International network on preserving safety and nutrition of Indigenous fruits and their derivatives

Post-Harvest Technology and cold Chain management

20-22 March 2012

Venue: Amity University, Noida, India

Workshop Proceeding

Introduction

To develop an interdisciplinary research network and promote technical innovation and cooperation in the production-to-consumption system of indigenous fruits in the Asian region as a new approach to linking sustainable agriculture with preventative nutrition, the second training workshop was hosted by the Indian partner. It was attended by the project partners from Bangladesh, India, Vietnam, Sri Lanka, France and the UK. The partner from Cambodia was unable to attend the training workshop. Four participants from Bangladesh, two participants from Vietnam, two participants from Sri Lanka and one participant from France attended the workshop. From India two network partners and twenty four (local) participants from agricultural university, NGOs and SMEs attended the workshop. Apart from the official participants, students and faculty members numbering over 150 attended the lecture and panel discussion sessions. These invitees belonged to their institutions of Amity University viz. Food technology, Organic Agriculture and Rural Management. A full list of participants is provided in Appendix 1.The workshop programme (see Appendix 2) consisted of the first day of lectures and demonstration sessions, second day field trip with visit to two cold chain units while the third day was a full day of discussion with the eminent panellist of India drawn from the areas of Horticulture, Biotechnology, Postharvest Technology, Cold Chain Management, Food Processing sector and from the universities.

Opening session, Tuesday, 20th March, 2012

The opening session consisted of registration and introduction of participants and a presentation on Amity University followed by the main session.

Main Session

The welcome address was given by Dr Sunil Saran, Amity International Centre for Post-Harvest Technology and Cold Chain Management, Amity University, Noida. Dr Saran extended his hearty welcome to all the participants and hoped they will benefit from the training programme. He also expressed his thankfulness to the participants for attending the workshop. A video address was made by Dr Kate Schreckenberg, Coordinator, Centre for Underutilised Crops (CUC), University of Southampton. She highlighted the network aims, objectives & activities. She emphasised the workshop objectives and advised the participants to find out research gaps in the areas of post-harvest technology and cold chain management to initiate presentation of research proposals in those areas. She also explained the importance of indigenous fruits and the constraints leading to their better utilisation. The video address was followed by presentations from the project partners.

Presentation by Project Partners

Dr Max Reynes, UMR Qualisud TA, France: **USE OF LACTOPEROXYDASE FOR POST HARVEST TREATMENT: CASE OF MANGO** (See appendix 3 for full presentation)

Dr Max Reynes highlighted the considerable research efforts that have been made to develop treatments for limiting of post-harvest diseases. He referred to the use of chemicals in food which has become a matter of worldwide concern at the present moment. It is a big challenge to find substitutes for chemicals to improve post-harvest storage of fresh fruits that do not have any residual effect. He stressed the importance of preserving fresh fruits by lactoperoxydase instead of fungicides or bactericides. Lactoperoxydase is an enzyme which is extracted from milk which has no effects on human physiology or the environment. He cited the example of mango. He also explained the chemical reactions of lactoperoxydase activity. He also explained the procedure of using lactoperoxydase for preservation of mango. The high effectiveness of this natural anti- fungal system is considered safe for the consumers.

Dr Modan Gopal Saha, Principal Scientific Officer, Dr Nazrul Islam, Senior Scientific Officer, Mohammad MainuddinMolla, Scientific Officer, Horticulture Research Centre, BARI, Gazipur and Ms Nazma Parvin Laizu, private entrepreneur, Nokshi Food Products, Savar, Dhaka, Bangladesh**: POST- HARVEST TECHNOLOGIES OF INDIGENOUS FRUITS OF BANGLADESH: CONSTRAINTS AND OPPORTUNITIES** (See appendix 4 for full presentation)

Dr Modan Gopal Saha highlighted the post-harvest losses, nutritional improvement, food security and employment generation by listing 47 of Indigenous fruits in his presentation. He explained some of the methods and technology for maturity indices, handling, chemical treatments, packaging, transportation and storage of Mango (*Mangifera indica*), Jackfruit(*Artocarpus heterophyllus*), Banana (*Musa spp*), Litchi (*Litchi chinensis*), pineapple (*Ananas comosus*), Guava (*Psidium guajava*), Ber *(Ziziphus mauritiana*), Palmyra palm (*Borassus flabellifer*), Wax jambu (*Eugenia javanica*), Golden apple (*Spondias pinnata*), Indian olive (*Elaeocarpus floribundus*), Tamarind (*Tamarindus indica*), Aonla (*Emblica officinalis*). He also explained about the assessment of artificial ripening practices, shelf life, and quality of fruit, modified atmosphere packaging, colour development. He referred to the constraints and opportunities of post-harvest technologies in Bangladesh. He further discussed about the processing and preservation techniques of those fruits and their products e.g. candy, jam, pickle, juices, chips leather, jelly, ketchup.

