

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

Characterisation of Fresh and Processed Fruit Quality

23-25 July 2012

Venue: Nong Lam University, Ho Chi Minh City, Vietnam

Workshop Proceedings

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 third training workshop was hosted by the Vietnam partner. It was attended by 25 participants including researchers and entrepreneurs (see Appendix 1).

The workshop's objectives were:

- To promote research into the characterisation of sensory, nutritional and functional qualities of fruit quality by providing training in analytical methods.
- To highlight the nutritional potential of some indigenous fruit in Vietnam and show how techniques developed for the exotic fruit industry could be applied to indigenous fruit.
- To strengthen and extend the existing network in two ways:
 - Making existing network partners more familiar with each other's capacities and special interests in the field of characterisation of fruit quality;
 - Inclusion of new individuals from partner institutions and from Vietnam.
- To provide an opportunity for partners to identify research gaps in the area of sensory, nutritional and functional characterisation of indigenous fruit.
- To enable partners to agree on promising research areas and initiate research proposals in the area of characterisation of indigenous fruit.

The workshop programme consisted of a first day of presentations and discussions on fruit quality characterisation, a second day of hands-on training in the laboratory on fruit ash and vitamin analysis by HPLC and AAS, and a third day comprising a field trip to a traditional fruit market in Ho Chi Minh city followed by a final set of presentations and a certificate awarding session. The detailed programme is provided in Appendix 2.

Tuesday, 23rd July 2012

Following registration, an introductory speech by Mrs Diep Duong and introduction of the participants, a welcome address was given by Dr Nguyen Hay, rector of Nong Lam University, Vietnam. Dr Nguyen warmly welcomed the participants and expressed his gratitude for their attending the workshop. He highlighted the important role of characterising indigenous fruits, developing innovative technology and value chain approaches in improving the livelihoods of both producers and consumers. He hoped that food scientists, researchers, government and private sector would work together for the sustainable management and marketing of indigenous fruits and their derivatives. Dr Kate Schreckenber, Coordinator, Centre for Underutilised Crops (CUC),

University of Southampton introduced the network aims, objectives and activities. She underscored the need to promote knowledge transfer and foster cooperation and development of human resources between the partner countries and different types of organisations (research, NGOs, private sector). She outlined the workshop objectives, emphasising the need to identify research gaps in the area of characterisation of fresh and processed fruit quality.

Session 1: Fruits and indigenous fruits production, Chair: Dr Kathrin Schreckenberg

Dr Susanta K Roy, Amity International Centre for Post-harvest Technology and Cold Chain Management, Amity University, India: [Potentiality of processed indigenous fruits and their derivatives for providing safe nutrition](#)

Dr Roy highlighted that most of the indigenous fruits of the South-Asian region have the ability to grow under adverse conditions and are also known for their therapeutic and nutritive value. Because of their curative properties, these fruits have been used in traditional systems of medicine since time immemorial. In addition, quite a few of these fruits have excellent flavour and very attractive colour. There is always a market demand all over the world for new food products, nutritious and also delicately flavoured products. Consumers today are becoming increasingly conscious of the health and nutritional aspects of their food. The tendency is to avoid chemicals and synthetic foods and choose therapy and nutrition through natural sources. Indigenous tropical fruits have an important role to play in satisfying these demands. However, many of these fruits are highly perishable and difficult to market in the fresh form. Some of them are not easy to eat out of hand. A few are not acceptable as a fresh fruit because of high acidity and/or strong astringent taste. However, all these fruits have unlimited potentiality in their processed products developed following the food safety norms. Apart from safe processing and market demand, there is a need to create awareness and consciousness among the producers and consumers of indigenous tropical fruits. Dr Roy went on to outline the case of two indigenous fruits with particularly high potential as sources of vitamin C, polyphenolics and antioxidants: *Phyllanthus emblica* ('aonla') and *Aegle marmelos* ('bael'), which require processing to overcome high perishability, rapid oxidation and difficulties in eating the fresh fruit.

