

PROCEEDINGS OF DISSEMINATION WORKSHOP FOR THE DFAT-PSLP ACTIVITIES

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1.0 Introduction

A day-long workshop was jointly organized by the University of Sydney, Australia and Bangladesh Agricultural Research Institute (BARI) in collaboration with Horticulture Export Development Foundation (Hortex Foundation) to review the Department of Foreign Affairs & Trade (DFAT)-Public Sector Linkage Programme (PSLP) activities of postharvest management of vegetables for improved nutrition and livelihood funded by DFAT, Australia formerly AusAID. The workshop disseminated update status of project activity under DFAT (62354) namely “Improving Nutrition and Livelihoods through Efficient Postharvest and Supply Chain Management of Vegetables in Bangladesh”. The workshop further shared current findings & experiences of DFAT-PSLP project among the high officials of Ministry of Agriculture, Government of the People’s Republic of Bangladesh, Bangladesh Agricultural Research Council (BARC), BARI, Department of Agricultural Extension (DAE), traders, farmers, entrepreneurs, scientists, researchers and national & international experts of Hortex Foundation attended the workshop. The workshop was held on 25th of November 2013 at 9.00am to 4.00pm in the BARC Training Room # 01, Farm gate, Dhaka-1215. About **50 (pls. check)** diverse participants attended the workshop. The list of participants is shown in **Annex-1 (to be developed by HRC of BARI)**. Mr. Mitul K. Saha (Agriculture Economist), Assistant General Manager (Supply and Value Chain, Marketing, R&D), Hortex Foundation served as a rapporteur of the workshop. The workshop had two sessions, i.e. inaugural and technical sessions. Activities of each session are appended briefly.

2.0 Workshop sessions

2.1 Inaugural session

The inaugural session was chaired by Dr. Wais Kabir, Executive Chairman, BARC. Md. Anwarul Islam Sikder, ndc, Additional Secretary, Ministry of Agriculture (MoA), Government of Bangladesh (GoB) was the chief guest while Dr. M. Rafiqul Islam Mandal, Director General, BARI was present as special guest in the workshop. The session started with the recitation from the Telwat-e-Quran.

2.1.1 Welcome speech

Dr. Anowarul Bokshi, Research Associate and Consultant, Faculty of Agriculture and Environment, the University of Sydney, Australia welcomed the respected chairman of this session, honorable chief guest, special guest, A/Professor Dr. Robyn McConchie, Head, Department of Plant and Food Sciences, Faculty of Agriculture & Environment Resources, the University of Sydney, Australia, Director of Horticulture Research Centre (HRC), Managing Director of Hortex Foundation and the distinguished participants and experts present the workshop. We are very much delighted due to Additional Secretary, MoA, GoB join in the workshop as the chief guest, Dr. Bokshi said. In his welcome address, he said that this is an activity of DFAT, Australia. He briefly highlighted main focus of the workshop for sharing

experiences of last two year activities under DFAT programme. He mentioned that post harvest loss reduction of some vegetables and how we can reduce the losses are the main aim of this programme. He further stated that, we provided standard operational practices, training manual and different trainings tools to the different stakeholders for minimizing post harvest losses of vegetables. Dr. Bokshi said that there will be created awareness by engaging leadership of local people on systematic management of post harvest losses of vegetables which will further generate rural employment and development under this programme. He added that some specific recommendations will come from the workshop that helps further for designing interventions in the project area. He informed the audience that two scientists of Hortex Foundation and HRC of BARI visited Australia for attending two weeks hands-on training cum study visit on post harvest management of vegetables under this programme. How the supply chain will functional, this is the challenge of the programme, he added. He mentioned that, they enjoyed the present activities and hopes for the successful ending of this programme. He further thanked to Dr. Md. Saleh Ahmed, Dr. Md. Anisur Rahman and Dr. Alamgir Hossain, DG of BARI and Managing Director of Hortex Foundation to run the activities of the programme successfully. He extended his thanks to DFAT, Australia for supporting the programme. Finally, Dr. Bokshi said that, A/Prof. Robyn McConchie learned a lot from visiting Bangladesh and he thanked to Ms. McConchie for her special soft corner for Bangladesh.