Dr DAN Dharmasena, Dept. of Agric. Engineering, Faculty of Agriculture, University of Peradeniya and Dr KH Sarananda, Agriculture Enterprise Development and Information service, Department of Agriculture: PRESENT STATUS, ISSUES, AND FUTURE TRENDS IN FRUITS AND VEGETABLE HANDLING, DISTRIBUTION AND MARKETING IN SRI LANKA (See appendix 5 for full presentation)

Dr DAN Dharmasena began by highlighting the overall scenario of agriculture sector with an emphasis on post-harvest operation and cold chain management. He also addressed agricultural

sector contributions, food availability and food security, post-harvest operation and marketing of agro produce.

Dr Dharmasena described that the country has two main fruit and vegetable distribution chains; the conventional distribution through a central distribution centre called the "Economics Centre" and the other supply is the "Supermarket supply chain". The major super markets having fairly large number of outlets have integrated the farm gate to the consumer with cold chain management. He emphasised the importance of agriculture scientists and policy makers working together to increase the food availability and ensure food security of the country as well as satisfy the growing needs.

Duong Thi Ngoc Diep, Lecturer, Nong Lam University, Hochiminh City, Vietnam: THE **UTILIZATION OF CASHEW APPLES IN VIETNAM (**See appendix 6 for full presentation)

Ms Diep explained that Vietnam is the world's second biggest producer in terms of area and production volume of cashews after India. Vietnam has been the world leading exporter of cashew kernel in the recent years.The cashew apple from which the nut protrudes is usually discarded. In Vietnam, an estimated 250,000 tonnes of cashew apples are utilized every year. In the year 2010 Vietnam produced 291.5 million tons of cashew apples. In fact, cashew apple is very high in vitamin C, vitamin $B_{2,}$ and calcium contents, compared with many other fruits. There is a big potential of cashew apple utilization in forms of prunes, juice, wine, pulp, teas and vinegar but at present it is mostly used as a fresh fruit. Processing of cashew apple has some positive effect such as reduction in environmental pollution, increase in the income of farmers, creation of jobs for workers, diversification of food products and enhancement in value addition.

The opening programme was concluded by vote of thanks given by Dr Susanta K Roy, Professor Emeritus, Amity International Centre for Post-Harvest Technology and Cold Chain Management, Amity University, Noida.

Lecture session on Post-Harvest Technology

Dr Susanta K Roy: Influence of post- harvest operations, packaging and storage on the quality of fruits (See appendix 7 for full presentation)

This session was addressed by Dr Susanta K Roy, who outlined the different factors which affect the quality of fruits during post-harvest operation, packaging and storage. This session was followed by demonstration on post-harvest technology. This session was addressed by Dr S K Roy, Dr Neeru Dubey and Dr Shailendra Dwivedi. In this demonstration assessment of physiological changes and loss of quality and methods of quality evaluation was shown by the trainers.

Dr Susanta K Roy: Different methods of processing, preparation of processed products and minimal processing of fruits (See appendix 8 for full presentation)

This session was also addressed by Dr Susanta K Roy in which he explained the different methods of processing, preparation of processed products and minimal processing of fruits. He clarified the objectives and principles of preservation. He also explained the methods of preservation such as – canning, drying, freezing, aseptic processing, addition of sugar, addition of salt, addition of acids, etc.

Demonstration on Post-Harvest Management

This session was addressed by Dr. Susanta K Roy, Dr Neeru Dubey and Dr Shailendra Dwivedi where the trainer demonstrated the effect of different temperatures on packaging and storage and also the effect of different temperatures on fruits without packaging. The participants were also shown the Zero Energy Cool Chamber and the effective storage of fruits and vegetables in comparison with their storage under ambient conditions. The trainers demonstrated the different packaging and cushioning materials, the juice and pulp extraction and minimal processing.

