Fifth Year
Quarterly Activity Report No. 1
July-September, 2006

Food Security in Bangladesh:
Improving Wheat, Maize and Papaya Production,
and Impacts of Arsenic Contamination

USAID Grant No. 388-G-00-02-00070-00

Submitted by
International Maize and Wheat Improvement Center (CIMMYT)
October 2006

USAID
FROM THE AMERICAN PEOPLE

CIMMYT

Table of Contents

Introduction

The period July 2006 to June 2007 is the last year of the five year project "**Food Security in Bangladesh: Improving Wheat, Maize and Papaya Production and Impacts of Arsenic Contamination".** This project is financed by USAID Grant No. 388-G-00-02-00070-00. All components of the project ended by June 2006, except for "Papaya Improvement through Ring Spot Viral Disease Resistance", which continues until June 2007.

Additionally the CIMMYT Office in Bangladesh continues to support some follow-up activities related to these three components of the project:

1. Facilitation and Promotion for Adoption of Mechanization by Growers
2. GIS - Bangladesh Country Almanac (BCA)
3. Whole Family Training in Maize

In this first 3-month report for the 2006-07 year, we describe the papaya project achievements against each proposed activity for the period July to September 2006 and highlight some interesting follow-up activities from the other components. A budget summary is also given.

Some progress has been made in deploying ring spot virus resistant papaya to Bangladesh. Additionally, the summaries of work on farm machinery, the BCA and maize training show continued interest and impact with these components, building well from the substantial support provided by USAID.

CIMMYT Office in Bangladesh, Dhaka, 31 October 2006

Facilitation and Promotion for Adoption of Mechanization by Growers

The project component on 'Facilitation and Promotion for Adoption of Mechanization by Growers' has brought lots of benefit to the farmers, including cost saving, reduced turn-around-time and reduced crop production costs. Significant interest was generated in the power tiller operated seeder (PTOS) by farmers, researchers and machinery suppliers. Hundreds of farmers have been interested to buy a PTOS for the 2006-07 farming year as a result of previous project activities on awareness and promotion. As an indication of project impact, farm equipment suppliers have now agreed to support farmers to access the PTOS. This enthusiasm by both suppliers and users led the CIMMYT Office in Bangladesh to continue the program with minimum funds from July 2006.

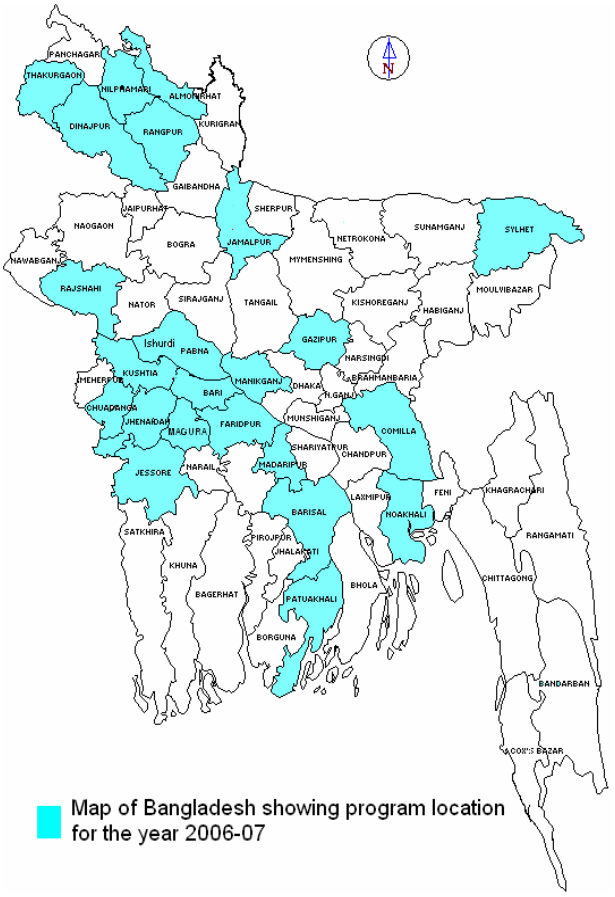


Figure 1.1: Map of Bangladesh showing the mechanization program sites

PTOS provision and training

A total of 35 PTOS were imported by Green Machinery Stores during the report period and sold according to a prior agreement with farmers (see Project Annual Report 2005-06, Section 1.6, Page 13). Most of the PTOS were distributed to farmers from Rajbari district on October 4, 2006. The PTOS were distributed as follows:

