Approach to Enhancing Nutrition Security with Safe Vegetables and Fruits in Bangladesh

BACKGROUND NOTE TO CONSULTATION WORKSHOP

At

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EXECUTIVE SUMMARY

Horticultural produce with high nutritive value and is considered to be a vital component of a diversified and nutritious diet. They become all the more important for nations like Bangladesh where highly prevalent malnutrition makes nutritional security an important public health concern. While it is possible to address malnutrition by including horticultural produce in daily diet, it is equally important to ensure the quality and safety of such food making food safety a prime concern.

The horticultural sector in Bangladesh today faces critical food safety problems seriously impacting the quality of the produce. Both on and off farm interventions are required to deal with these critical concerns in an expedient manner. Major issues include huge post harvest losses, lack of knowledge on good agricultural practices (GAP) and good handling practices (GHP), inadequate market infrastructure, and water contamination. As a result of these issues, the fresh produce reaching the consumer has serious microbial and toxicological contamination resulting in cases of food borne illnesses more so in the underprivileged community owing to their inability to access modern retail.

It is understood that interventions for the horticultural sector development in Bangladesh can lead to effective reduction in incidence of food borne diseases and ensured nutrition intake for the people. In addition, resource poor farmers and their families can engage in horticultural farming on their small land holdings, thus providing them with an additional source of income.

The Government of Bangladesh has identified food safety in horticulture as a key area requiring immediate strategic interventions. To address this issue, the Bangladesh Mission and the Bangladesh Agricultural Research Institute (BARI) approached USAID with seven key objectives: crop yield improvement, seed delivery system, post harvest technology, food safety and adoption of GAP, food processing and value addition, market linkage, and extension education.

This led to the conceptualization of a project under HortCRSP in Bangladesh that brings together BARI, Cornell University, University of California Davis and Sathguru Management Consultants. While the lead partners will engage in exploring technological solutions to address major issues and implementing the project, many public and private institutions within Bangladesh will also be associated by the partners in this initiative on need basis.

In view of the fact that the efforts to realize these objectives may not begin together, farm level food safety and adoption of GAP was considered to be a near term priority, with other objectives forming part of the long term plan. To address food safety in horticulture, a two phase approach was taken, with first phase dedicated for planning and second phase for execution.

As part of the first phase, in May-June, 2011 meetings with key stakeholders were planned in Bangladesh to understand the ground level situation. This background note has a detailed account of these meetings and the findings. A consultation

workshop is subsequently being held in Dhaka from 16 to 18 August, 2011 to collectively develop an action plan for efforts to be taken during the second phase.

INTRODUCTION AND APPROACH

Horticultural products which include fruit, vegetables and nuts, are vital for the daily diet as these contain micronutrients, fibers, vegetable proteins and bio-functional components. Consumption of fruits and vegetables is vital for a diversified and nutritious diet. Vegetables, especially leafy, have significant amounts of calcium, iron and some other minerals including vitamins A and C. Dietary diversification through horticultural food intake can be seen as a sustainable approach to fighting micronutrient malnutrition. This will require adequate supply, access to, and consumption of a variety of safe horticultural produce.

Even though the nutritional status of children and women in Bangladesh is very poor and needs special attention in order to improve the overall health status of the population, continuing low consumption of fruits and vegetables has been observed. Despite various interventions designed under National Nutrition Program (NNP), the low birth weight, malnutrition, dehydration from diarrhea, continue to be important contributing cause of childhood mortality. The estimated number of deaths due to diarrhea was about 45,000 in 2004 (HNPSP 2008), which can be attributed to food borne illnesses.

The exhibit below shows food wise per capita daily dietary intake related data in Bangladesh. Factors influencing utilization of food such as food preference, general health conditions, overall environment under which food is prepared and consumed impacts the absorption of food and the consequent nutritional status of people.