Dr Seingheng Hul, Institute of Technology of Cambodia, Cambodia: [An overview on fresh and processed fruits production in Cambodia](#)

Dr Hul explained that tropical countries like Cambodia provide a good opportunity for growing different tropical fruits such as lychee, mango, longan, jackfruit, cashew, rambutan, durian, etc. The main source of GDP in Cambodia is agriculture but this is threatened by climate change, drought and erosion, together with low technical support which constrains penetration of the local, regional and international market. According to the statistics from the Ministry of Agriculture, Forestry, and Fisheries in 2010, Cambodia has 23,734 hectares of mango plantations. Recently, cashew plantations are also becoming popular among farmers due to high local and regional market demand. However, the product is normally exported to the neighbouring countries in raw form. In general, fruit production suffers from seasonal gluts and a lack of any significant investment on post-harvest management to overcome them. The uncertainty of fruit yield in terms of quality and quantity, insufficient human resources invested in food processing technology, and a range of socio economic factors are the reason that the SME food processing sector in Cambodia is not growing.

Session 2: Fruits and indigenous fruits quality, Chair: Dr Max Reynes

Dr Jean-Christophe Meile, Food Safety Group, UMR Qualisud TA, France: [Microbial ecology of indigenous fruits in relation with geographical origin and/or production mode](#)

Dr Meile described a microbial ecology technique based on molecular biology (PCR-DGGE) allowing a rapid and global analysis of the micro flora associated with fruits. This addresses the problem that the traceability of food commodities is currently only possible through documentation. Previous studies from the laboratory of CIRAD have shown that there is a strong linkage between the structures of the micro flora and the geographical origin and mode of production. This approach provides a biological barcode and was successfully applied to a wide variety of foodstuffs (e.g. fish from different farms in Thailand and Vietnam; organic versus conventionally produced vegetables; fruit from different countries). Although the technique uses information from the surface of the fruit, cleaning the fruit (e.g. for consumers) does not seem to eradicate the microbial flora 'signature'. It is now proposed to trial its application to indigenous fruits. This could help explore their characterisation by giving insights into four important aspects for the development of underutilised crops that are: food safety, food process, food quality and traceability.

Dr Nguyen Van Phong, Southern Horticultural Research Institute (SOFRI), Vietnam: [Physico-chemical properties and current postharvest practices of main fruit varieties in the South of Vietnam](#)

Dr Van Phong explained in his presentation that the South of Vietnam has four agricultural zones i.e. Central Coastal provinces, Central High land, South East and Mekong Delta Zone, with a fruit production area of 471,558 hectares. The range of fruits in the South of Vietnam is plentiful and diverse, especially concentrated in the Mekong Delta Region. Many unique fruit crops from local selection and import (Lò rên milk fruit, Hoa Loc mango, Com Vang Hat Lep durian (yellow flesh and thin seeds), Ri 6 durian, Cai Mon, MonThong durian, Da xanh pomelo, Năm Roi pomelo, Thailand mango etc.) are very popular in the domestic market.

Most of main fruits in the South of Viet Nam are tropical fruits with a short shelf life and very perishable. There have been some positive changes in applying postharvest technology on some exported fruits. However, postharvest practices for fruits in Vietnam in general and in the South of Vietnam in particular, are still poor and there is a lack of investment in technology.

Dr DKNP Pushpakumara, Dr DAN Dharmasena Faculty of Agriculture, University of Peradeniya, Sri Lanka and **C Gunawardane** Institute of Post-harvest Technology, Anuradhapura, Sri Lanka: [Status of Characterisation of Sri Lankan fruits](#)

Dr Pushpakumara highlighted that Sri Lanka has been identified as one of the biodiversity hotspots in the world due to the richness of different species, although the country is very small in size. Therefore, there is a very large range of underutilised crop species in the country and most of the domesticated commercial fruit species are imported from other countries. A limited amount of morphological characterisation has been carried out for underutilised fruit and a few selected nationally important crops have been genetically characterised. However, very little work has been done on the chemical characterisation of local fruit species including the quality of fresh and processed products, sensory evaluation, antioxidant content, etc. More work is needed on genetic

characterisation and on relating morphological variation with different uses so that molecular markers can be used to disseminate appropriate varieties to farmers.

