

**USDA-ARS / USWBSI
FY04 Final Performance Report
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Cover Page

PI:	Tomohiro Ban
Institution:	CIMMYT
Address:	Km. 45, Carretera Mexico-Veracruz P.O. Box 60326 Texcoco, C.P. 56130 MEXICO
E-mail:	t.ban@cgiar.org
Phone:	52-55-5804-2004
Fax:	52-55-5804-7558
Year:	FY2004 (approx. May 04 – April 05)
FY04 ARS Agreement ID:	59-0790-0-F076
FY04 ARS Agreement Title:	International Wheat and Barley Germplasm and Information Exchange through CIMMYT.
FY04 ARS Award Amount:	\$ 88,390

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Adjusted Award Amount
GIE	International Bread Wheat Germplasm and Information Exchange Through CIMMYT.	\$ 58,537
GIE	International Durum Wheat Germplasm and Information Exchange Through CIMMYT.	\$ 16,585
GIE	International Barley Germplasm and Information Exchange Through CIMMYT.	\$ 13,268
	Total ARS Award Amount	\$ 88,390

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: *International Bread Wheat Germplasm and Information Exchange Through CIMMYT.*

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

The overall goal of this collaboration is to increase genetic resistance to Fusarium Head Blight (FHB) as quickly as possible in commercially grown USA bread wheat varieties and thus significantly increase the production and yield stability of wheat in the United States of America.

Researchers at CIMMYT are working on incorporating genetic resistance for FHB into commercially grown bread wheat varieties; specifically identifying and combining resistant types I (penetration), II (spread), III (low toxin content) and IV (tolerance, good grain filling in the presence of the disease). Sources of resistance from genetic sources have been identified in Brazil, Japan, Argentina, China and Romania, Ukraine, South Korea and Uruguay. These are acquired and then evaluated by CIMMYT in Mexico, China and Uruguay. Resulting data and resistant germplasm are shared with the USWBSI. Additional promising sources of Type II resistance have been identified in synthetic wheats.

The best sources of FHB resistance have been crossed with USA bread wheat parents and the most promising germplasm will be shipped to USWBSI contacts. Web-access of global International Wheat Improvement Network data is anticipated during this project year.

2. What were the most significant accomplishments?

- During the 2004 summer cycle we marked and artificially hand-inoculated 10 spikes each of spring bread wheat entries to evaluate for Type I and Type II resistance, independently. Selected resistance lines were sent to Rick Ward. Most accessions were introductions from outside Mexico. All related data files were sent to Anne McKendry and Rick Ward.
- We screened the 400 CIMMYT-derived entries sent to the USWBSI over the past years with nine markers with the help of Manilal William at CIMMYT. Less than 10% contained the 3BS locus derived from Sumai#3. This was reported at the Florida scab meeting (2004).
- The best spring wheat scab resistance sources were used to (back)cross resistance into six elite high yielding lines from Richard Trethowan's 'rainfed wheat' program. These materials are presently in the F3 and F4 stage. Half the sources contained the Sumai#3 3BS locus and molecular markers will soon be applied on these populations.
- Analysis of the 8th Scab Resistance Screening Nursery indicated several agronomical superior accessions to express high FHB resistance in three distinct locations. Several of these were crosses that did not involve Chinese lines and hence may contain novel resistance worthy of study. And, the 9th Scab Resistance Screening Nursery was globally distributed to 59 cooperators in 22 countries.
- All data means (including that on FHB response) for all of CIMMYT's international nurseries and yield trials are now available on the following CIMMYT websites
 - IWIN: <http://www.cimmyt.org/iwin/index.htm>.
 - Data download: <http://www.cimmyt.org/wpgd/index.htm>.

Accomplishment: The overall goal of this collaboration is to increase genetic resistance to Fusarium Head Blight (FHB) as quickly as possible in commercially grown USA bread wheat varieties and thus significantly increase the production and yield stability of wheat in the United States of America. Less than 10% bread wheat germplasms contained the 3BS locus derived from Sumai#3 among 400 CIMMYT-derived entries screened as high performance to FHB resistance and sent to the USWBSI over the past years. Several of these were crosses that did not involve Chinese lines and hence may contain novel resistance worthy of study. Analysis of the 8th Scab Resistance Screening Nursery indicated several agronomical superior accessions from the CIMMYT nurseries to express high FHB resistance in three distinct locations.

Impact: This is the first time that broadness of the genetic diversity on FHB resistance lines selected in CIMMYT nurseries was analyzed by molecular markers. It is the first step for globally G x E effect on FHB resistance through international nurseries. It will provide wheat and barley breeder and scientist novel FHB resistance germplasms with information of their reliability from world wide collaboration.

