

**USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY05 Final Performance Report (approx. May 05 – April 06)
July 14, 2006**

Cover Page

PI:	Richard W. Ward/James J. Kells
Institution:	Michigan State University
Address:	Department of Crop & Soil Sciences 382 Plant & Soil Science Building East Lansing, MI 48824-1324
E-mail:	wardri@msu.edu
Phone:	517-575-7640
Fax:	517-353-3955
Fiscal Year:	2005
FY05 ARS Agreement ID:	59-0790-4-128
Agreement Title:	Conventional Breeding Information Technologies to Control FHB in Wheat and Barley.
FY05 ARS Award Amount:	\$ 179,039

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Adjusted Award Amount
EC/HQ	U.S. Wheat & Barley Scab Initiative's Networking and Facilitation Office and Website.	\$ 82,545
VDUN	Development of FHB Resistant Soft White Wheat Varieties for Michigan and Similar Environments.	\$ 96,494
	Total Award Amount	\$ 179,039

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: *U.S. Wheat & Barley Scab Initiative's Networking and Facilitation Office and Website.*

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

Scab affects the industries and people involved in virtually every stage of the production, processing, and distribution systems of five market classes of wheat and barley across the U.S. The Networking and Facilitation Office (NFO) has been in existence since 1999. The goal of the NFO is to minimize the barriers to the success of the U.S. Wheat & Barley Scab Initiative arising from the administrative burdens and communication challenges. In FY05, there were 81 researchers working in 24 institutions (including ARS and CIMMYT) across 23 states and Mexico. The NFO is addressing this problem by 1) helping scientists and all interested parties, who in the past may have problems communicating with each other, to learn from each other by facilitating communications and communication system development; 2) identifying and implementing an internet-based communication and collaboration mechanisms; and 3) acting as a center of accountability and a rapid clearing house of scab-related information. The NFO provides administrative support to the various committees, as well as being responsible for the organization of the Initiative's annual scientific conference. Finally, the NFO facilitates the annual resolution of a comprehensive national research plan and budget, and represents the Initiative's only 'fixed' asset.

2. List the most important accomplishment and its impact (how is it being used?). Complete all three sections (repeat sections for each major accomplishment):

Accomplishment(1): Scientific findings and technological advances during the past several years, combined with a desire to work as efficiently as possible, prompted the U.S. Wheat and Barley Scab Initiative (USWBSI) Steering Committee to restructure the Initiative's research areas for 2006 (FY06). The overarching objectives behind the need for reorganization were: 1) minimize situations where proposals require review by more than one committee (narrow the focus or scope of research); 2) and increase the effectiveness of committees by eliminating the need to add additional reviewers to cover broad areas of research (i.e. transformation and mapping) within a single area. One issue discussed repeatedly was that the Initiative needs to focus on the practical outcomes (i.e. results, accomplishments). The process of restructuring began in April, 2005 (FY04) and concluded in July, 2005 (FY05). The original six research areas, established in 1997, have been reorganized into the following eight research areas:

- Chemical, Biological & Cultural Control
- Etiology, Epidemiology & Disease Forecasting
- Food Safety, Toxicology & Utilization of Mycotoxin-contaminated Grain
- Genetic Engineering & Transformation
- Host Genetic Resources
- Host Genetics & Genomics
- Pathogen Genetics & Genomics
- Variety Development & Uniform Nurseries

Impact (1): The restructuring is designed to facilitate even greater advances in the future by taking advantage of new science and technology as well as the experience gained during the past several years.

As a result of that accomplishment, what does your particular clientele, the scientific community, and agriculture as a whole have now that they didn't have before?:

This restructuring demonstrates vitality and flexibility within the Initiative, and hopefully builds confidence in the Initiative's stakeholders of its continued commitment to its goal (see answer to question1). The restructuring should also improve resource allocation by stakeholders to research deemed most effective in meeting the USWBSI's mission.