Exhibit 1: Per capita food intake by food items and residence

Food items	Per capita daily intake (grams)					
	2005			2000		
	National	Rural	Urban	National	Rural	Urban
Cereals	469.2	485.6	419.3	486.7	502.8	422.4
Rice	439.6	459.7	378.5	458.5	478.8	377.7
Potato	63.3	61.9	67.5	55.0	54.7	58.4
Vegetables	157.0	156.5	158.7	140.5	140.1	137.9
Pulses	14.2	12.7	18.6	15.6	15.0	19.0
Milk/milk prod.	32.4	31.0	36.6	29.7	29.0	32.6
Edible oil	16.5	14.3	22.9	12.8	11.3	19.1
Meat, egg	20.8	17.6	30.7	18.5	15.4	31.0
Fish	42.1	39.7	49.6	38.5	37.8	40.9
Spices, candy	53.4	50.2	63.1	50.0	48.5	56.1
Fruits	32.5	32.4	32.9	28.4	26.5	35.6
Sugar/gur	8.1	7.5	9.7	6.9	6.4	8.8
Miscellaneous	38.2	36.9	42.5	10.0	10.2	8.9
Total	947.7	946.3	952.1	893.1	898.7	870.7

Source: BBS (2007a).

Although Bangladesh has accomplished food security, household nutrition security will depend upon the per capita consumption of balanced nutritious food. It is essential that resource poor communities secure affordable and safe food that is nutritionally rich. Even with requisite quantum of production at the farm gate, the nutrition security can be seriously impacted if the food produced is not safe to be consumed or treated for post harvest processing needs.

Horticultural interventions to enhance food safety at farm level combined with extensive nutrition and food safety education can offer a long-term food-based strategy to control and eliminate micronutrient malnutrition in the resource poor people. Horticultural production is relatively easy for unskilled people and it can play an important role in poverty alleviation programs and food security initiatives by providing work and income opportunities.

WHY FOOD SAFETY IN HORTICULTURE

Bangladesh is blessed with many horticultural crops. More than 90 vegetables, 60 fruits and 25 spices are grown in the country. Major vegetables include potato, tomato, brinjal, cabbage, cauliflower, aroids, pumpkin, bottle gourd, cucumber, pointed gourd, bitter gourd, hyacinth bean and yard long bean. In case of fruits, banana, pineapple, papaya, jackfruit, mango, guava, lemons, pummelo, litchi and jujube are important. Major spice crops are chilli, onion, garlic, turmeric and ginger. Some of the popular flowers are rose, gladiolus, tube rose, dahlia, chrysanthemum, marigold, night jasmines and belly. The total cultivated area of horticultural crops is about 0.69 million hectare which is about 5% of the total cropped area (BBS 1996).

The horticulture sector in Bangladesh produces around 3.2 million metric tons/year. The total production of vegetables in Bangladesh is about 2.5 million tons, which is far below the required 11 million tons to feed its population. Statistics indicate that, with the current population boom in Bangladesh, 12.60 million tons of vegetables will be required to feed its estimated population of 172.90 million in the year 2020. To increase the output five fold in a span of ten years is not an easy task. Lack of adequate varieties, non-availability of quality seeds, inadequate crop protection measures, high cost of production, and seasonality are some of the major deterrents to vegetable production in Bangladesh.

In addition, the small farmers engaged in horticulture production in Bangladesh suffer economic losses due to, lack of high yielding varieties and hybrids; post harvest technologies; food safety issues and processing facilities. Among them the food safety issues affect marketable produce, human health and food quality resulting from high chemical and microbial content and also due to unhygienic production and storage facilities.

Post harvest losses in Bangladesh are 38%, and it accounts for significant potential income loss mostly to small farmers who are largely women. As per a recent study conducted by the World Bank in Bangladesh, more than 47% of farmers use more pesticides than the recommended limits. Another alarming factor limiting food

safety in Bangladesh is the spread of food borne diseases due to the presence of high levels of pathogenic bacteria and other harmful micro organisms in leafy vegetables, fruits and legume crops in Bangladesh as well as other developing nations in the South Asian region.