A/Prof. Dr. Robyn McConchie, the University of Sydney, Australia welcomed the respected chairman of this session, honorable chief guest, special guest and the distinguished participants attended the workshop. She said that, they worked 12 international projects in Vietnam, Laos and Asia Pacific Region on post harvest management of agro-commodities. She thanked project officials for arranging visits at different places to see the beauty of Bangladesh. She further mentioned that this project is giving collaborative support for post harvest management of vegetables for improved nutrition and livelihoods. She added that this is beginning for future collaboration.

2.1.2 Remarks by special guest

Dr. M. Rafiqul Islam Mandal, Director General, BARI in his address as the special guest expressed that he is delighted to join in the programme and thanked to all participants attended the workshop. He said that 30-40% loss is occurred on horticultural crops after harvest time and added that efficient post harvest management can determine producers profit and food security in Bangladesh. He shared major constraints of horticulture sub-sector like inefficient handling & transportation system, poor packaging and too many actors are involved in the supply chain. Dr. Mandal further shared major challenges of horticulture sub-sector like minimization of post harvest losses, linking operation & capacity building of different actors, better marketing system. He added that improved strategies are needed for value addition of horticultural products where public-private sectors can jointly work to eliminate the problems of this sub-sector. In 2011, BARI received this collaborative project from AusAID. After receiving this project, BARI and Hortex Foundation had made some interventions minimizing post harvest losses of vegetables for fulfilling more demand of continuous growing population, he mentioned. For assuring quality, safety and capturing export opportunity of vegetables, we should generate technology, develop human resource for improving nutrition and livelihoods of the peoples, he suggested. He also said that future development should be focused on demand driven. He stated that BARI is

working on capacity building for research. He demanded that DFAT (former AusAID) will continue support for Bangladeshi scientists & experts for giving support hands-on training in Australia. Finally, he wishes every success of this programme.

2.1.3 Remarks by the chief guest

Mr. Md. Anwarul Islam Sikder, ndc, Additional Secretary, Ministry of Agriculture, Government of the People's Republic of Bangladesh in his address as the chief guest expressed his satisfaction for arranging this type of workshop at right time and given special thanks to respected chairman of the workshop Dr. Wais Kabir, special guest Dr. M. Rafiqul Islam Mandal, A/Prof. Robyn McConchie, Dr. Anowarul Bokshi, Dr. S M Monowar Hossain, and agricultural scientists, university professors, farmers, traders, entrepreneurs, learned participants including officials of BARC, DAE, BARI, Hortex Foundation and international organizations attended the workshop. At first Mr. Islam highlighted significant importance of the workshop due to vegetables are highly perishable where 25-40% post harvest losses are occurred. He said that post harvest loss not only reduces income of the farmers but also reduces nutritional value of the vegetables. This type of loss created several problems for the farmers, he added. He mentioned that Govt. of Bangladesh has taken several initiatives for post harvest management under different projects, but this is not sufficient. He also shared the audience that Govt. of Bangladesh is now aware of food safety and safeguard of human health issues. He thanked to the University of Sydney, BARI and Hortex Foundation for intervene this project successfully minimizing post harvest losses of vegetables in Bangladesh. His thanks also extended to Govt. of Australia for financial support of this project. He further stated that Bangladesh Agriculture Policy 2013 specifically highlighted the issues of post harvest loss and its minimization process. He expected that this type of technology cooperation programme will reduce the post harvest losses of vegetables in Bangladesh. He suggested that shelf life extension of vegetables, innovative way of research, introduction of Good Agricultural Practices (GAP), cool chain transportation and up gradation of laboratory facilities should be ensured for combating post harvest loss minimization in Bangladesh. He also stated that there are some debates on GAP, but he believed that we have to go for introduction of GAP fulfilling requirements of international standards, otherwise quality, food safety and agro-commodity export will be hampered in near future. He mentioned that BARI has developed lot of improved technologies on post harvest management that shall be disseminated to the farmers and others stakeholders involved in the supply chain. He further suggested that comprehensive demand driven technology should be developed where food safety issues will be addressed properly. He also said that MoA can facilitate any programme on post harvest management of agro-commodities if workshop organizer/relevant organization can place proposal to the Govt. for initiating special programme. Finally, he said that farmers and every stakeholder will be benefitted if everyone can contribute on this aspect as national issue.