1.	Farmers at Rajbari district	21 units
2.	RDRS, Rangpur (NGO)	1 unit
3.	BLRI for triticale fodder program	1 unit
4.	WRSS, Rajbari, Dinajpur for triticale program	1 unit
5.	IRRI, Dhaka	1 unit
6.	Prova, Rajshahi for ACIAR lentil project	1 unit
7.	WRC, Dinajpur for ACIAR lentil project	1 unit
8.	Farmers of Rangpur district for DFID project	8 unit
	Total:	35 units

Sixty power tiller owners and operators were trained in a power-tiller, seeder, thresher and weeder operation, repair and maintenance course from September 16 to 18, 2006. About 50% of the training cost was covered by the FMPE Division of BARI and the rest came through CIMMYT.

Direct seeded Aman rice and mung-bean planting

During the monsoon season, 5.0 ha of aman rice seed (BR33; BR39 and BR 44 varieties) were planted directly through PTOS, Zero Till Drills and Bed Planters in farmer fields and in research plots. About 0.41 ha of mung-bean was planted at RDRS Rangpur by the PTOS. The crop field conditions, establishment and growth seemed very good. Yield and other data will be presented in the next quarterly report after harvesting the crops. Photographs of the program are given below:

Figure 1.2: Direct-seeded aman rice field at early stage

Figure 1.3: Direct-seeded aman rice field at harvest stage

Figure 1.4: Mung-bean field planted by PTOS

Figure 1.5: Machinery handover at Baliakandi, Rajbari district on October 4, 2006

Figure 1.6: PTOS Training Program during September 2006

GIS-Bangladesh Country Almanac (BCA): A User Friendly GIS Tool for Agricultural, Forestry and Natural Resource Management

The Bangladesh Country Almanac (BCA) project has a vision to increase the access of various stakeholders to and the effective use of integrated geo-spatial information related to agricultural research and development and natural resource management in Bangladesh.

BCA 3.0 is the largest offline CD-based database in Bangladesh, consisting of both spatial and attribute data on climate, land and soils, crops, demography, hydrography, infrastructure, health, marketing, livestock, forestry and poverty. The BCA is being applied for problem solving analysis such as identification of research locations, determination of extrapolation domains of potential technologies, assignments to university students by academicians for utilization of the available resource base and the design of development programs by extension and NGOs. Soil Resource Development Institute (SRDI) officially decided to use BCA as a platform to deliver field level data to its HQ.

Several activities have continued in the report period following from the release of BCA 3.0 and the series of training and awareness workshops conducted in the first half of 2006. To create awareness among the users and policy makers, a policy workshop, individual demonstrations, and institutional capacity development work was conducted during July-September, 2006. Additionally the CIMMYT officer responsible for the BCA worked with several end users on specific tasks and case studies that use the BCA.

Policy workshop

A Policy Workshop on BCA was held on 9 July 2006 at BARC HQ to raise awareness of BCA among a range of key government and NGO decision makers. Presided over by the BARC Chairman, Dr. Nurul Alam, the workshop received the honorable Minister for Agriculture, Mr. M. K. Anwar MP, as chief guest. Among others present were Mr. Kazi Abul Kashem, Secretary, Ministry of Agriculture, and Mr. Walter E Shephard, Acting Deputy Director of USAID. Heads and senior management of the NARS

Figure 2.1: BCA policy workshop at BARC on July 9, 2006

institutes, several other Government Organizations, some NGOs, Vice Chancellors and senior professors of several public universities attended the workshop.

Mr. Anwar Iqbal, Member Director, Planning and Evaluation, BARC delivered the key-note presentation on BCA – its history, content, capabilities, present state of use and future development plan. The presentation was followed by discussions.

In his welcome address Dr. Stephen Waddington, the CIMMYT Country Liaison Officer for Bangladesh, described BCA as an extremely successful product of the USAID funded project that comes with an updated database on many sectors. BCA has catalyzed the interchange of data from many organizations and made those available to common users for wider applications. BCA has already been put to many exciting and innovative uses in Bangladesh.