OBJECTIVES FOR HORTICULTURE SECTOR DEVELOPMENT

The government of Bangladesh has identified food safety in horticulture produce as an important area which needs immediate strategic interventions. Bangladesh mission along with other leading regional institutions such as Bangladesh Agriculture Research Institute (BARI) collectively felt the need to address food safety issues in the Bangladesh horticulture sector more seriously and this was shared with the USAID mission through a report. This report highlighted the following seven major areas which require immediate strategic interventions to address the key constraints hindering the growth of the horticulture sector in Bangladesh:

1. Crop Yield Improvement: Despite the conduciveness to produce fruits and vegetables, the food security of the country is constantly challenged by natural phenomenon such as soil salinity, drought, pests, pathogens and climate change. There is enormous need for imparting durable resistance to horticultural crops of economic importance for various biotic and abiotic stresses while implementing strategies for sustainable yield increase using technologies that can transform horticulture in Bangladesh.
2. Seed Delivery System: The contribution of the formal seed sector to the national seed requirement of most of the crops ranges from 5-6% in Bangladesh, while 94-95% of seed supply is managed by the informal farmer saved seed and uncontrolled imports. The public sector is eager to play a key role in promoting and developing the seed industry in Bangladesh. Their envisaged role includes varietal development, source seed production, seed multiplication, seed certification, quality control, seed processing and storage, seed distribution and marketing, seed security and support to develop the private seed industry.
3. Post Harvest Technology: Huge post harvest losses in fruits and vegetables and meagre cold storage facilities are a big constraint in Bangladesh for horticulture sector development. Nearly 75% of the tuber crops are stored at home under unsanitary conditions. Due to the lack of many post harvest arrangements, the farmers resort to illicit preservation techniques by applying hazardous chemicals, compromising on food safety.
4. Food Safety and Adoption of GAP: The current output of horticultural crops that are harvested in Bangladesh are prone to heavy doses of contamination with toxic chemicals, food borne bacteria and pathogens due to exposure of the crops to indiscriminate spraying of chemicals and movement of harvested produce in unhygienic conditions prior to their consumption. Food contamination exposure also occurs due to lack of processing capacity and lack of access to technologies

to store harvested produce. The ability to detect food borne pathogens is limited due to lack of appropriate detection systems.

5. Food Processing and Value Addition: The food processing sector in Bangladesh relies heavily on its domestic agricultural production and mainly focuses on serving domestic requirements. In recent times, fruit and vegetable processing has received considerable attention in Bangladesh. However, the efforts have not been converted to meaningful results due to lack of access to vital technologies necessary for value addition.
6. Market Linkage: The unavailability of real time information to farmers on the wholesale prices of horticultural produce in the nearby markets has been a major reason of low returns on the farm produce. Substantial progress is foreseen in Bangladesh under various on-going projects to enhance the domestic and international market access for horticultural products.
7. Extension Education: The Bangladesh agriculture backdrop is constrained by weak extension systems seriously impacting transfer of suitable technologies to the farmers. While extension is an important element of each of the objectives mentioned above, revamping the system is considered to be a key and is therefore addressed separately under this objective.

PARTNER INSTITUTIONS

The CRSP project in Bangladesh brings together Bangladesh Agriculture Research Institute, two leading universities in the US, Cornell University, Ithaca, NY and UC Davis, California, and Sathguru Management Consultants, a techno-market advisory body based in India as leading partners in this effort. While the US institutions and BARI will explore together the technological solutions to address major issues, BARI will act as a lead in-country implementation partner, with Indian partner providing translational support for technologies and the market access strategy. Many public and private institutions in Bangladesh with synergistic efforts will also be associated by the partners in this initiative on need basis.

NEAR TERM AND LONG TERM OBJECTIVES

Considering various resources available and the number of areas to be addressed as part of the overall plan, partners felt the need to prioritize and arrive at near term and long term objectives of the planned engagements.

Near Term Objectives

Considering **farm level food safety and adoption of GAP** as the immediate priority which can bring about maximum impact in short time to improve the livelihood, partners collectively selected it as near term objective, and decided to achieve this objective in two parts over a period of 4 years.

Part-1 being a one year effort, to carry out a ground level situation analysis study for developing understanding of the current synergistic efforts in food safety in horticulture sector and identifying potential partners. Subsequent to this study, a stakeholder consultation workshop is planned to be organized in Dhaka for sensitization of potential partners on critical elements of the project, and to collectively develop action plan for Part-2 of the project.

In Part-2, which will be a three years engagement, will undertake various tasks relating to baseline assessment of prevalence of food borne pathogens and chemicals; implementation of measures to enhance the level of food safety through adoption of a package of practices that are cost effective, sustainable and globally relevant; Capacity building and awareness programs in the area of food safety; and development of detection systems with low cost.