Dr Madan Gopal Saha, Principal Scientific Officer and **Mohammad Mainuddin Molla**, Scientific Officer, Horticulture Research Centre, BARI, Gazipur: [Quality assurance status and future perspective in fresh and processed fruits of Bangladesh](#)

Dr Saha presented a brief scenario of quality assurance status and future perspective in fresh and processed fruits in Bangladesh. He highlighted the problems encountered by researchers and entrepreneurs in meeting quality parameters. As a result, the country cannot export fresh and processed fruits beyond the domestic market. Although the Bangladesh Standard and Testing Institute (BSTI) has formulated over 1700 national standards, none are available for fresh produce. Other than BSTI, the Institute of Nutrition and Food Science (Dhaka University), the Institute of Food Science and Technology (Bangladesh Council for Scientific and Industrial Research) and the Atomic Energy Commission are not well equipped to perform the required test for export markets and are also unable to detect chemical residues and contaminants. Dr Saha outlined the slow but steady increase in exports of fresh fruits and processed products in recent years. He emphasised the requirement to meet safety measures if Bangladesh products are to penetrate EU markets. He concluded his presentation with a hope that Bangladesh has a high potentiality of export expansion due to increased global demand for quality assurance products. With improvement of quality assurance (GAPs, GMPs, TQM, HACCP) system Bangladesh could have a bright future for boosting fresh and processed products.

Session 3: Fruit antioxidants, Chair: Dr Susanta K Roy

Dr Max Reynes, UMR Qualisud TA, France: [Main class of antioxidant \(polyphenol and carotenoids\) of indigenous fruits](#)

Dr Max Reynes stressed the need for research into the main class of antioxidants (polyphenols and carotenoids) of indigenous fruits for their unique properties and protective mechanism against chronic diseases. His presentation synthesized a number of scientific papers by scientists of INRA and CIRAD of France. He also highlighted some of the example of mammals, fruits & vegetables. He explained the role of polyphenols, antioxidants and carotenoids and their chemistry. There is growing interest in antioxidants molecules because they limit the stress oxidant (characterised by a ROS: reactive oxygen species), because oxygen molecules are somewhat unstable and can be transformed into reactive species, depending on temperature, pressure, etc. He also explained the antioxidant power of some of the fruits analyzed by the ORAC method.

Dr Shailendra K Dwivedi, Amity International Centre for Post-harvest Technology and Cold Chain Management, Amity University, India: [Studies on extraction, characterisation and antioxidant activity of anthocyanin extracted from plum pomace](#)

Dr Dwivedi explained that the colour of food stuff is one of the most important characteristics determining its acceptability besides enhancing its delicacy. Anthocyanins are naturally occurring compounds which are hygroscopic in nature and responsible for the red, purple, and blue colours of many fruits, vegetables, cereal grains, and flowers. They provide pro-vitamins, antioxidants and

endow many health benefits. Plum is one of the most important fruit crops of Himachal Pradesh, India, which is very rich in anthocyanin. Plum fruit cv. Santa Rosa contains 15°B total soluble solids, 2.04 per cent titratable acidity (as malic acid), 34.20 mg/100 g (fresh fruit weight) total anthocyanin and 5.5 per cent pomace. Among different methods used for the extraction of anthocyanin, pomace with water is found to be the best in respect of anthocyanin content and types of anthocyanin which can be identified by thin layer chromatography. Anthocyanins are adsorbed with amberlite adsorbent XAD-16 for 8 hours and eluted with ethanol. Antioxidant activity of anthocyanin is directly related to their concentration increasing with increase in concentration. The study showed that plum pomace is as an excellent source of biocolourant which can enhance the colour attributes of the pomace as well as nutritional property of the fruit.