Figure 2.2: CIMMYT Country Liaison Officer commenting at the Policy Workshop about the exciting and innovative use of BCA

The Acting Deputy Director of USAID expressed his satisfaction with the success of the BCA project and remarked that the BCA tools and database could be very useful to the people and organizations involved in agricultural research and development and natural resource management. He looked forward to see the full application of BCA in Bangladesh.

Mr. Kazi Abul Kashem, Secretary, Ministry of Agriculture termed BCA a 'warehouse' of information on agriculture, natural resources and many other topics and expects it will be well used in research and resource management planning. He encouraged that cooperation among different organizations would continue in data sharing to update the BCA database and stressed the need for capacity building. He expressed his hope that USAID would continue its assistance for further enhancement of BCA.

Figure 2.3: Honourable Minister for Agriculture delivering his speech on BCA at the BCA Policy Workshop, July 2006

Mr. M K Anwar, Honorable Minister for Agriculture in his chief guest's deliberation stressed the need for efficient utilization of resources for optimum harvest. The minister said that although food grain production has increased several-fold over the last couple of decades, a significant part of our population still suffers from malnutrition. He cited his experience in yield gap assessment in rice cultivation and said that the farmers' yield gap is actually a knowledge gap on production technologies. He urged the scientists and extension agencies to develop mechanisms to transmit research information to the farmers for reducing their knowledge gap. The BCA was key part of that process.

In the discussion, Mr. Ibrahim Khalil, the Director General, Department of Agricultural Extension (DAE) said that DAE finds the BCA useful in their extension planning and suggested to incorporate more information on fisheries and livestock in BCA as these sectors are equally important. Executive Chairman, SPARRSO proposed that the BCA should have a database on suitable areas for hybrid rice that has a higher production potential than the other varieties.

Dr. L R Khan, Vice Chancellor of Bangabandhu Sheikh Mujibur Rahman Agricultural University said that data on ground water resources is important in developing an effective irrigation policy for efficient utilization of ground water and the design of location specific water management practices. Md. Eshaque Ali, Secretary of National Nutrition Council (BNNC) said that BCA carries important data on agriculture, nutrition and other aspects but there should be adequate training on how this information particularly that from the Block or Upazila level can be used and integrated for national level planning. Mr. Abdur Rashid Sikder of DAE informed that the block level mapping is appreciated by extension workers for block level planning of extension activities.

Prof. R I Sarker of Bangladesh Agricultural University described BCA as a powerful tool for use by researchers and extension agencies for the benefit of farmers. He stressed the need for adequate training of Upazila extension offices, who are directly involved in agricultural development planning, in the use of BCA. Further suggestions were made on continuing to update BCA with the latest information and on the need for a BCA training unit.

In his concluding remarks, Dr. Nurul Aman, Executive Chairman, BARC described BCA as a user friendly GIS tool that does not require expensive GIS facilities and GIS expertise. BCA can be used for precision planning to reduce the yield gap, a concern of the honorable minister. The partners should continue their work to update the BCA tools and the database HRD program. He reiterated the importance of BCA database and requested different agencies and organizations to train staff to collect and process data and to provide authentic data for continued advancement of BCA. He also urged USAID and CIMMYT to continue their support.

Demonstrations

NGO representatives attended demonstrations on BCA held at the CIMMYT office. In some cases, BCA was demonstrated to some interested organizations on request of the latest update.

Database

The Upazila database provided in the BCA was updated. The following crop information for 2005-06 was obtained and added to the BCA:

1. Area, Production and Yield of Rice (Aus, Aman, Boro)
2. Area, Production and Yield of Wheat, Maize
3. Area, Production and Yield of Cash Crops (Jute, Sugarcane)
4. Area, Production and Yield of Pulses (Lentil, Mung, Gram, Mashkalai, Kheshari, Motor, Arhar, Felon)
5. Area, Production and Yield of Oilseeds (Mustard, G. Nut, Soybean, Till, Tisi, Gorjon, Sun Flower)
6. Area, Production and Yield of Spices and Potato (Chilli, Onion, Garlic, Turmeric, Ginger, Coriander, Kalozira, Methi, Potato, S. Potato)
7. Area, Production and Yield of Vegetables.