Accomplishment (2): One of the Networking and Facilitation Office's (NFO) most important accomplishment was the successful facilitation of the development of the USWBSI's FY06 Research Plan and Budget, which was approved by USDA-ARS in February. See attached table (1), for a list of meetings, conference calls, etc. facilitated by the NFO that lead to the FY06 Research Plan and Budget.

Impact (2):

One-hundred and nineteen research projects across, eight research areas, and the USWBSI Headquarters, received funding in the amount of \$5,031,880 to continue the fight against FHB.

As a result of that accomplishment, what does your particular clientele, the scientific community, and agriculture as a whole have now that they didn't have before? (2)

There are 82 scientists in 25 states and Mexico continuing to work on developing as quickly as possible effective control measures that minimize the threat of Fusarium Head Blight (Scab) to the producers, processors, and consumers of wheat and barley.

Table 1. Summary of Meetings, Conference Calls and Workshops facilitated by the Networking & Facilitation Office (NFO).

Date	Committee/ Research Area	Type of Mtg.	Description/Purpose of Meeting	# of Part.	Mtg. Location
5-26-05	Steering Committee (SC)	Meeting	Semi-Annual Meeting	25	Chicago, IL
9-13-05	Executive Committee (EC)	Conference Call	EC's Quarterly Conference Call – Discuss upcoming Pre-Proposal Review Process	10	NA
10-3-05	USWBSI Co-Chairs, ARS ADODR, NFO and RAC Chairs	Conference Call	Discuss upcoming FY05 Pre-Proposal Review Process.	10	NA
10-14-05	EEDF Review Panel	Conference Call	Discuss panel's review of FY06 submitted pre-proposals.	3	NA
10-25-05	FSTU Review Panel	Conference Call	Discuss panel's review of FY06 submitted pre-proposals.	4	NA
11-04-05	EEDF Review Panel	Conference Call	Discuss panel's review of FY06 submitted pre-proposals.	4	NA
11-8-05	FSTU Review Panel	Conference Call	Discuss panel's review of FY06 submitted pre-proposals.	4	NA
11-11-05	EEDF Review Panel	Conference Call	Discuss panel's review of FY06 submitted pre-proposals.	4	NA
11-18-05	CBCC Review Panel	Conference Call	Discuss panel's review of FY06 submitted pre-proposals.	4	NA
11-16-05	HGG Review Panel	Conference Call	Discuss panel's review of FY06 submitted pre-proposals.	4	NA
11-16-05	VDUN Review Panel	Conference Call	Discuss panel's review of FY06 submitted pre-proposals.	4	NA
11-17-05	HGR Review Panel	Conference Call	Discuss panel's review of FY06 submitted pre-proposals.	4	NA
11-22-05	PGG Review Panel	Conference Call	Discuss panel's review of FY06 submitted pre-proposals.	4	NA
12-10-05	EC/RAC Chairs and Vice-Chairs/ USDA-ARS ADODR	Meeting	Discuss review panels recommendation for pre-proposals submitted for FY06 funding.	27	Milwaukee, WI
12-11-05	SC	Meeting	Semi-Annual Meeting – Review FY06 Research Plan and Budget	32	Milwaukee, WI
12-13-05	EC	Meeting	Follow-up of Annual Forum and USWBSI's recommendation for FY06 Research Plan and Budget.	10	Milwaukee, WI
1-05-06	USWBSI Co-Chairs/NFO	Conference Call	Discuss finalization of USWBSI's FY06 Research Plan and Budget	4	NA
02-14-06	Executive Committee (EC)	Conference Call	EC's Quarterly Conference Call	10	NA
3-24-06	USWBSI Co-Chairs/NFO	Conference Call	Discuss planning of aerial application projects	3	NA
4-19-06	CBCC RAC	Conference Call	Discuss finalization of FY06 Research Priorities for CBCC	4	NA