Dr Justine yen Phuong, Conseil en Innovations Technologiques Agroalimentaires Avancees (CITAA) France: [NIRS and its applications in assessment of fruits quality](#)

Dr Phuong explained NIRS (near infrared spectroscopy) and its application for assessing the fruit quality. NIRS is a rapid, precise and non-destructive way of determining fruit and vegetable quality. An integrated research work from G. WOLFANG (CGIAR) and F. DAVRIEUX (CIRAD) on the application of NIRS on difference food items was presented. The total-carotenoids and β -carotene in sweet potato freeze-dried storage root samples; the total-carotenoids, β -cryptoxanthin, β -carotene, zeaxanthin and lutein in maize; total soluble solid (TSS) and lipid contents in freeze-dried kernels of two cultivars of coconuts at different stages of ripeness were NIRS scanned and chemometrics analysed (data pre-processing, calibration and model validation). A PLS model applied to interactance data from sweet potato showed a goodness-of-fit ($R^2=0.95$) between predicted and actual total carotenoids while this value for β -carotene was $R^2=0.92$. The observation of NIRS calibration on maize had a R^2 on total-carotenoids, β -carotene, lutein, zeaxanthin were 0.93, 0.72, 0.72 and 0.86, respectively. The spectra of 385 coconuts samples were acquired on a NIR Systems 6500 monochromator at the reflectance wavelengths from 400 to 2500 nm at 2 nm intervals. Using this spectral library, a classification algorithm was applied to extract 128 samples representative of the library. The latter were used to construct calibration equations in reference to HPLC laboratory analyses for sugar contents and automatic extraction by organic solvent for lipid contents. NIRS was demonstrated as a suitable tool for assessing the quality of coconuts. The cost of the study was lowered by 70%, whilst the volume of organic solvents was reduced by more than 90%.

Session 4: Fruit quality Characterization, Chair: Dr Le, Dinh Don

Dr Le Dinh Don, Nong Lam University, Vietnam: [Introduction about Nong Lam University](#)

Dr Don explained the history of Nong Lam University. He pointed out the present facilities, organisation and the training centre. He also informed the participants about the research activities, joint training programme, international cooperation, and the areas of potential collaborators.

Ms Phung Vo Cam Hong, Nong Lam University, Vietnam: [Application of High Performance Liquid Chromatography \(HPLC\) and Atomic Absorption Spectrophotometric \(AAS\) in nutritional assessment for fruits](#)

Ms Hong explained the theory and methodology of HPLC and AAS.

Ms Lam Thanh Hien, Nong Lam University, Vietnam: [Sensory evaluation in characterisation of fruit quality](#)

Ms Hien explained the theoretical and practical aspects of sensory evaluation.

Tuesday, 24th July, 2012

Training in Laboratory: Fruit mineral and vitamin analysis, and fruit sensory evaluation.

Hands-on training was provided on the second day of the workshop. During a short tour around the RIBES labs, participants were shown the [High Performance Liquid Chromatography \(HPLC\) and Atomic Absorption Spectrophotometry \(AAS\)](#) and other lab equipment.

Ms. Phung, Vo Cam Hong and Ms Lam, Thanh Hien, Nong Lam University, familiarised the participants with the lab equipment and showed them how to use and operate those equipment.

Fruit quality is a measure of the degree of acceptability by the consumer and is comprised of (i) sensory characteristics (appearance, texture and flavor) and (ii) hidden characteristics or internal characteristics (nutritive value, mineral, vitamins). Training was provided on these two sets of characteristics.

The [sensory analysis](#) was conducted on three different Vietnamese banana varieties (chuoï bot, chuoï cao, chuoï sapa), two dragon fruits (red and white flesh dragon fruit), and two papaya (red and yellow flesh papaya). The sensory tests were *scoring tests* in which samples are scored on a scale, between like and dislike, it allows participants to evaluate samples and score in order of preference; *paired comparison test* which allows participant to compare one attribute, e.g. which one is sweeter?; and *ranking test* which allows participants evaluate samples and place attribute in rank order, e.g. juiciness.