CD Distribution

Our new version of BCA is being distributed among existing interested users. A plan has been developed to give the CDs along with small demonstrations to the following organizations and universities:

1. Bangladesh Sugarcane Research Institute and Regional Agricultural Research Station of BARI, Ishurdi
2. Rajshahi University, Rajshahi
3. Hazi Mohammad Danesh Science and Technology University, Dinajpur
4. Wheat Research Centre, Dinajpur
5. Regional Agricultural Research Station of BARI, Jessore
6. Khulna University, Khulna

Several international visitors also received copies of the BCA CDs.

Software License Distribution

More than 100 BCA licenses have been provided to BCA users after expiry of the trial license. The software allows users to test it for a period of 60 days commencing on date of installation. If there is no license for the application, or if the license expires, it will automatically prompt to enter a new license code. Upon expiry of the

runtime license, users register with the CIMMYT Office in Bangladesh or BARC for further renewal of their license. The BCA license renewals revolve on an annual basis. The license expires after every one year, after which users can request for a free license code renewal.

Future follow-up

Since there is no fund for follow-up activities of BCA after releasing the latest version, DAE, BARC and some other Govt. agencies have been requested to continue human resource development on the use of BCA from Govt. funds. Additionally, the CIMMYT Office in Bangladesh and partners will continue to seek opportunities for new funding for this work. Meanwhile we will continue to work with existing users to update the databases and to use the BCA in case studies.

Whole Family Training in Maize

Maize whole family training was launched in 2001. Since then, every year many farm families have been trained by the project on maize cultivation practices to increase the livelihoods of the rural poor. Additionally, various types of production research trials and other activities were conducted during the last few years to improve the content of maize whole family training. We continued a few activities on this program during July to September 2006, including assistance to BARI and other partners to continue the training with their own funds. Here we highlight activities during this quarter from July to September, 2006.

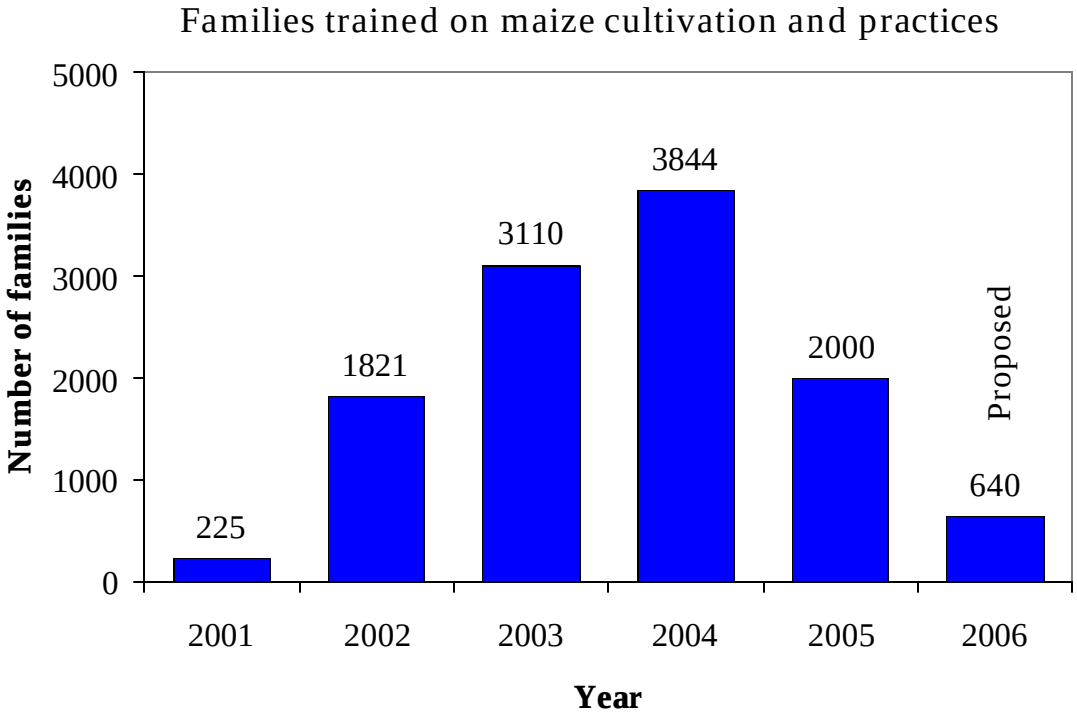
The CIMMYT Office in Bangladesh imported and distributed parents of CHTTY-A (CIMMYT trial – Tropical Yellow Normal and QPM) and TTWSCYLA (Tropical three-way and single crosses yellow late normal and QPM) seeds from CIMMYT HQ in Mexico at the request of the Plant Breeding Division of BARI (see below).