Wednesday, 21th March 2012: Field Visit to Cold Chain Management

The participants visited two cold chain Enterprise owned by the Govt. of India. 1. Fresh & Healthy Enterprise Ltd (CONCOR) 2. Mother Diary Fruit and Vegetable Pvt. Ltd.

1. Fresh & Healthy Enterprise Ltd (FHEL) - a subsidiary of CONCOR, Govt. of India

- Mr Sanjay Gupta and Mr Ramesh Babu welcomed all delegates at FHEL and briefed the participants about FHEL. Mr Sanjay Gupta informed that FHEL is a fully owned subsidiary of CONCOR, a Govt. of India undertaking.
- It was incorporated in February 2006 with Rs. 35 Crores as equity from CONCOR. It has been set up to create world class cold storage infrastructure in the country to provide complete cold chain logistics solutions to the various stakeholders of the region.
- Mr Gupta highlighted that an estimated 30% of the fruits and vegetables are lost due to poor post-harvest management which is valued at almost Rs. 50,000 Cr. Given the above situation there exists a tremendous business opportunity in the post-harvest technology, cold chain infrastructure, improvement in yield, quality marketing etc.
- During 2007-2008, FHEL procured, stored and marketed about 12,000 MT of apples from Shimla & Kinnaur district of Himachal Pradesh. Its first 12,000 MT state-of the-art CA store, currently the largest in the country, is operational since August 2007.

Mr Sanjay Gupta also briefed about the key objectives of the FHEP. During discussion with the participants, Mr Gupta highlighted the following points:

- FHEL (CONCOR) has realized that there is a great amount of wastage happening during post-harvest handling.
- Indian Agriculture sector accounts for 26% of country's GDP, produces 64% employment and 18% of country's export.
- India is 2nd largest producer of fruits & vegetables in the world.
- India is the 2nd largest vegetable Exporter.
- India's share is a little over 1% of world trade.

During plant visit, Mr Gupta told that FHEL has 78 controlled atmospheric storage chambers having a capacity of 150 MT each. Several commodities like apple, orange, carrot, garlic, rice are being stored at different temperatures for a long time. Each CA chamber is being controlled by central control room. Freon is being used as refrigerant in the plant.

Mr Gupta discussed various pre and post-harvest operations involved in the fruits and vegetables.

Pre-harvest:

Fresh and Healthy Enterprise Limited is promoting peoples and growers to improve their crop quality and in this context they are suggesting various pre-harvest activities to the growers under the supervision of the experts. The following pre-harvest activities are being done by the FHEL.

- They are providing guidance to growers on correct agriculture practices to ensure better quality fruits and better yields.
- Testing of maturity and colour of apples by trained personnel.
- Harvesting at appropriate maturity time.

Post- harvest:

In general different post-harvest activities like pre-cooling, transportation, storage, grading and packaging are being done at FHEL, but in some special cases or on special demand by consumer, waxing is also being done after grading of the fruits (especially apple and citrus)

- FHEL has designed cartons for packing of apples.
- Apples to be pre-cooled in a nearby hub to remove the field heat in FHEL designed mobile pre-coolers.
- Transportation after pre-cooling to the cold storage facilities at Rai, near Delhi
- Storage of apples in the CA chambers.
- FHEL having their own ripening and storage chambers for ripening and storage of the fruits.
- Apples are graded and sorted on computerized automatic imported sorting/grading lines.
- Grading and sorting are being done under controlled ambient temperature and humidity conditions.
- Dispatch of apples in Reefers to different markets across the country.
- Both Bulk & Retail packing were being done automatically.

2. SAFAL, Mother Dairy, Mangolepuri, New Delhi

Mr Nitin and Mr Sharma welcomed all delegates at their unit of SAFAL, Mother Dairy at Mangolepuri Delhi. Mr Nitin highlighted the fruit and vegetable processing and marketing at SAFAL. He pointed out the following features of the enterprise:

- Mother Dairy is an IS/ ISO-9002, IS-15000 HACCP and IS-14001 EMS certified organization. Moreover, its Quality Assurance Laboratory is certified by National Accreditation Board for Testing and Calibration Laboratory (NABL)-Department of Science and **T**echnology, Government of India.
- Mother Dairy was founded in 1974, as a pure subsidiary of NDDB (National Dairy Development Board).
- In 1988, Mother Dairy launched the sale of fresh and frozen vegetables and fruits under the brand name of SAFAL.
- In 2004 they added fruit juices under the product portfolio of SAFAL.

