheat line F201R. *Crop Sci.* 43:850-857.

Shen, X, M Zhou, W Lu, and H Ohm. 2003. Detection of Fusarium head blight resistance QTL in a wheat population using bulked segregant analysis. *Theor Appl Genet* 106:1041-1047.

Shen, X, L Kong, and H Ohm. 2004. Fusarium head blight resistance in hexaploid wheat (*Triticum aestivum*)-*Lophopyrum* genetic lines and tagging of the alien chromatin by PCR markers. *Theor Appl Genet* 108:808-813.

Shen, X, L Kong, and H Ohm. 2004. Marker-assisted characterization of Fusarium head blight resistance in wheat derived from wheatgrass. *Plant & Animal Genome XII Conference*. P451. San Diego, CA, January 10-14.