Trial code	Trial name	Trial description	No. of sets requested
ILWH0703	CHTTW	Elite Tropical late white Normal and QPM hybrid trial	3
ILYH0704	CHTTY	Elite Tropical late yellow Normal and QPM hybrid trial	3
ILYH0706	TTWSCYL	Advanced Tropical three-way and single crosses yellow Normal and QPM late	3
ILYH0731	CHTSY	Elite Subtropical late yellow Normal and QPM hybrid trial basically single crosses	3
SLYH0773	SA14-HY	Tropical late Yellow hybrid trial	3
EIWH0796	ECA-QHT07	Intermediate white QPM hybrids	3
EIWH0798	IRMA-SB-HVT07	Intermediate white stem borer resistant hybrids	3

Dr. Greg Edmeades, Consultant of CIMMYT HQ, visited Bangladesh during September 8-10, 2006 to collect and share ideas and experiences on maize research and development including constraints to growth, suitable hybrids, reliable seed supply, sustainable agronomic practices and maize seed production in Bangladesh. We facilitated him to meet different maize scientists and seed agencies.

Through encouragement by this project, the Plant Breeding Division of BARI has developed plans to organize maize whole family training with 640 families for October-December 2006, using BARI resources. A new version of our maize whole family training manual has been finalized to print for the training program.

Different partners are now asking for CIMMYT's assistance to continue maize research and development activities. As the crop shows great promise, we are looking for further funds to expand research and development activities with maize in Bangladesh.



Development of Ring Spot Virus Resistant Transgenic Papaya in Bangladesh

Key activities planned	Targeted no. of trainees /achievement	Time & duration	Achievements
i. Approval of application to import and test transgenic papaya in confined net house and confined field trials	Conduct various meetings	July 2006–June, 2007	The queries from BARC from the second-time resubmitted application were addressed. There were two major points requiring clarification: 1) There was some concern that given the way the Material Transfer Agreement (MTA) was written, BARI may not be able to commercialize papaya within the country. This is only part one of a two-tier MTA. This part is just between BARI and Cornell regarding the IP on the use of up to five genetic papaya lines having virus-free transgenic potential for experimental testing up to its release. When BARI wishes to release the seed within the country, another MTA will be formalized between the parties. No royalties or GOB liabilities will be entailed as long as papaya fruit and seed remain within the country. However, if anyone wishes to export the fruit or seed commercially outside of the country, then BARI and Cornell together will consider appropriate royalties. The MTA is very clear that once these seeds are received by BARI, they become the property of BARI. It is a very generous MTA. 2) The second point for clarification concerned the possibilities of a papaya program budget for infrastructure and human resource development associated with transgenic papaya. We explained that there is only one donor for biotech currently in Bangladesh, i.e. USAID. When it developed the holistic program, it gave $2.5 million to the Horticulture Research Centre for its infrastructure development. USAID then established the ABSPII to continue biotech infrastructure development and human resource development. They have done a tremendous job in

Key activities planned	Targeted no. of trainees /achievement	Time & duration	Achievements
			training BARI, BRRI, and BARC personnel both within the country and outside. Similarly, ISAAA and AgBios worked hard for in-country training. The program that USAID approved for transgenic papaya was to 'fast-track' a very unregulated GMO that has proven to be safe in many countries around the world so that a GMO could be potentially quickly tested and possibly released to growers where the 300-600% yield increases and drastically improved fruit quality would make a tremendous impact in growers' fields. The above clarification was sent to the DG of BARI for follow-up. As of October 31, 2006, the application remains at BARI where it has next to be submitted to the BARI biosafety committee and then the Ministry of Agriculture.
ii. Results from first screening of transgenic lines at Cornell by Fuchs		July 2006–June, 2007	Previously, Dr Akanda, sent USDA dried tissue of a number PRSV isolates collected throughout Bangladesh. USDA analyzed the coat protein sequences of six of these isolates and found that their coat protein gene shared 96% similarity to the Hawaiian isolate of PRSV for which we had developed genetically engineered papaya. Based on these data, we predicted that the transgenic papaya would be resistant to the Bangladesh isolates because our earlier studies showed that our transgenic papaya was resistant to PRSV isolates with 92-100% similarity to the Hawaiian PRSV. Attempts by Marc Fuchs to transmit PRSV from the dried tissue to nontransgenic papaya growing at Cornell University failed; we don't have permission to inoculate foreign strains of PRSV to papaya in Hawaii due to risk to the industry. Thus, we asked Dr. Akanda to send us fresh tissue from

