USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY05 Preliminary Final Performance Report
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Cover Page

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Fiscal Year:	**2005**
FY05 ARS Agreement ID:	**59-0790-5-F093**
Agreement Title:	**Novel FHB Resistance Sources in Bread Wheat from International Genetic Resources.**
FY05 ARS Award Amount:	**$ 80,000**

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Adjusted Award Amount
GIE	Novel FHB Resistance Sources in Bread Wheat from International Genetic Resources.	$ 58,537
GIE	Novel Sources of FHB Resistance in Durum Wheat Through Use of Wild Relatives.	$ 21,463
	Total Award Amount	**$ 80,000**

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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: *Novel FHB Resistance Sources in Bread Wheat from International Genetic Resources.*

1. What major problem or issue is being resolved and how are you resolving it?
The most potent sources of resistance available to US FHB researchers derive primarily from a single source, Sumai 3. The heavy reliance on a single source of resistance is problematic as it presents a risk should breakdown of the resistance occur, potential problems with linkage drag associated with the resistance, and because Sumai 3 alone does not provide adequate resistance under conditions of heavy epidemics. CIMMYT is resolving this problem by searching for other sources of resistance through the evaluation of genetic resources (from our gene bank and shuttle breeding programs- inclusive of new synthetic/synthetic derived wheats) and the exchange of elite and research germplasm among FHB researchers around the world.

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):
An entirely new FHB screening system was initiated in 2006. The primary screening site has been changed from Toluca to El Batan, Mexico, where the FHB group is situated and closer monitoring of the disease can occur. In addition, a new misting system, following the pattern of those that have proven to provide excellent and uniform disease conditions in the US (under the counsel of Dr. Thomas Scherer and Dr. Ruth Dill-Macky), is being implemented on 4.7 acres for highly effective conditions for screening. In addition, the *Fusarium* isolates that were previously used for screening wheat at our primary screening site were identified as *F. crookwellense*. New *F. graminearum* isolates were collected and identified for future FHB screening that have the following characteristics: 1) are pathogenic and virulent in greenhouse assays; 2) are DON producers; 3) show a relatively high accumulation of DON in a rice medium; and, 4) are relatively good symptom producers in a live leaf assay which is being developed.

Impact (1):
This change in location, improvements in environmental conditions for disease, and improvements in the selection of isolates used for inoculation will provide more effective disease conditions and enable more accurate identification of resistant materials. .

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):
Improved screening capabilities in Mexico for the identification of resistant materials.

Accomplishment (2):
In March 2006, 50 researchers and breeders from 18 countries participated in the "CIMMYT Workshop on the Global Fusarium Initiative for International Collaboration". Participants discussed the most critical research needs, opportunities for web-based knowledge, opportunities for international collaboration, and action plans regarding QTL, pathogens, and international nurseries. Outcomes of this meeting included plans for the development of the first globally developed and distributed international nurseries for winter and spring wheat for the exchange of potentially useful *Fusarium* resistance and research materials. These nurseries are now being

assembled (see Accomplishment 3). Research plans were proposed for greater understanding and monitoring of *Fusarium* pathogens around the world. In addition, plans were discussed for more focused efforts to collaborate and consolidate information relating to QTL for Fusarium resistance, including the development of a review paper on the topic of FHB QTL and the use of web-technology for information sharing.

Impact (2):
This workshop has enabled leading world FHB researchers to jointly plan relevant research which can only be accomplished through international 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? (2):
The Global Fusarium Initiative endorsed by the March workshop provides a mechanism for creating a virtual community of FHB researchers with which to identify and pursue critical research objectives on a global scale that can only be accomplished through collaboration. The accomplishment of such objectives will allow the FHB community, as a whole, to more effectively understand the nature of FHB and combat the effects of it around the world through a greater understanding of host plant resistance and the pathogen, as well as enhanced exchange and utilization of important germplasm.

Accomplishment (3):
CIMMYT has initiated, through the collective request and endorsement by the participants of the March meeting (see Accomplishment 2), multi-origin international spring wheat nurseries that involve the active participation of top FHB researchers around the world. These nurseries will consist of the best breeding and research materials nominated by participants and will be screened world wide in uniform nurseries for validation and examination of resistance and interactive sharing of germplasm for the continued development of FHB resistant germplasm around the world. To date, 111 entries from eight institutions in six countries have been acquired, and additional entries are expected.