Accomplishment (3): In December of 2005, the NFO working with the Forum Organizing Committee facilitated the USWBSI's annual scientific Forum, which was held in Milwaukee, Wisconsin. Over 200 crop scientists (including research associates, research technicians and graduate students), growers, and industry representatives from across the nation and around the world, as well as area leaders of the U.S. wheat and barley industry, attended the 2005 National FHB Forum. Research results and findings were presented to the forum participants in the form of oral (22) and poster (102) presentations, accompanied by abstracts or papers published in the Forum proceedings. There were also separate breakout sessions covering the following topics:

- FHB Disease Forecasting Models;
- Genes, Genome and Functional Genomics of *F. graminearum*;
- Collaboration between breeders and the Genotyping Centers;
- Uniform Trials and Integrated Control; and
- Procedures in FHB research: an informal exchange of ideas and protocols for technicians and graduate students

Impact (3):

The annual forum is the primary mechanism whereby USWBSI scientists and stakeholders come together to discuss both the progress being made, as well as problems that interfere, with the successful combat against this devastating disease.

As a result of that accomplishment, what does your particular clientele, the scientific community, and agriculture as a whole have now that they didn't have before? (3)

The clientele has a greater understanding of what research is being conducted under the USWBSI; as well what progress is being made in the following areas (titles of Forum sessions):

- Host Plant Resistance and Variety Development
- Genetic Engineering and Transformation
- Etiology, Epidemiology and Disease Forecasting
- Pathogen Genetics and Genomics
- Food Safety, Toxicology and Utilization of Mycotoxin-contaminated Grain
- Chemical, Biological and Cultural Control

Project 2: *Development of FHB Resistant Soft White Wheat Varieties for Michigan and Similar Environments.*

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

Soft white winter wheat (SWWW) is a significant element of Michigan agriculture- both on the farm and in the food processing industry. Kellogg's and other major cereal companies use processed soft white wheat with high-bran content in many of their products. The high concentration of wheat in such cereal foods results in lower maximum tolerances for Deoxynivalenol in soft white wheat. SWWW cultivars with adequate resistance to FHB are not currently available. We employ conventional plant breeding approaches including field and greenhouse FHB screening nurseries to redress this shortcoming.

2. List the most important accomplishment and its impact (how is it being used?). Complete all three sections (repeat sections for each major accomplishment):

Accomplishment (1):

Increased Capacity for FHB Resistance Evaluation: For the third consecutive year we expanded our capacity to evaluate breeding families and lines in misted, inoculated nurseries. The entire FHB nursery was relocated to a location very close to the main facilities on campus. Investments in mist irrigation equipment now enable misting of 1.9 acres. For the 05/06 season we screened over 1200 plots of replicated advanced lines also included in yield trials. We also screened 1223 early generation and pre-yield test families or lines.

Impact (1):

Higher proportion of pre-screened FHB resistant materials reaching the yield test stage.

As a result of that accomplishment, what does your particular clientele, the scientific community, and agriculture as a whole have now that they didn't have before? (1)

Increased potential for FHB data generation and increased availability of FHB resistant germplasm.

Accomplishment (2):

Adoption of Early Generation Selection for FHB: One hundred twenty nine F3:4 progeny of F2:3 families selected in the 04/05 FHB nursery exhibited excellent resistance in the 05/06 nursery (being harvested at this time). This result demonstrates that selection for FHB resistance is effective in single row 1.5m plots among F3 families. In anticipation of this result, all F2:3 and more advanced families were planted in the 05/06 FHB nursery. Families/lines not selected in the FHB nursery are discarded. One hundred twenty nine F2:3 families exhibited excellent resistance to FHB in the 05/06 nursery. F4 derived and more advanced families are now evaluated both in the FHB nursery and in the standard breeding nursery.

Impact (2):

The frequency of FHB resistant families/lines from the F4 generation onward will increase.