The following fruits and vegetables are being processed at SAFAL:

- Mango pulp

- Mango concentrates
- Banana Puree
- Organic banana pulp
- Papaya concentrates
- Mango, litchi, citrus based RTS beverages

A wide range of vegetables like pea, potato, tomato, leafy vegetables, pumpkin, etc. are being processed and sold at different outlets of SAFAL.

During the visit, participants were taken around various facilities viz. food and fruit processing, freezing of peas after washing and drying, sorting, grading, packaging of cooled vegetables and fruits, final sorting before packaging and culling of damaged, diseased and defective fruits and vegetables, etc.

Thursday, 22nd March 2012: Panel discussion- Post harvest management

Mr Gokul Patnaik, Chairman, Global AgriSystem chaired and moderated the session. First, he welcomed the panellists and started the discussion with his comments that most of the work has been done on temperate fruits in the cold countries since preservation was required to save the commodities from frost wastage. In India vegetables were available according to the season, but now due to post-harvest management almost all vegetables are available throughout the year. This brings to fore the efficiency of post-harvest management with emphasis on minimising losses.

Mr P.L. Kaul, CEO Mariental India Pvt. Ltd. started the presentation (see Appendix 9 for full presentation) with a brief overview of his company's activities and gave a detailed account of the current Indian scenario in terms of production and processing. He informed that value addition in agriculture products is only 7 % and the country's share in agriculture produce is only 1.6 %. He explained that both pre-harvest and post-harvest management practices influence the post-harvest life of the produce. He also gave a detailed account of the per day availability handling capacity of various fruits and vegetables as 25,000 MT for apple, 15,900 MT for Litchi, 78,000 MT for Peas. He proposed the redressed strategy for fruits and vegetables and mentioned the following points:

- Application of pre and post-harvest technologies to develop and stimulate the horticulture production of quality fruit & veg, prevent post-harvest losses, improve the characteristic properties and add value to the products through processing.
- Plan and set-up modern and effective storage system based on modified & controlled atmosphere at low temperature for fruit & veg mainly through PPP or BOOT Schemes.
- Facilitate and encourage entrepreneurship to venture into fruit & veg processing industry in large or medium scale which would help effective utilization of the valuable horticulture produce, assurance to the farmers of quick disposal of produce at remunerative price and for the consumers to enjoy the fruit & veg of their choice throughout the year at uniform and affordable prices and encourage application of technology for effective utilization in product value addition.

Dr Charanjit Kaur, Principal Scientific Officer, Division of Post-harvest Technology, IARI addressed the audience about the indigenous fruits and vegetables of India and their derivatives (see Appendix

10 for full presentation). She outlined that the global food trends have been towards functional food and India is slowly moving towards that. She mentioned that the indigenous Indian food has a lot of anthocyanins which are anticarcinogenic, antidiabetic, and anti-inflammatory and have cardio protective properties. The major important indigenous commodities were- Jamun, Phalsa, Kokum, Brinjal, Black carrot, Karonda and Mulberry. She discussed in detail the properties of these commodities and various products which can be developed from them. The major research gaps she identified were-

- Documentation of antioxidant potential of Indian indigenous / underutilised fruits – new product developments ,
- functional beverages (anthocyanin),
- extruded products,
- breads,
- health supplements,
- Juiceceuticals- hybrid dairy products – fruit pulps that enhance the probiotic viability in yoghurts,
- Shelf –life studies/ packaging studies
- Quality products with stable formulations of bioactive principles.

Mr Sagar Kurade, Suman Food Consultants, detailed about the Indian agriculture scenario and also about the wastages in agriculture produce which is highest in case of fruits and vegetables and lowest in case of milk (see Appendix 11 for full presentation). He gave a comparison of the Indian supply chain and the supply chain of the developed countries. In India the wastage is high and income margins are low while in developed countries high investments lead to low wastage and better margins. He gave an account of the growth of the Indian Food Processing industry and the Indian government food policies affecting the food processing industry and suggested:

- Increase of farm size by involving private sector.
- Put reasonable production & productivity goals,
- Appoint Multi State agencies to track and collect variety data of Fruits and Vegetables,
- Encourage small & medium enterprises by giving subsidy which should be 25% of technical Infrastructure.
- Cap on subsidy to be increased to at least Rs. 1 Cr, if not more,
- Incentives to entrepreneur in case he sources Indian manufactured goods.
- A “Buy Indian” policy could lead to a number of foreign companies setting up their “Fabrication Units” in India. .
- Encourage R &D, Import duty of Food Processing machinery needs to be reduced to a minimum of 5% and Amend APMC act to enable direct procurement from farmers. Should encourage private sector participation.