Impact (3):
The impact of this will be validation of various resistance sources, mutual awareness in the FHB community of available materials, and rapid deployment of valuable germplasm and corresponding knowledge to FHB breeders and researchers world-wide.

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):
World FHB researchers will have a mechanism for rapid access to FHB resistant germplasm irrespective of its origin. Likewise, the global FHB community will for the first time have a means of addressing global questions concerning variation in FHB pathogens and their interaction with the best available host plant resistances.

Accomplishment (4):
The majority of the FHB research at CIMMYT, including USWBSI and other major donors, is now under the management of the newly reconstituted CIMMYT Global Wheat Program. FHB is now considered one of the standard criteria for selecting parents for the crossing blocks in the Mexico shuttle system.

Impact (4):
The FHB improvement program is now an integrated part of CIMMYT's Global Wheat Program, which is the world's largest public wheat breeding program.

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? (4):
CIMMYT FHB research is informed by and benefits from the resources of CIMMYT's Wheat Program.

Project 2: *Novel Sources of FHB Resistance in Durum Wheat Through Use of Wild Relatives.*

1. What major problem or issue is being resolved and how are you resolving it?
FHB breeding in durum remains problematic because of the lack of potent resistance genes. We are resolving this problem through creation/selection of elite durum wheats containing the *Fhb1* allele for resistance on chromosome arm 3BS of the hexaploid wheat, introduction of resistance from other relevant genotypes in cytogenetic stocks, and examination of CIMMYT genebank materials.

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:
New genetic resources of durum wheat, potentially carrying resistances from hexaploid and diploid relatives have been created.
(1) Backcross-3 plants from crosses between hexaploid wheat 'Wuhan#3' and durum wheat were created and subjected to selection for *Fhb1* (via markers), leaf and yellow rust.
(2) F2 plants of crosses between *ph1c* bearing durum wheats and two putatively resistant *Aegilops tauschii* accessions have been developed. These plants are now being subjected to cytogenetic analysis to identify those carrying translocations from the *Aegilops* donor. These materials will be shared with the USWBSI,

Impact:
New genetic resources with potential FHB resistance have been generated in durum wheat.

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?:
Durum wheat with potentially new FHB resistance.

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.

Ban, T., Kishii, M., Ammar, K., Murakami J., Lewis, J., William, M., Peña, R.J., Payne, T., Singh, R. and Trethowan R. (2005) CIMMYT Challenges for Global Communication and Germplasm Enhancement for FHB Resistance in Durum and Bread Wheat. In: Proceedings 2005 US National Fusarium Head Blight Forum, December 11-13, Milwaukee, 6-10.

Ban, T., Lewis, J., Zeigler, N. and Trethowan, R. (2005) Global collaboration of genetic studies and breeding for Fusarium head blight resistance in wheat. In: Proceedings 2005 US National Fusarium Head Blight Forum, December 11-13, Milwaukee, 11.

Murakami, J. and Ban, T. (2005) Development of novel bioassay system for FHB molecular interaction. In: Proceedings 2005 US National Fusarium Head Blight Forum, December 11-13, Milwaukee, 167.

Kishii, M., Ban, T. and Ammar, K. (2005) Improvement of the FHB resistance of durum wheat. In: Proceedings 2005 US National Fusarium Head Blight Forum, December 11-13, Milwaukee, 52.

Murakami, J. and Ban, T. (2005) Development of novel bioassay system for FHB resistance evaluation and molecular interaction analysis. *Canadian Journal of Plant Pathology* (in press).

Ban, T. (2005) CIMMYT FHB research and international collaborations. In the 4th Canadian Workshop on *Fusarium* Head Blight, November 1-3, 2005 in Ottawa.

Ortiz, R., Ban, T., Bandyopadhyay, R., Banziger, M., Bergvinson, D., Hell, K., James, B., Jeffers, D., Kumar, P. L., Menkir, A., Murakami, J., Nigma, S. N., Upadhyaya, H. D., and Waliyar, F. CGIAR research-for-development program on mycotoxins. Mycotoxins: Detection Methods, Management, Public Health and Agricultural Trade. (in press).

Ban, T., Lewis, J., Zeigler, N. And Trethowan, R. (2005) Global collaboration of genetic studies and breeding for Fusarium head blight resistance in wheat. Proceedings of 7th International Wheat Conference, 27 November – 2 December, Mar Der Plata, Argentina, pp. 166bis.