Key activities planned	Targeted no. of trainees /achievement	Time & duration	Achievements
			the isolates that he had sent previously. He did not have fresh tissue at the time and collected fresh tissue from other PRSV isolates from the field. Marc Fuchs successfully transmitted those isolates to papaya at Cornell University. Marc inoculated our transgenic papaya with one of the isolates that he had recovered from the fresh tissue that Dr Akanda sent. Unfortunately, the transgenic papaya was susceptible to that isolate. One possibility was that the isolate was not as closely related to the Hawaiian PRSV as the previous isolates that Akanda sent as dried tissue and which USDA had analyzed for coat protein sequence. We subsequently analyzed the coat protein gene of the isolate that overcame the resistance of our transgenic papaya, and it showed only an 88% similarity to the previous isolates that Dr. Akanda sent. This is the likely reason that the PRSV isolate overcame the resistance of our transgenic papaya. Since USDA's previous analysis of six Bangladesh isolates showed that they shared 96% similarity to Hawaiian PRSV, we asked Dr. Akanda to send us fresh tissue of those specific isolates that we had tested. He only had dried tissue. Thus, we asked him to collect fresh samples from around his University and from the area in BARI where we expect to test transgenic papaya when it is introduced. Dr. Akanda recently sent these samples to Marc Fuchs who has inoculated them to nontransgenic papaya to establish a fresh culture at Cornell. We are awaiting the results of his recovery tests. We should get these results shortly.

Key activities planned	Targeted no. of trainees /achievement	Time & duration	Achievements
			Recent tests again verified the suggestion that our transgenic papaya is resistant to PRSV isolates with 92-100% similarity with the Hawaiian PRSV. Our transgenic papaya was resistant to Mexican PRSV isolates that showed 96% similarity to the Hawaiian PRSV. These tests were conducted by Marc Fuchs at Cornell.
iii. Shipment of first seeds of selected lines to Bangladesh		July 2006–June, 2007	We have obtained 17 transgenic lines with the synthetic gene that shows very high similarity to all PRSV isolates. These transgenic lines are being micropropagated so we can have sufficient clones of each line to test against the PRSV isolates from Bangladesh. These clones should be ready for testing in the first half of 2007. These are additional potential transgenic papayas that could be useful for Bangladesh.
iv. Screening first transgenic lines in net house and confined field tests		September 2006 - June 2007	
v. Development of papaya agronomic guidelines for Bangladesh			Research work was done in North West Bangladesh by Mrs. Jackie King – a Ph. D student of Cornell University. She has reported the following findings from her research: Over the measurement period, papaya yielded less than 10 kg ripe fruit per plant under PRSV and environmental stresses and about 50 kg / plant without these stresses. Papaya seedlings planted in October were quickly infected with PRSV due to abundance of the aphid vector, but recovered somewhat after the winter to provide ripe papaya about six weeks earlier than seedlings planted in April. A combination of planting dates and continuing some trees into the second year has potential to improve fruit availability over the year.

Key activities planned	Targeted no. of trainees /achievement	Time & duration	Achievements
			Results showed that the application of poultry manure greatly improved papaya yield under certain conditions. For example, manure amendments gave the greatest yield response in sandy soils and in those locations that were prone to flooding. In contrast, the addition of lime to an acid sandy soil had a very limited effect on papaya yield. Laboratory analyses are currently being conducted to better understand the role of manure and micronutrients on papaya growth and possibly tolerance to disease. In addition, papaya samples that were obtained from experiments at Pabna and Rangpur will be analyzed for vitamin content.