Dr D.S. Rathore emphasised the prioritization of studying various based commodities on utility and availability.

Mr Gokul Patnaik in his concluding remarks requested the researchers to keep in focus the following crops- Bael, Jamun, Ber, Aonla, Jackfruit, Custard Apple, Sapota, Kokkum, Black carrot,

Brinjal, Mulberry and Makhana and prepare projects in collaboration with the industry for development of indigenous fruits of India.

Panel discussion- Cold Chain Management

Mr S. Kankan welcomed the panellists and emphasised the need for channelizing panel discussion to reveal the gaps in the cold chain management. He invited Mr Sanjay Gupta for the presentation.

Mr Sanjay Gupta, MD Infracool, (see Appendix 12 for full presentation) defined a cold chain as a series of facilities to maintain ideal storage conditions for the perishables which covers the span from the point of origin to consumption. He outlined the benefits of cold chain as:

- Reduction in spoilage, retention of quality at consumption point,
- Extension of marketing period ,
- Coverage of distant markets and cost efficient delivery to the consumer.

The steps needed in cold chain infrastructure are:

- Pre-cooling Facilities,
- Cold Storage,
- Refrigerated Carriers,
- Packaging, Warehousing,
- Retail Point,
- Cold Facilities and Information Management System.

He discussed about the international scenario and told that in developed countries the cold chain is continuous and does not break at any point from pre cooling, cold storage up to the consumer level but in Indian conditions the cold chain is fragmented and exists for only limited commodities. He also gave some inputs on what is required further in India to develop the cold chain industry- e.g. Cold Chain to Suit Specific Products at Production Area, Cold Chain for Specific/ Multi-commodity Storage at Consumption Centre and Research to establish Optimum Storage conditions.

Mr K. K. Mitra, Vice President, Lloyd insulation Systems discussed about the modern energy efficient cold storages (see Appendix 13 for full presentation). He gave details about the fresh produce pipeline and problems at every stage starting from sorting, packaging, storage, transport and marketing. Fresh produce are living products that respire, breathe, release heat, lose moisture, become sick and can die. Briefing about the purpose of insulation, he mentioned that, initially when Cold Storage starts, refrigeration equipment brings down the temperature and subsequently insulation maintains the temperature. He mentioned about the conventional cold storages and problems faced by them. He emphasised the importance of a good insulation system in which once the temperature goes down in the cold storage due to refrigeration equipment, the temperature is maintained with the help of:

- continuous moisture ingress through plaster,
- walls become wet and moisture resistance decreases,
- Plaster chipping off;
- Vapour barrier becomes weak,

- Formation of cold spots Deterioration & failure of Thermal Insulation System.

He informed about the best insulation systems and told that we can revamp the old cold storages just by fixing the insulation panels of PUF either from outside or inside while in CA storages we have to do it only from the inside. Some states have also recommended the houses to be insulated.

Dr Omveer Singh, Head Agribusiness, Field fresh Pvt. Ltd. shared his experiences of the last decade when he worked with the cold chain and fresh produce industry. According to him the cold chain has been successful in some products like Litchi, Grape and Apple while it has been a complete failure in Onion, which remains fresh till it is inside the cold chain but when brought out in July, deterioration sets in very fast due to high temperature and high humidity. He also told that during the last decade the infrastructure in cold chain had increased manifold but the technology has to be locally targeted and produce specific.

Mr S. Kankan concluded the session with positive note and hoped that the cold chain in India will make remarkable progress in the coming years.