Meanwhile, for the internal characteristics, the two fruit quality parameters which are Magnesium and Vitamin C were selected for analysis on three indigenous fruits (Rambutan (*Nephelium lappaceum*), Barbados Cherry (*Malpighia glabra* L.) and Guava (*Psidium guajava* L.)). Participants took part in sample preparation and determination of Magnesium and Vitamin C by using AAS and HPLC, respectively. The AAS method allows Magnesium to be determined quickly and reliably. The preparation of the sample is usually simple and rapid, and concentration of magnesium ions at the parts per million levels (ppm) is easily measured. HPLC analysis shows acceptable linearity, precision and accuracy in Vitamin C determination on fruits.

Wednesday, 25th July, 2012

Field visit to the Vietnam traditional market in Hochiminh City: The main purpose of this visit was to familiarise participants with the Vietnam indigenous fruit and how they are marketed. A very wide range of exotic and indigenous fruits was being sold at the market. Stallholders were seen to keep all fruits, even peeled jackfruit bulbs, at ambient temperature, without protection from dust and dirt, and often using poor quality packaging.



Session 5: Post-harvest storage and marketing

Dr Neeru Dubey, Amity International Centre for Post-harvest Technology and Cold Chain Management, Amity University, India: [Low Cost Storage Technology for Small Scale Farmers](#)

Dr Dubey highlighted the necessity of mechanical refrigeration for farmers with limited resources ; as the convention refrigeration is economically and practically infeasible for the farmers. To overcome this problem a device COOLBOT is a solution for the farmers.

She explained that temperature management is the key tool for reducing the unacceptably high losses of horticultural crops in the developing world. Very few smallholder farmers have access to cooling or cool storage facilities and, even refrigerated transportation is a rarity. For resource-limited farmers in the developing world, standard cool rooms and transportation systems employing mechanical refrigeration have been economically and practically infeasible. To address this gap a project entitled “Cool room and cool chain transport for small scale farmers” was funded by HortCRSP in collaboration with UC Davis, Amity University India, LLC Uganda and Zamorano University, Honduras to test the device “Coolbot” along with locally available insulating materials.

Dr Chu Ky Son, Hanoi University of Science & Technology, Vietnam: [An overview on the quality of some indigenous fruits in North Vietnam](#)

Dr Ky Son explained that the production and consumption of fresh and processed fruits has been increased significantly in Vietnam. The North of Vietnam has both tropical and sub-tropical climates which explained for a wide range of fruit varieties. He reviewed the current status of fruit variety and production in the North of Vietnam in his presentation. The advantages and challenges for fruit supply chains in this region have been presented in parallel with the efforts to improve fruit quality. Moreover, some factors influencing fruit quality such as variety, production and post-harvest factors have also been addressed. An example of litchi which is a particular and promising fruit of the North of Vietnam has been presented in term of production, storage and processing.

Dr Le Nguyen Doan Duy, Cantho University, Vietnam: [Market Access through Competency Based Education and Training in Horticulture](#)

Dr Le explained about the market access through competency based education and training in horticulture (MACBETH). The project focuses on capacity development to improve compliance with food safe and SPS requirements, general training curricula for fresh and processed horticulture value chain, dissemination of training materials using internet based technology, develop linkages of participants' farmers and processor with higher- value market opportunities both export and domestic.

The food safety knowledge network (FSKN): A global competency-based programme to improve knowledge and skills of food safety professionals. www.fskntraining.org
www.foodsafetyknowledgenetwork.org .