Long Term Objectives

The long term plan would involve efforts on all seven key objectives of the partners aiming at accomplishing holistic socio economic gains for the economy of the Bangladesh.

PRE-WORKSHOP STUDY IN BANGLADESH

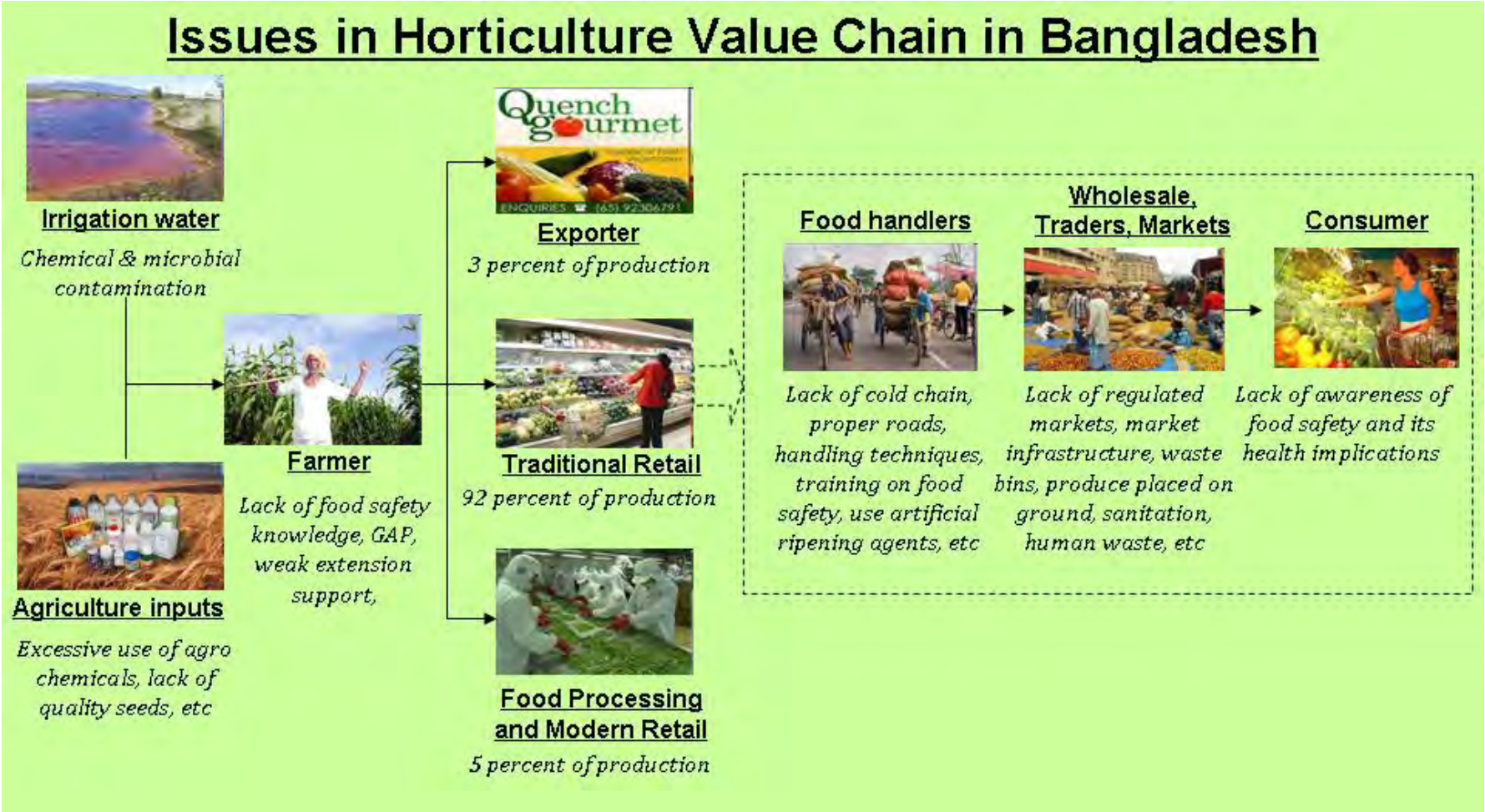
A team of experts from HortCRSP visited Dhaka to meet with stakeholders working in the areas of horticulture food safety in Bangladesh. The purpose of this visit prior to the consultation workshop planned in August, 2011 was to understand the current level of efforts that are being pursued by Bangladeshi institutions working in the area of food safety in horticulture. As part of this preliminary work, meetings were held with the government departments, NGOs, and private institutions in Bangladesh. A chronological list of these meetings is provided in *Annexure 1.*