The research gaps identified during the panel discussion included:

- Fruits and vegetables are important components of a healthy diet, and their sufficient daily consumption could help prevent major diseases. Consumption of fruits in term of combating specific diseases may be further explored.
- Indigenous fruits play a vital role in the livelihoods of many rural communities in India. They are an important component in the nutrition of most families particularly in metro cities and need to be researched to unravel their nutritional values.
- Some of the fruits are articles of commerce in the local, national and regional markets. Such as Bael, Aonla, Ramghota, Ber in fruits and Black carrot and Brinjal in vegetables which are underutilised in spite of their high nutritive properties.
- Indigenous fruits can mitigate poverty and spur economic growth if properly developed.
- Exploration of the resource base of indigenous fruit trees.
- Study on intra-species variation in the size and taste of fruits
- Ecology/Habitat/Geographical Distribution of indigenous fruits.
- Uses: food value (composition) and traditional knowledge.
- Season of availability, Seed development, germination and storage behaviour.
- Harvesting, post-harvest handling (including losses), storage, processing for domestic, national and international markets, value addition, agro-industrialization/industrialization.
- Propagation techniques and domestication of semi-wild, nutritionally valuable varieties.
- Efficient harvesting and post-harvest handling methods to enhance preservation.
- Value addition for indigenous fruits.
- Develop and organize marketing systems to create more rewarding opportunities for producers and collectors of fruits.
- Nutritional studies and preservation, elimination of anti-nutritive substances besides safety measures for fruit utilization.
- Co-ordination and communication on research and development initiatives among stakeholder

Evaluation and Valedictory

Mr Malik Hamid asked participants to fill in the workshop evaluation form. The workshop ended with distribution of participation certificates and mementos from Amity University.

List of Appendices

Appendix 1

List of Participants attending in the workshop in India from 20-22 March, 2012
On
Post-Harvest Technology and Cold Chain Management

Jointly organised by Amity International Centre for Post-Harvest Technology and Cold Chain Management Amity University, Uttar Pradesh, India and Centre for Underutilised Crops, University of Southampton funded by Leverhulme Trust

Country	Sl No	Name of the Participant/E-mail	Name of the Organisation
Bangladesh	1	**Dr Modan Gopal Saha** Principal Scientific Officer mgs_60@yahoo.com.	Horticulture Research Centre, Bangladesh Agricultural Research Institute (BARI), Bangladesh.
	2	**Dr Md Nazrul Islam,** Senior Scientific officer eshaadeesha@yahoo.com	
	3	**Mr Mohammad Mainuddin Molla** Scientific Officer mainuddinmolla@yahoo.com	
	4	**Ms Nazma Parvin Laizu** Entrepreneur (ManagingDirector) nokshi@yahoo.com nokshi787@gmail.com	SME- Nokshi Food Products, Savar, Dhaka
Sri Lanka	5	**Prof. DAN Dharmasena** dand@pdn.ac.lk	Faculty of Agriculture, University of Peradeniya, Sri- Lanka
	6	**Dr K H Sarananda,** Research Officer saranandahewage@yahoo.com	Department of Agriculture Enterprise Development Information Service Centre, Sri-Lanka
Vietnam	7	**Ms Duong Thi Ngoc Diep,** Lecturer diepngocduong@yahoo.com	Nong Lam University, Vietnam
	8	**Mr Quang Hong Luong,** Lecturer lhongquang@yahoo.com	
France	9	**Dr Max Reynes** max.reynes@cirad.fr	CIRAD, France
UK	10	**Malik Hamid** m.a.hamid@soton.ac.uk	University of Southampton , UK
India (Amity University)	11	**Dr Sunil Saran** **ssaran@.amity.edu**	Amity International Centre for Post-Harvest Technology and Cold Chain Management Amity University, Uttar Pradesh, India
	13	**Prof Susanta Kumar Roy** **roysusanta2002@yahoo.co.in**	
	14	**Dr NeeruDubey** needub@gmail.com	
	15	**Dr ShailendraDwivedi** **skdwivedi@amity.edu**	