2.1.4 Remarks by the chairperson

Dr. Wais Kabir, Executive Chairman, BARC, chairperson of the workshop thanked the respected chief guest, special guest, guests from Australia A/Prof. Dr. Robyn McConchie and Dr. Anowarul Bokshi and the distinguished participants of scientists, farmers and entrepreneurs attended the workshop. He appreciated Dr. Bokshi for implementing this project at *Kurigram*, Bangladesh with the financial support from DFAT (former AusAID). He said that this business meeting really important due to here joined number of experts from BARC, Hortex Foundation, BARI, DAE, University and other organizations. He mentioned that post harvest management of agro-commodities is today top priority and Ministries also they are talking about the issue. He

stated that there are many large projects in Bangladesh like National Agricultural Technology Project (NATP), Second Crop Diversification Project (SCDP), USAID HortCRSP, USAID IPMCRSP and all the projects are implementing issues of post harvest management and supporting the farmers/entrepreneurs for minimizing the post harvest losses of high value agro-commodities. He further said that we have to really protect not only the consumers benefit but also protect the producers benefit as well. Dr. Kabir mentioned that we have shifted our research goal due to see a disorganized total food supply chain in Bangladesh. He added that our policy makers, media, different organizations are talking about food adulteration, so that we need to have a bridge among the stakeholders for combating this issue. He said that we have to rather more proactive to deliver what the ideal situation in total food system. He informed the audience that our consumers are ready to pay some value added activities on post harvest management. In this regard, we can encourage our farmers and entrepreneurs and this is probably needed of the time to answer on post harvest management. Dr. Kabir stated that we want to bring international science and there is no matter of financial support. He further informed that our agriculture is now more productive and very increasing trend. This increasing trend needs to be improved further by necessary support and technical collaboration with different international organizations. As not only producer, we have to recognize the role of all actors like traders, processors, transporter involved in the supply chain, he added. Finally, he mentioned that we can have a more organize supply chain system in Bangladesh.

2.2 Technical session

The technical session was chaired by Dr. S M Monowar Hossain, Managing Director, Hortex Foundation and Director, Project Implementation Unit (PIU), Supply Chain Development Component (SCDC) of NATP. Total of five technical papers presented in this session.

2.2.1 The first paper was presented by **Dr. Anowarul Bokshi** and he made presentation titled on “*Post harvest Management of Vegetables in Bangladesh: Current Situation and Prospects of Improvement*”. Dr. Bokshi shared nature of post harvest losses of vegetables and suffering of Bangladesh on nutritional deficiencies where 16% population is under nourished and children stunting rate is 40% (FAO 2013). He said that the country has favourable climatic conditions for growing a wide range of vegetables year-round. However, production of vegetable is not profitable for the farmers at remote areas due to poor marketing system, and lack of packaging, transportation and storage are the major limiting factors. He also said that 1.25 million tons of vegetables are losing every year due to absence of proper post harvest management knowledge. By reducing the post harvest losses of vegetables through manageable practices, Bangladesh can significantly reduce its food and nutritional deficiencies, he added. Dr. Bokshi shared existing supply chain of vegetables in Bangladesh where packaging of the vegetables are changing in each of segment of the supply chain.

Dr. Bokshi further shared the audience on programme activities of DFAT (AusAID)-PSLP titled on “Improving Nutrition & Livelihoods through Efficient Postharvest and Supply Chain Management of Vegetables in Bangladesh” where the project officials gathered updated information on post harvest and supply chain management of vegetables, developed & disseminated standard operating procedures (SOP) training manual, provided post-harvest and supply chain management training to the scientists & supply chain stakeholders. He summarized the activity report with intervention strategies for post-harvest management.