Key Issues Flagged During the Pre-Workshop Study

The visiting team had a wonderful opportunity to meet with senior officials and heads of the institutions with synergies in horticulture food safety. These institutions were identified prior to the visits and appointments were sought from key officials to understand their current engagements in food safety; their strengths; synergies with our efforts; willingness to collaborate; and to understand the status of data availability related to sampling of produce for heavy metals, microbial contamination, pesticide residues and other post harvest losses. The local fresh produce markets were also visited to gain awareness on the food handling practices adopted.

The key links in the horticulture value chain in Bangladesh are farmers who produce vegetables; wholesalers/food-handlers/retailers who buy, distribute or sell these vegetables to consumers; and consumers who buy these vegetables from markets and consume them.

Exhibit 2 highlights various food safety issues prevailing in each link in the value chain



The visiting team understands that strategic interventions with clear understanding of the issues prevalent in the value chain can play a pivotal role to bring in a turnaround in the horticultural sector in Bangladesh. What follows are key issues that were highlighted by the key stakeholders in various segments, followed by observations of HortCRSP team.

Farm Level

Issues flagged by stakeholders

- High chemicals and pesticide usage in fruits and vegetables
    - Indiscriminate use of pesticides by farmers
    - Artificial ripening chemicals used for fruits like banana, mango, etc
    - Artificial color in Potol (local vegetable) to make it look greener
- Little efforts towards development and implementation good agricultural practices (GAP) which can ensure food safety in horticultural produce
- Contaminated water is used for irrigation and on farm washing of fresh produce after harvesting
- Very limited amount of food processing and value addition happens, although it can effectively reduce the high post harvest losses

Observations

The Bangladesh food chain from the farm to the consumer must be considered in unison when developing mitigation plans that are to effectively improve food safety. Early in this food chain is the farmer. Appropriate education and mitigation measures aimed at farmers can have obvious benefits in the livelihood of all agricultural workers by improving health, reducing occupational risk and successful adoption of mitigation measures resulting in greater overall farmer income.

There is need to create awareness among the farmers about causes of food borne illness due to chemical and microbial contamination. It is often assumed that farmers may learn from government and NGO-based farm extension advisors, however, there need for external experts to educate these trainers providing knowledge in the areas of food safety and GAP implementation, so that the extension professionals are in a state of preparedness. The hazards of chemical toxicants are generally recognized but the implementation of improved farming practices are impaired by the misconception that reducing chemical use will result in lower horticulture crop yields, quality and shelf life.

Food Borne Diseases

Issues flagged by stakeholders

- Most prevalent food borne disease in Bangladesh is diarrhea and its cases are reported every day, with major causes/sources for it being poor sanitation and hygiene, bottle feeding in infants, water contamination mainly in the rainy season
- Rota virus, ecoli, salmonella, cholera are major microbes causing diseases
- Tube well water, city municipal water supply, pond water are the major sources of drinking water in Bangladesh, and many times salmonella (non typhoid) has been detected in drinking water samples. More than 35% of the population depends on packaged water for human consumption needs
- Prenatal nutrition - women eat after feeding others in the family and their health is not considered on priority in the society
- Food poisoning - need to check the safety of all agro chemicals which are being used, presence of heavy metals can also be looked into
- Absence of central food safety surveillance system to generate base line data on pesticide residues, heavy metals, etc. Arcenic, Cadmium, lead and mercury are the major problems in heavy metal contaminants category
- Absence of hi-tech and modern food safety laboratories and rapid detection kits for surveillance work

Observations

It is observed that there is the need to enhance the quality of baseline data compilation. Most of the institutions having a food safety mandate in Bangladesh which were visited by the HortCRSP team informed that very little baseline data relating to levels of toxicological and microbiological risks in fresh produce is available, and the credibility of whatever little available is questionable.