	16 17	**Mrs Naga Laxmi Raman** nlmraman@gmail.com **Ms Nidhi Verma** Nidhiverma_delhi@in.com	
India (Local Participants)	1	**Mr Amandeep Girdhar,**	H.No.30, old grain Market, near Mukstar bus stand, Punjab
	2	**Ms Anshu Sharma**	Dept. of Food Science & Technology, Dr YS Parmar University of Horticulture & Forestry, Himachal Pradesh
	3	**Mr Ashish Bhardwaj**	ASI, Sunhara India Project, Agra
	4	**Mr Balaji Vikram**	Institute of Agriculture Technology and Science, Uttar Pradesh
	5	**Dr D S Mishra**	GovindBalap Pant Universityof Agriculture & Technology (GBPA&T), Uttarakhand
	6	**Mr Bhojaraj Belakud**	Allahabad Agriculture University, Uttar Pradesh
	7	**Mr Jeffrey Rappaul Pohrmen**	Allahabad Agriculture University, Uttar Pradesh
	8	**Mr Karan Ket**	Future Group, Food pack Division, Bangalore
	9	**MS Kavita Sharma**	Premium Market, Delhi
	10	**Md Munaff Bhat**	Jammu & Kashmir
	11	**Ms Neha Singh**	Dept. of Food Science & Technology, Dr YS Parmar University of Horticulture & Forestry, Himachal Pradesh
	12	**Mr Niamthailung Gonmei**	Allahabad Agriculture University, Uttar Pradesh
	13	**Mr Deepak Rajput**	HESCO, Dehradun
	14	**Er Nitin Sonkar**	Allahabad Agriculture University, Uttar Pradesh
	15	**Mr Pankaj Goyal**	Champion Agro, Delhi
India (Local Participants)	16	**Ms Pooja Lakhanpal**	Dr YS Parmar University of Horticulture & Forestry, Himachal Pradesh
	17	**Dr Prabhat Kumar**	GovindBalap Pant Universityof Agriculture & Technology (GBPA&T), Uttarakhand
	18	**Ms Pratibha Bish**	Premium Market, Delhi
	19	**Mr Rakesh Malvi**	Field foods Private Limited(A Bharti Enterprise) Gurgaon
	20	**Mr Sanjeev Kumar Tiwari**	Agribusiness System International Uttar Pradesh
	21	**Mr Subir Kumar Saha**	Premium Market, Delhi
	22	**Dr Veenu Gopal Rao**	Champion Agro, Delhi
	23	**Dr Vigya Mishra**	Dept. of Food Science & Technology, Dr YS Parmar University of Horticulture & Forestry, Himachal Pradesh
	24	**Dr Sandeep Chauhan**	Botanical survey of India, Noida, Uttar Pradesh

Appendix 2
Amity University Uttar Pradesh
Training –Workshop on
"Post-Harvest Technology & Cold Chain Management"
March 20 – 22, 2012
Technical Programme

Day 01 : March 20, 2012 - Tuesday

Time	Session /Activity Description	Speaker(s)
9 .00 – 10.00 a.m.	Registration & Introduction of Resource Persons and Participants (F-3 MDP Room) Presentation on Amity University	 Maj. Gen. R.K. Dhawan
Lecture Session : International Speakers : F-3 Seminar Hall		
10:00-10:05 a.m.	Welcome Address	Dr. Sunil Saran
10.05-10.15 a.m.	Address by : Dr Kate Schreckenberg, Coordinator, CUC	Through Video link
10:15-10:30 a.m.	Use of lactoperoxydase for post-harvest treatment: case of mangoes.	Dr Max Reynes **France**
10:30-10:45 a. m.	Post-harvest technologies of indigenous fruits of Bangladesh: constraints and opportunities.	Dr ModanGopal Saha **Bangladesh**
10:45-11:00 a.m.	Present status, issues and future trends in fruit and vegetable handling, distribution and marketing in Sri Lanka.	Prof. DAN Dharmasena **Sri Lanka**
11:00-11:15 a.m.	The utilization of Cashew apple in Vietnam	Ms. Duong Thi Ngoc Diep, **Vietnam**
11:15-11:30 a.m.	Vote of Thanks	Dr. Susanta K Roy
11.30 – 12.00 p.m.	***Tea/Snack break***	
Lecture Session : Post Harvest Technology : AIFT Lecture Theatre – I-1 Block Room # 408		
12.00 – 12.45 p.m.	Influence of post-harvest operations, packaging and storage on the quality of fruits	Dr. Susanta K Roy
Training /Demonstration : Post Harvest Technology : AIFT Laboratory- I-1 Block Room # 404		
12.45 - 1.30 p.m.	(i) Assessment of Physiological change and loss of quality - Physiological loss in weight (PLW %) and Quality evaluation: (a) Texture (Firmness /softness etc.) (b) Total Soluble solids (TSS) (c) pH (Acidity or alkalinity) (d) Sensory/organoleptic evaluation (Colour, flavour and texture) (e) Temperature (f) Relative humidity	Dr. Susanta K. Roy Dr.Neeru Dubey Dr.Shailendra Dwivedi **(Contd.. 3.00 –3:45 p.m)**
1.30 – 2.15 p.m.	***Lunch***	
Lecture Session : Post Harvest Technology : AIFT Lecture Theatre–I-1 Block Room # 408		
2.15 – 3:00 p.m.	Different methods of processing, preparation of processed products and minimal processing of fruits.	Dr. Susanta K. Roy
Training /Demonstration:Post Harvest Technology. AIFT LabI-1 Block Room # 404		
3:00-3:45 p. m.	(ii) Packaging and Storage : Effect of different temperatures with and without packaging on quality of fruits in different conditions Room temperature, Refrigerator temperature, Freezing condition in ice, ZECC Temperature	Dr. Susanta K. Roy Dr.Neeru Dubey Dr.Shailendra Dwivedi
3.45 – 4.00 p.m.	***Tea break***	
Training / Demonstration : Post Harvest Technology : AIFT Laboratory I-1 Block Room # 404		
4.00 – 5.30 p.m.	(i) Low Cost Techniques of Storage: Construction and operation of Zero Energy Cool Chamber (ii) Demonstration of different packaging and cushioning materials used in fresh fruits, Rigid containers, Flexible	Dr. Susanta K. Roy Dr.Neeru Dubey Dr.Shailendra Dwivedi