As a result of that accomplishment, what does your particular clientele, the scientific community, and agriculture as a whole have now that they didn't have before? (2)

Increased frequency of FHB resistant materials among agronomically superior F4 and later generation families/lines.

Accomplishment (3):

Identification of Superior Advanced Lines:

A series of F4 and more advanced lines derived from crosses with Chinese lines W14, CJ9306, CJ9403, Yang158, etc. were selected in both the 05/06 FHB nursery and in the 05/06 standard breeding nurseries. Twenty six of those lines representing nine crosses were identified as visually acceptable for inclusion in six location, replicated yield trials for the 06/07 season. Two sets of sisters exhibit the strongest resistance to FHB that this program has witnessed in a winter wheat. These lines, which exhibit nearly zero incidence (and very low spread when a spikelet is symptomatic), winter hardiness, white grain, good plant height, and would be selected on visual agronomic characteristics; will be widely distributed for confirmation domestically and internationally in the fall plantings of '06. They have already been used in the crossing block. These lines have 50% Chinese parentage and are unlikely to have grain quality and yield adequate for release but we postulate they represent a quantum leap in the overall genetic value of breeding parents with extreme FHB resistance in winter wheat.

MSU Lines E0001 and E0009 again exhibited 'Truman' level resistance. Release of these lines, planned for 05/06, is delayed. Breeder seed was produced in Colorado. Several advanced lines with FHB resistance equal to those lines are in second and third year yield tests.

Impact (3):

Dramatic increase in the probability of breeding commercially acceptable soft white winter wheats with FHB resistance equal or superior to Sumai 3.

As a result of that accomplishment, what does your particular clientele, the scientific community, and agriculture as a whole have now that they didn't have before? (3):

Superior breeding parents.

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.

Abstracts:

Jiang, Guio-Liang, JianRong Shi and Richard Ward. 2005. "QTL Mapping of Fusarium Head Blight Resistance in Novel Wheat Germplasm." In: Canty, S. et al. (Eds.), Proceedings of the 2005 National Fusarium Head Blight Forum, 2005 Dec 11-13, Milwaukee, WI; East Lansing: Michigan State University. p. 43.

Jiang, Guo-Liang, Yanhong dong, Lee Siler and Richard W.Ward. 2005. "Resistance to Fungal Spread and DON Accumulation of *Fusarium graminearum* in Wheat." In: Canty, S. et al (Eds.), Proceedings of the 2005 National Fusarium Head Blight Forum, 2005 Dec 11-13, Milwaukee, WI; East Lansing: Michigan State University. p. 44

Forum Proceedings:

Canty, S., T. Boring, J. Wardwell, L. Siler, and R. Ward (Eds.). 2005. Proceedings from the 2005 National Fusarium Head Blight Forum, Milwaukee, WI; December 11-13. Michigan State University, East Lansing, MI.

Reports:

Ward, Richard, and Lee Siler, 2005. Michigan State Wheat Variety Trial: 2005. Michigan State University, East Lansing, MI.

Invited Talks:

The US Wheat and Barley Scab Initiative: Progress and Prospects. Presentation by David Van Sanford (Co-Chair of the USWBSI and Director of the NFO) to the National Association of Wheat Growers, San Antonio, TX, February 2006.

The US Wheat and Barley Scab Initiative: Progress and Prospects. Presentation by David Van Sanford (Co-Chair of the USWBSI and Director of the NFO) to the Wheat Quality Council, February 2006

The US Wheat and Barley Scab Initiative: Progress and Prospects. Presentation by David Van Sanford (Co-Chair of the USWBSI and Director of the NFO) to the Illinois Wheat Growers, Mt. Vernon, IL, February 2006

The US Wheat and Barley Scab Initiative: Progress and Prospects. Presentation by David Van Sanford (Co-Chair of the USWBSI and Director of the NFO) to the North American Millers Assn. Technical Committee, Marco Island, FL, March 2006.