Throughout the food value chain the sources of health risk include both infectious microbes and chemical toxicants transmitted through contaminated food. Among the infectious microbes impacting the population *Salmonella*, *Shigella,* enteropathogenic *E. coli* and *Campylobacter,* are derived from animal and human reservoirs. These microbes enter the food chain at various points along the food chain. On the farm, the common entry points include the use of contaminated surface water for irrigation and application of incorrectly composted animal waste. *Vibrio cholerae* is an additional infectious microbe that is endemic in the watershed that presents seasonal issues.

There is also serious risk introduced post harvest when horticulture products are "cleaned" or "washed" using unhygienic methods with contaminated water and reusing of untreated water. Other poor practices include, reusing unclean containers, storage on the ground and lack of sorting. Adoption of mitigation measures to improve these practices can provide greater food safety, decrease product losses and increase quality. The common misconception by farmers, handlers and sellers is that if food looks clean then it must be safe. Another source of contamination comes from the complete lack of hand washing and toilet facilities on

farms and in local markets. This presents Bangladesh with a guarantee for continued routine food borne disease outbreaks.

The health outcomes due to infectious microbes in water and food consumed by the Bangladeshi people are both acute and chronic manifestations of diarrheal disease. A visit to the Women's and Children's Hospital in Dhaka provided informative first-hand observations of those stricken by diarrheal disease. Physicians reported that the incidence of diseases by food borne illness was exasperated during the dry season and was a countrywide issue. Hypothetically, this is due to less water flushing and diluting areas of contamination in the environment where animals or humans are housed. For many people, the persistence of chronic diarrheal illness is accepted as a normal part of challenges of everyday life. Chronic diarrhea is especially problematic for children who suffer symptomatically and continue with long-term health deficits caused by chronic interruption of normal nutrition absorption from a diet that is generally nutritionally limited. Children in regions where chronic food borne illness is prevalent, combined with nutritional limitations develop more slowly with decreased overall cognitive functions.

The health risks from the combined exposure to infectious and chemical hazards result in depressed abilities of human immune response and diminished nutrition. Decreased immune system function sets up a downward spiral of health for farmers, farmer's families and consumers of horticulture products. The long-term effects take society a generation or more to overcome.

Produce Handling & Markets

Issues flagged by stakeholders

- Huge post harvest losses occur due to improper facilities for food storage and transportation
- Insufficient power supply is also a major issue. Current supply levels are not sufficient to support the storage facilities.
- Lack of proper infrastructure for selling of produce. Local fresh produce wholesale markets are in a bad shape with food products lying in mud under unhygienic conditions in the wet markets, coupled with improper fresh produce handling practices
- Insufficient and contaminated water usage for short term preservation of fresh fruits and vegetables by small retailers
- The imported fruits and vegetables coming from Aus, India, etc are also not being tested for pesticide residues

Observations

Furthermore, horticulture products are sold in local markets where visits (in Dhaka) by the HortCRSP team during June, 2011 revealed a complete lack of post harvest considerations that can promote both shell-life, quality and food safety. Generally,

products lay directly on the ground in contact with water, waste, and dirt. During periods of rainfall, vendors crowded into the sheltered areas making space for people by placing fruit and vegetables out into the surrounding streets and walkways. The use of tables and clean containers was limited. The location of garbage bins or waste piles on the ground was often directly adjacent to vendors selling fresh products. Human fecal and urine remains was not restricted as toilet facilities were absent. It was observed that defecation and urination by humans occurred in areas near waste bins and near vendors on the periphery of the market. There was no hand washing facilities available.

There is need to develop customized training programs which are relevant for food handlers and retailers, and also engage in organizing training programs to provide latest scientific knowledge on good handling practices (GHP) covering all the food safety aspects. Partners feel that lack of storage and cool chain transportation facilities severely restricts timely movement of products from producer to the ultimate consumers. This requires attracting government's attention for policy level interventions.