Dr. Bokshi further mentioned that an introductory workshop on post harvest management of vegetables was organized under the programme in July 2012 where diverse participants from different organizations like BARI, HORTEX Foundation, BARC, BAU, SAU, BSMRAU, RDA, DAE, MoA attended and discussed planned activities of the project. He shared outcomes from the introductory workshop like limited knowledge and skills of the stakeholders for post harvest handling of fresh produces in the supply chain, proper post harvest treatment & packaging procedures are not practiced by the farmers and traders. He also shared limiting factors like packaging materials, transport, storage, skilled manpower, public awareness in the supply chain of Bangladesh for developing an improved post harvest handling system of vegetables. Dr. Bokshi informed the audience that some valuable recommendations were adopted from the introductory workshop for future interventions. He further mentioned that the team members of the project were visited extensively in different organizations like HRC & post harvest division of BARI, BSMRAU, RDA to know their research activities. The project organized discussion meeting with the vegetable farmers & traders at Kurigram and visited vegetable farm & market observing handling practices, he said. He added that the team also attended meeting with the Australian Embassy in Dhaka for sharing the project activities. He further shared experiences from the extensive field visits and current supply chain practices at project areas. He informed the audience that two scientist's one each from BARI and Hortex Foundation attended a Focus Course in Australia for their capacity improvement on post harvest management of vegetables. Under the programme, two training events were organized during 2013 at BARI and Rangpur for the stakeholders of vegetable supply chain on improved post harvest management of vegetables, he added. He further shared that this project developed a manual in 'Bangla' for improvement of knowledge on post harvest biology and physiology of vegetables and improved post harvest handling practices for the common Bangladeshi vegetables that might be created awareness among the stakeholders on proper post harvest handling system. He mentioned that two additional workshops were also conducted at Kurigram for creating awareness among the farmers and traders on post harvest handling and value adding practices of vegetables. Dr. Bokshi shared present outcomes of the DFAT-PSLP programme activities where they generated an updated baseline data on current post harvest losses of vegetables in Bangladesh (up to 30% physical loss), observed significant improvement of knowledge and developed capacity of the farmers, traders and scientists for modern post harvest management practices. He shared some programme activities for evaluation where traders have started to use baskets instead of gunny bag to avoid physical damages after receiving the training. Finally, Dr. Bokshi shared some recommendations for future interventions.

2.2.2 The second paper was presented by **Dr. Md. Alamgir Hossain**, Senior Scientific Officer (SSO), Post harvest Technology Section, Horticulture Research Centre (HRC) of BARI which was findings of DFAT-PSLP programme survey on postharvest losses of cabbage, cauliflower, radish, spinach and hyacinth bean at two selected areas of Kurigram and Jessore district in Bangladesh. He presented the paper very brief in an apprised form. The paper mainly highlighted efficacy of the current postharvest losses of vegetables in the different segment of supply chain and shared information with data on post-harvest physical and nutritional losses of vegetables. Dr. Hossain further shared schematic diagram of sampling operation at local, wholesale, retail markets and BARI laboratory where conditions of fresh vegetables were shown in different day's

interval by using ordinary and refrigerated truck. He further shared sampling for physical damage assessments and vitamin analysis of above mentioned vegetables using local transportation, refrigerated van and improved packaging. Dr. Hossain further shared per cent of total damages in fresh vegetables during handling in the supply chain from Jessore and Kurigram to Dhaka city markets. He highlighted vitamin A & C contents in vegetables during post harvest handling in the supply chain. He shared colorimetric assessment for freshness of five vegetables during postharvest handling and supply chain management. Finally, he said that there was no loss in vitamins but some vegetables had shown a tendency of increased content of vitamin C during three days of storage in the cool chain management system. On the other hand, ordinary transportation and retailing reduced the freshness of the vegetables indicated by the increased lightness of the green vegetables and decrease in the colour intensity, he added. He mentioned that proper packaging and cool chain management can significantly reduce physical and nutritional losses of fresh vegetables, which are essential for long distance marketing.