Ms Naga Laxmi m. Raman, Amity International Centre for Post-harvest Technology and Cold Chain Management, Amity University, India: [E-learning programme on Post-Harvest Technology](#)

Ms Raman informed the participants that Amity International Centre for Post-Harvest Technology & Cold Chain Management (AICPHT&CCM) and The Postharvest Education Foundation (PEF) are now in the process of setting up a model Integrated Postharvest Management Center on the Amity University campus in Noida. In preparation for this new training center's launch in 2013, AICPHT &CCM, PEF and Tamale Polytechnic in Ghana are offering postharvest technology training via two new Postharvest E-learning Programs during 2012 for young horticultural professionals.

- The South Asia 2012 Postharvest E-Learning Program is open to qualified applicants from India, Pakistan, Bhutan, Sri Lanka, Nepal and Bangladesh and the
- Global 2012 Postharvest E-Learning Program is open to applicants from any country in the developing world.

She also explained that the knowledge and skills gained from this practically oriented field based training will help to improve the quality of extension work and postharvest training programs for small and marginal horticultural farmers and a variety of food handlers, processors and marketers. Gain access to evolving internet based postharvest resources, information and e-mentoring to support long term professional development and improved job performance.

Closing session

The training-workshop ended during which certificates were distributed along with some gifts among the workshop participants. Dr Kate acknowledged the effort of the host for rendering a good training workshop. She expressed her gratitude and thanks to Ms Diep and her colleagues and students who worked together for hosting the training working workshop in a befitting manner.

Appendix 1. List of Participants

Country	Name of the Participant	Name of the Organisation
Bangladesh	Dr. Madan Gopal Saha Principal Scientific Officer mgs_60@yahoo.com . Mr. Mohammad Mainuddin Molla Scientific Officer mainuddinmolla@yahoo.com	Horticulture Research Centre, Bangladesh Agricultural Research Institute (BARI), Bangladesh.
	Ms. Nazma Parvin Laizu Entrepreneur (Managing Director) nokshi@yahoo.com nokshi787@gmail.com	SME- Nokshi Food Products, Savar, Dhaka
	Dr. Hul Seingheng Director of Research, hul@itc.edu.kh	Institute of Technology of Cambodia, Cambodia
India	Prof. Susanta Kumar Roy Roysusanta2002@yahoo.co.in Dr. Neeru Debey needub@gmail.com Dr. Shailendra Dwivedi skdwivedi@amity.edu Mrs. Naga Laxmi Raman nlmraman@gmail.com	Amity International Centre for Post-Harvest Technology and Cold Chain Management, Amity University, Uttar Pradesh, India
Sri Lanka	Prof. DKNP Pushpakumara ngpkumara@pdn.ac.lk	Faculty of Agriculture, University of Peradeniya, Sri Lanka
	Prof. DAN Dharmasena dand@pdn.ac.lk	Faculty of Agriculture, University of Peradeniya, Sri Lanka
	Mr. Chaminda R Gunawardena crohan74@gmail.com	IPHT Research & Development Centre, Sri Lanka.
France	Dr. Max Reynes max.reynes@cirad.fr Dr. Jean Christophe Meile jean-christophe.meile@cirad.fr Dr. Phuong Justine Boffo jean-christophe.meile@cirad.fr	CIRAD, France
UK	Dr. Kate Schreckenber k.schreckenber@soton.ac.uk Ms. Sarah Hickman sarahohickman@gmail.com Mr. Malik Hamid m.a.hamid@soton.ac.uk	University of Southampton , UK
Vietnam (Hosts)	Ms. Duong Thi Ngoc Diep , Lecturer diepngocduong@yahoo.com Mr. Quang Hong Luong , Lecturer lhongquang@yahoo.com	Nong Lam University, HCMC, Vietnam