Capacity Building

Issues flagged by stakeholders

- Malnutrition is rampant all over Bangladesh therefore adequate nutrition of family food is very important area to be addressed. Modern malnutrition is as high as 46% and the traditional one is as low as 11%
- Consumption of fruits and vegetables is not common in Bangladesh as they are expensive, and food habits in Bangladesh are different in which meat, fish, beef, chicken and eggs are preferred over fruits and vegetables. Modern foods like Complain, Horlicks, Cerelac, are popular all over the country and they don't suffice the nutritional requirement
- Horticultural produce gets contaminated at both on farm and off farm. Therefore, food safety related training a vital need, as people are not aware of the health hazards of microbial and chemical contamination. Sensitization workshops for the producers, food handlers and also for the consumers is a basic requirement

Observations

There is a severe need for education that involves modern approaches to promote behavioral adoption of good agricultural practices that improve food safety. Adoption of GAP combined with appropriate streamlined local and national policy will positively benefit farmers through increased livelihoods, better health and a reduction of occupational hazards. Mitigation of infectious and chemical food safety hazards is a complex goal. Successes will be achieved through a combination of various objectives such as implementing appropriate irrigation practices and proper application of composted waste. Further success can be achieved through proper

limited use of chemicals and fertilizers. There is a need for educating farmers, handlers and sellers on proper toilet usage and hand washing. Post harvest technologies can be implemented that improve shelf-life of products while improving food safety.

The food chain is a complex open-ended system involving farmers, collectors, distributors, and sellers. The food agribusiness sector of Bangladesh is dynamic in ways that prevent interventions that depend highly on the control of a "closed" food chain. Implementing educational programs is a challenging element in a program that seeks behavioral changes in a population. The educational targets may be well-defined but the methodologies for achieving positive outcomes are not always clear. Recent successful programs have implemented participatory action plans that directly target farmers, collectors and sellers or target trainers who then interact with aforementioned. Most important is that the educational program directly involves participants in planning and executing the educational plan. An enormous challenge in food safety education programs is creating positive reinforcing incentives to enable lasting behavioral changes. One successful approach has been the use of participatory projects. Priorities for project goals can be assigned by participants to best ensure that they are directly involved throughout the program. Implementing a participatory program will require trained specialists who can provide onsite programs with follow up sessions on a routine schedule.

A pilot project to this effect may be planned and expanded to other areas at a later stage.

EXPECTED IMPACTS

The overall impact of the near term efforts under HortCRSP will be beneficial economic engagement of farmers in sustainable horticulture crop production by adopting good agriculture practices through a long term engagement of partners to introduce, disseminate and adopt good agriculture practices; reduce the incidence of food pathogens and chemical residues in food; and enhance the value of the farm produce through appropriate adoption of post harvest technologies. These interventions will factor comprehensively the impact of each intervention on enhancing the engagement of women in the decision process, adoption of best practices that will benefit women farmers and women engaged in small enterprise level value enhancement projects and capacity building among women students to gain exposure to best practices so that they can effectively disseminate them to the needy players in the farming to food marketing network of the country. The project will address an important component of the holistic development need, the need to produce safe horticulture products that are free of contaminants. A much larger impact that this project will create on the society will be the establishment of healthier living conditions among resource poor Bangladesh nationals due to better access to nutrition and lower spending on malnutrition driven health issues.

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ANNEXURES

Annexure 1: HortCRSP acknowledges the time and support provided by the following organizations during the pre-workshop meetings in Dhaka in May-June, 2011

Meeting Date	Organization
May 25, 2011	Bangladesh Agriculture Research Council (BARC)
May 26, 2011 and June 9, 2011	Bangladesh Agricultural Research Institute (BARI)
May 29, 2011	Atomic Energy Centre (AEC)
May 30, 2011	Institute of Epidemiology, Disease Control & Research (IEDCR) & National Influenza Centre (NIC)
May 31, 2011	International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b)
June 1, 2011	BRAC University
June 1, 2011	National Institute of Preventive & Social Medicine (NIPSOM)
June 2, 2011	Food and Agriculture Organization of the United Nations (FAO)
June 6, 2011	Gemcon Food & Agricultural Products Ltd
June 7, 2011	Bangladesh Agriculture University (BAU)
June 8, 2011	Consumers Association of Bangladesh (CAB)
June 9, 2011	Hortex Foundation
June 9, 2011	Department of Agriculture Marketing and Department of Agriculture Extension
June 11, 2011	Institute of Child and Mother Health (ICMH)
June 14, 2011	Bangladesh Standards and Testing Institution (BSTI)
June 15, 2011	BSAFE Foundation
June 15, 2011	Institute of Food Science & Technology (IFST)