2.2.3 The third paper was presented by **Dr. Md. Anisur Rahman**, Supply Chain Knowledge Management Expert, SCDC of NATP, Hortex Foundation which was an overview of activities and achievements of focus course in Australia. He shared experiences and technologies of hydroponic leafy vegetables and protective farming system on farmer's field at Camden/Liverpool. He further shared characteristics of Australian agriculture like large farm size unlike Bangladesh, crop productions are mostly under protective form, hydroponic culture are prevalent for specialized crop, farmers are directly linked with the wholesale markets through wholesalers, fresh produces are centrally distributed through central markets etc. Dr. Rahman shared the audience on their experiences of research laboratory visit where they learned basic and applied research, metabolic process of shelf life, quality and maturity management system, effect of temperature on products and cooling methods, cooling and heat transfer on refrigeration, effect of respiration on food preservation, ethylene effect on ripening and studied water loss, chilling and heat on post harvest stress on fresh produces. He shared experiences of farmers field visit on flower orchard and seen the effect of temperature & environmental factors on the growth rate of flower buds and stem length and effect of cutting bud on the growth of the stem. He expressed pictures of one wholesale market where modern facilities existed like well structured assembly market, cool house augmentation, improved packaging system, ripening house and direct shipment for export & local market. After one flower market visit, Dr. Rahman said that their art of flower presentation were very attractive and suggested that underutilized/unutilized parts of flower may become the potential agribusiness in Bangladesh. He further shared the characteristics of secondary market that functions as retail market and price even lower than the retail market. He further shared supply chain of vegetables in Australia which was very short unlike Bangladesh. Dr. Rahman highlighted a Australian certification body i.e. The Freshcare Food Safety & Quality Program, which was established in 2000 through the support of Horticulture Australia Ltd (HAL) and the commitment of Freshcare's industry owner groups providing benefits to both suppliers and customers by linking food safety on farm to the quality and food safety management programs of the other members of the fresh produce supply chain. He further shared role of Central Markets Association of Australia (06 nos.) that plays a significant role as a central hub for marketing & distribution of fresh fruits and vegetables. The focus course team visited Research Institute at Gosford, New Castle i.e. Gosford Primary Industries Institute (GPII), which is the New South Wales (NSW) DPI's Centre of Excellence for Market Access and Greenhouse Horticulture. The Institute developed and implemented science-

based technologies and production systems for horticultural crops, he added. He further said that the protected cropping industries are some of the fastest-growing, most intensive and high-product value sectors in NSW, Australia. He added that they learned agriculture production management, market linkage, short supply chain, variety having physiological and biological control is inversely related to post harvest management, improved but low cost packaging system (Styrofoam box), quality concern, underutilized commodity turns utilized through better presentation from the two weeks focus course in Australia. Finally, he made some recommendations for future interventions in Bangladesh.

2.2.4 Dr. Md. Saleh Ahmed, Post Harvest Handling and Quality Assurance Expert, SCDC of NATP, Hortex Foundation presented the fourth paper which was an overview on post harvest handling and quality assurance systems of vegetables in Bangladesh: *current status & future actions*. Dr. Ahmed shared status of current availability and future demand of vegetables in Bangladesh. He said that according to HIES¹ 2010, rice consumption is decreasing in Bangladesh. He mentioned that post harvest handling system of vegetables are under developed in Bangladesh and huge post harvest losses (25-30%) occur in different points of the supply chain. He shared current post harvest practices where harvesting is done at any time of the day, lack of knowledge on maturity indices resulting immature and over mature produce are harvested, minimum sorting and grading and post harvest operations are done in unhygienic conditions. He added that packaging is done using gunny bags, used fertilizer sacks, bamboo baskets that provide very simple protection to the perishable items. He also said that inappropriate and unventilated transportation is used during transportation. He mentioned that rough unloading & reloading cause substantial losses in the wholesale markets and there are no storage facilities in the production areas, even in rural and urban markets. He said that farmers, traders are frequently using road space for assembling their produces. In the rural market, vegetables are exposed in open sun, he said. He added that farmers are using indiscriminate pesticides and ripening chemicals in their production period. Dr. Ahmed shared problems of post harvest management and quality assurance to the audience. He suggested that foldable plastic crates should be used widely for minimizing post harvest losses during transportation. He also added that SCDC, Hortex Foundation distributed more than 5000 plastic crates to the Common Interest Group (CIG) farmers at 20 project areas to minimize the losses of fresh produces. He shared problems of R&D institutions in Bangladesh and suggested that R&D support is needed on post harvest management. Dr. Ahmed further shared status of quality assurance system where quality control and standards is weak for vegetables. He also shared safety, quality deficiencies of vegetables due to weak monitoring & sanitary practices and quality losses after harvest due to poor handling practices. He shared the probable factors that affecting quality and safety of the produces like lack of collection centers and packing houses, inadequate transport and cool chain facilities. He suggested some specific strategy and future actions like develop maturity indices, design appropriate harvesting tools, conduct training, information dissemination, safety practices, easy access to tools and equipments, ensure project funding to minimize post harvest losses, subsidy, technical assistance, ensure investment from private sectors, proactive role & facilitation of Govt., provision for logistics & management, develop suitable packaging technologies, implementation of food safety legislation and creation of public awareness. Finally, he made some recommendations for immediate interventions.