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?:

All data means including that on FHB response for all of CIMMYT's international nurseries and yield trials are now available on the CIMMYT websites. The best sources of FHB resistance have been crossed with USA bread wheat parents and the most promising germplasm will be shipped to USWBSI contacts.

Project 2: *International Durum Wheat Germplasm and Information Exchange Through CIMMYT.*

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

The overall goal of this collaboration is to increase genetic resistance to FHB as quickly as possible in commercially grown USA durum wheat varieties and thus significantly increase the production and yield stability of durum wheat in the United States of America.

Researchers at CIMMYT are working on incorporating genetic resistance for FHB into commercially grown durum wheat varieties. Sources of resistance from genetic sources are limited, but have been identified in CIMMYT main-stream breeding lines. Wide crosses will be used in which the D genome resistance of *Ae. tauschii* accessions will be transferred into the durum A genome. The most promising materials will be shipped to USWBSI contacts.

2. What were the most significant accomplishments?

- We marked and artificially hand-inoculated 10 spikes each of spring durum wheat entries for evaluating Type I and II resistance.
- We pre-screened 36 accessions of *Triticum dicoccon* and 164 accessions of *T. dicoccoides*, and two and six accessions were promoted for the screening, respectively.
- It appears that a more appropriate strategy would be to introgress the D genome resistance for FHB into the durum wheats; a strategy that has some supporting cytogenetic evidence of preferential homoeologous pairing but needs further investigation before execution.
- One *Aegilops tauschii* accession of FHB resistance was crossed with durum (Capelli *ph1c* mutant), and F1 hybrids were obtained.

Project 3: *International Barley Germplasm and Information Exchange Through CIMMYT.*

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

The overall goal of this collaboration is to increase genetic resistance to FHB as quickly as possible in commercially grown USA barley varieties and thus significantly increase the production and yield stability of barley in the United States of America.

Researchers at CIMMYT are working on incorporating genetic resistance for FHB into commercially grown varieties; specifically identifying and combining resistant types I (penetration), II (spread), III (low toxin content) and IV (tolerance, good grain fill in the presence of the disease). Sources of resistance from genetic sources have been identified in Brazil, Japan, Argentina, China, Korea and Uruguay. These will be evaluated by CIMMYT in Mexico, China and Uruguay and included in the breeding programs. The best sources of FHB resistance have been crossed with US parents and segregating populations are being screened for other foliar diseases in Toluca, Mexico. The most promising materials are shipped to our USWBSI contacts.

The project aims to develop as quickly as possible, FHB resistant germplasm that will minimize the threat of Fusarium head blight to the producers, processors and consumers of barley.

2. What were the most significant accomplishments?

- We marked and artificially hand-inoculated 10 spikes each of barley entries for evaluating Type I and II resistance. The data will be shared with USWBSI.
- Testing of the North American Barley Scab Evaluation Nursery in Toluca, Mexico.
- Crosses were made to major USA cultivars to transfer FHB resistance to agronomically suitable germplasm.

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.

PUBLICATIONS:

- Lillemo M, van Ginkel M, He ZH, Chen X, 2004: CIMMYT – China shuttle breeding for durable resistance to powdery mildew in wheat. 15th International Plant Protection Congress, Beijing, China, May 11-16, 2004.
- Lillemo M, van Ginkel M, Crossa J, 2004. Interaction effects of locations and evaluation methods on Fusarium Head Blight in bread wheat. 15th International Plant Protection Congress, Beijing, China, May 11-16, 2004.
- Van Ginkel, M., L. Gilchrist, F. Capettini, M. Kazi, W. Pfeiffer, M. William, T. Ban, and M. Lillemo. 2004. .Breeding for global resistance to FHB. In: T. Ban (Ed.) Collaborative research for Fusarium head blight resistance in wheat and barley. JIRCAS Working Report No.37, Japan International Research Center for Agricultural Sciences, Tsukuba. Pp. 20-25 in: Proceedings of JIRCAS FHB Workshop. February 10-11, 2004, Tsukuba, Japan.
- Lewis, J. M., K. Suenaga, M. van Ginkel, L. Gilchrist, J.R. Shi, G.L. Jiang, S. Kravchenko, A. Mujeeb-Kazi, and R.W. Ward. 2004. Identification and mapping of a QTL for type II resistance to Fusarium head blight on chromosome arm 2DL of wheat. In: Proceedings of 2nd International Symposium on Fusarium Head Blight, Orlando, Florida, USA, December 11-15, 2004.
- Van Ginkel, M., M. William and M. Lillemo. 2004. CIMMYT's FHB field research approach, evidence for host-by-location interaction and potentially new genetic diversity in resistance in wheat. In: Proceedings of 2nd International Symposium on Fusarium Head Blight, Orlando, Florida, USA, December 11-15, 2004.