	packaging, Crate liner, Wrapping in cling film (iii) Extraction of juice and pulp and minimal processing	

Day 02 :March 21, 2012–Wednesday : Field Trip

Time	Session /Activity Description	Speaker(s)
Training /Demonstration : Cold Chain Management (field visit)		
9.30-1:00p.m.	Visit to Fresh & Healthy Enterprise Ltd. CONCOR India, Govt. of India Enterprise.	Enterprise Experts
1.00 – 2.00 p.m.	**Lunch**	
Training /Demonstration : Cold Chain Management (field visit)		
2.00 – 5.30 p.m.	Mother Diary Fruit and Vegetable Pvt. Ltd. An enterprise of National Dairy Development Board, Govt. Of India	Enterprise Experts
6.30 – 7.30 p.m.	Session for partners only	Kate Schreckenberg and Nazmul Haq by video link

Day 03 :March 22, 2012–Thursday

Time	Session /Activity Description	Speaker(s)
Lecture Session : Biotechnology : F-3 Seminar Hall		
9:00-10:00 a.m.	Biotechnological approaches in post-harvest management - overview	Dr. K. C. Upadhyay
Panel Discussion : Post Harvest Technology : F-3 Seminar Hall		
10.00 – 11.30 a.m.	Panellists: **International: Dr. Max Reynes, Md.Nazrul Islam, Ms. Duong Thi Ngoc Diep and Mr. Quang Hong Luong** Dr. P.L. Kaul, Managing Director, Mariental India Pvt. Ltd. Mr.SagarKurade, Director, Food Consultants Pvt. Ltd Dr.CharanjitKaur, Principle Scientist, Division of Post-Harvest Technology, IARI Dr. D. S. Rathore, Former Vice Chancellor, HPKV, Palampur	Chairman/Moderator Mr.GokulPatnaik Chairman, Global AgriSystem
11.30 – 12.00 p.m.	*Tea Break*	
Panel Discussion : Cold Chain Management : F-3 Seminar Hall		
12.00 – 1.30 p.m.	Panellists: **International : Dr. Max Reynes & Prof. DAN Dharmasena** Mr. N. K. Jawa, CEO, Fresh & Healthy Enterprises Mr.SanjayGupta, Executive Director, Infra Cool Mr. K. K. Mitra, Vice President, Llyod Insulations (I) Ltd. Mr. S. Kankan, Advisor Horticulture Business DevBhumi Cold Chain Ltd.	Chairman/Moderator Mr. P.K. Swain, Director, Department of Agriculture & Cooperative, Ministry of Agriculture, Krishi Bhawan
2.00 – 3.00 p.m.	***Lunch***	
Feedback / evaluation of Training /Demonstration F-3 MDP Room		
3.00 – 4.00 p.m.	Feedback form from the Participants	
4.00 – 5.30 p.m.	**Valedictory function** (to be Chaired by Dr. Ashok K. Chauhan, Founder President, Amity Universities) (Distribution of Certificate etc.)	