¹ Report of the Household Income Expenditure Survey, Bangladesh Bureau of Statistics (BBS)

2.2.5 A/Prof. Dr. Robyn McConchie presented the fifth paper in the technical session titled on Fresh Produce Safety- the challenge ahead where she highlighted brief of quality assurance (QA) in Australian horticulture, the food safety operating environment, food safety issues & incidents and food safety research & development issues. She said that food safety is very critical issue where children's are in very vulnerable condition due to risk of their brain and kidney damages. She shared typical supply chain model in Australia where growers can directly sale their produces to the retailers/supermarkets/exporters and sometimes with the support of agents/merchants/facilitator. She highlighted wide range of requirements of food safety for producers where growers followed approved supplier program "Freshcare" in Australia. She further said that due to regulatory framework, food safety program becomes mandatory for 'food businesses' from 2001 in Australia. Dr. McConchie further shared QA operating environment where modern IT systems are followed for tracking the product quality. She discussed food safety issues in Australia with major findings like microbial contamination is the most prevalent category and salmonella is the most prevalent individual, residues not as significant as expected in their food chain. She mentioned that in Australia, horticultural crops made an early start into food safety management which was driven by government regulations and by customers' requirement. They are still trying to harmonize too many QA options in this sub-sector, she added. She mentioned that QA is a complex operating environment for fulfilling many different expectations and requirements for the industry. She added that despite so many efforts, there are still food safety issues are occurring. Dr. McConchie further stated that consumers are always expecting their food to be safe and regulators should protect public health. She added that producers are also responsible for healthy and nutritious food production for ensuring food safety. She said that still there are some failures to recognise responsibility of producers and buyers view of food safety. She mentioned that food safety affects everyone, so that it is a one kind of responsibility where all stakeholders must be proactive. In line with food safety management, she said that science can answer questions and identify the probable risk. She shared three basic questions like where do pathogens come from, how do they get on the crop and how can we kill them? She further mentioned that compost, irrigation water, animal vectors and wash water sanitation may be the key research areas where scientists can contribute for managing food safety. She highlighted different kinds of pathogens like E. Coli, Salmonella, L. monocytogenes, Campylobacter and Noroviruses. She further shared different research findings like problem of survival and regrowth of composting, irrigation water, wash water sanitation, animals as pathogen vectors etc. Finally, she shared model on Australian Fresh Produce Safety Centre (FPSC) and role of the FPSC at the University of Sydney.

3.0 Open discussions

Discussions on five papers presented in the technical session

Very lively open discussion was held on all the papers presented in the workshop. Mr. M. Ahsan Ullah, President, Bangladesh Flower Growers and Exporters Association & Director, Governing Body of Hortex Foundation said that infrastructure of Bangladesh is good in road and bridges. He further mentioned that nobody cares to maintain food quality, standards in the local market of Bangladesh. He suggested that emphasize should be given creating awareness on food safety & quality. Dr. Md. Altab Hossain, Director, HRC of BARI said that we need to link with global knowledge where Australia can help us to provide technical cooperation and support. Dr. Sreekanta Sheel, Logistics (Transport & Storage) Expert, SCDC of NATP, Hortex Foundation said that cool chain management operation is costly and suggested that ice packaging

of vegetables with Styrofoam box might be introduced here in Bangladesh. Dr. Miaruddin, Chief Scientific Officer (CSO), Post harvest Technology Division of BARI mentioned that food and nutritional deficiency should be properly addressed in the time of post harvest loss determination of vegetables. Prof. Dr. Md. Nazrul Islam, Department of Horticulture, Sher-e-Bangla Agricultural University (SAU), Dhaka said that government policy, right investment, academic & private sectors involvement is needed for post harvest management in Bangladesh. He mentioned that no quality researcher is coming in this field. He further added that at present indiscriminate uses of formalin and pesticides are the major problems of vegetables in Bangladesh. Dr. Feroz, CSO, BARI mentioned that short supply chain of vegetables and effective farmers-wholesalers linkage is needed for reducing post harvest losses. He suggested that we can linked with Agriculture Information Service (AIS) for producing different media promotion tools, short drama on post harvest management technologies for creating awareness on mass people. Officials of Rural Development Academy (RDA), Bogra mentioned that post harvest loss minimization is very important issue. He added that we should introduce specialized course curriculum in relevant university/institutes on post harvest management. He further mentioned that we should arrange low cost management technologies. Hortex Foundation trying to develop low cost materials/technologies under SCDC programme, he added. He suggested that post harvest technology should be fully utilized. Dr. Abul Kalam Azad, Director, SAARC Agriculture Centre (SAC) mentioned that development of skilled manpower is important issue for post harvest management as well as creation of employment opportunity in the project area. He informed the audience that technology is available on preserving fruits and vegetables for six months without using any formalin and chemicals.

4.0 Wrap-up

The technical session and open discussion was wrapped up by Dr. S M Monowar Hossain. He summarized the activities of the workshop and thanked all the participants including scientists, farmers, entrepreneurs attended the event. Dr. Hossain said that it was learning and teaching workshop that environment we created in this event. He mentioned that Bangladesh is suffering betel leaves export to EU countries due to *salmonella spp.* where Australia can help us. He said that stakeholders are the decision maker and they should work jointly with close hands for minimizing post harvest losses. He appreciated all the members attending in the open discussions and giving their comments and suggestions. Dr. Hossain said that from this workshop he is getting insight ideas for process of post harvest loss minimization. He appreciated the comments and valuable suggestions made by the participants. He further summarized the outcomes came from the discussions. After threadbare discussion, the workshop's outcomes were adopted.

5.0 Outcomes

- Created sensation in the grass root level on post harvest losses
- Organized important trainings for the stakeholders
- Exchanged ideas and views
- Two scientists visited Australia and get idea on post harvest management
- Find lot of scope for further work with Bangladesh and the University of Sydney
- Mechanism of funding with the University of Sydney
- Developed strong linkage with the University of Sydney.

6.0 Concluding remarks

Dr. Md. Altab Hossain, Director, HRC of BARI said that post harvest management is the crucial demand in the country that has to be given immediate attention. He further said that post harvest losses are very high (about 40%) in Bangladesh. From this point of view, organization of this workshop is very timely, he added. He mentioned that presence of the Additional Secretary, MoA as the chief guest definitely encouraged the workshop organizers and the participants. He said that Chief Guest's resourceful deliberations and valuable directions will guide us to further proceed with right track. He further summarized the recommendations came from the workshop. Finally, Dr. Hossain delivered vote of thanks to the Hon'ble chairperson, chief guest, special guest, technical paper presenters for their valuable speech and suggestions. He extended his thanks to the distinguished participants for their active participation and also HRC of BARI, Hortex Foundation officials and staffs who worked hard for success of the workshop. He further thanked to DFAT, Australia and the University of Sydney for supporting the programme. Finally, the workshop came to end with the thanks to and from the chair at 04.00pm.

7.0 Recommendations

- Advance research is needed for managing post harvest losses of horticultural crops effectively.
- Logistics facilities are not sufficient, so that that has to be ensured as per requirement.
- Develop efficient human resource for combating with post harvest management.
- Build capacity of HRC, Hortex Foundation, farmers, traders and entrepreneurs.
- More collaborative programme is needed with the developed countries to bring international science.
- Develop suitable, low cost and effective technologies for post harvest management system.
- Shelf life extension of vegetables, innovative way of research, introduction of Good Agricultural Practices (GAP), cool chain transportation and up gradation of laboratory facilities should be ensured.
- Strengthen field extension activities.

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