Vietnam (Local Participants)	Ms Tong, Thi Thao Ngoc Ms. Phan, Thi Lan Khanh	Nong Lam University, HCMC, Vietnam
	Dr. Nguyen, Van Phong	Research Institute of Southern Fruits (SOFRI), Vietnam
	MSc. Le, Nguyen Doan Duy	Can Tho University (CTU), Vietnam
	Dr. Chu, Ky Son	University of Technology, Hanoi (HUT), Vietnam
	Mr. Ly Thong Vien	SME, Verges- Mekong Company, Vietnam
Vietnam (Trainers)	Dr. Le, Dinh Don MSc. Phung, Vo Cam Hong MSc. Lam, Thanh Hien Ms. Truong, Thi Bich Lieu Mr. Vo, Tran Kien	Nong Lam University HCMC, Vietnam

Appendix 2

Training Workshop on Characterisation of Fresh and Processed Fruit Quality Jointly organised by Nong Lam University, Hochiminh City, Vietnam and Centre for Underutilised Crops, University of Southampton funded by Leverhulme Trust

Vietnam, 23-25 July 2012

The Research Institute of Biotechnology and Environment (RIBE) at Nong Lam University, Ho Chi Minh City, Vietnam, and the Centre of Underutilised Crops (CUC) at the University of Southampton are jointly offering a three day (July 23-25, 2012) research training workshop funded by the Leverhulme Trust. The workshop is focusing on promoting cutting edge research and innovation under the project **“International network on preserving safety and nutrition of indigenous fruits and their derivatives”**.

Workshop objectives:

- To promote research into the characterisation of sensory, nutritional and functional qualities of fruit quality by providing training in analytical methods.
- To highlight the nutritional potential of some indigenous fruit in Vietnam and show how techniques developed for the exotic fruit industry could be applied to indigenous fruit.
- To strengthen and extend the existing network. This will be achieved in two ways:
 - By participating in the workshop, network partners will become familiar with each other’s capacities and special interests in the field of characterisation of fruit quality.
 - By including new individuals from partner institutions and from Vietnam, the network will be extended.
- To provide an opportunity for partners to identify research gaps in the area of sensory, nutritional and functional characterisation of indigenous fruit.
- To enable partners to agree on promising research areas and initiate research proposals in the area of characterisation of indigenous fruit.

Training will be provided by staffs from the Faculty of Food Technology, and from the RIBE, Nong Lam University. In addition our other partners will also present papers on relevant subjects. The workshop will comprise a mixture of presentation sessions, class-room training and laboratory work in which the participants can gain hands-on experience. Each participant will receive handouts and guiding documents relating to the training.

WORKSHOP PROGRAM

Time	Session/Activity Description	Chair/Speaker(s)
23rd July Day 1	PRESENTATIONS ON FRUIT CHARACTERISATION	
08:30	Registration	

09:00	Representative introduction	Ms Duong, Thi Ngoc Diep, NLU, Vietnam.
09:15	Welcome address	Dr. Nguyen, Hay, NLU, Rector
09:25	Introduction to the Workshop	Dr Kate Schreckenberg, CUC, University of Southampton, UK
	Session 1: Fruits and indigenous fruits production	Chair : Dr. Kate Schreckenberg
09:35	Potentiality of processed indigenous fruits and their derivatives for providing safe nutrition.	Dr. Susanta Kumar Roy, AU, India
09:55	An over view on fresh and processed fruits production in Cambodia.	Dr Seingheng Hul, ITC, Cambodia
10:15	General discussion	
10:30 – 11:00	COFFEE BREAK	
	Session 2: Fruits and indigenous fruits quality	Chair: Dr. Max Reynes
11:00	Microbiological ecology of indigenous fruits in relation with geographical origin and/or production mode.	Mr. Jean Christophe Meile, CIRAD, France
11:20	Physico-chemical properties and current postharvest practices on main fruit varieties in the South of Viet Nam	Dr. Nguyen, Van Phong – SOFRI, Vietnam
11:40	Status of characterisation of Sri Lankan fruits	Dr Pushpakumara, Dr Dharmasena, and Mr Gunawardena
12:00	Quality assurance status and future perspective in fresh and processed fruits of Bangladesh.	Dr M.G. Saha and Mr M.M. Molla, BARI, Bangladesh
12:20	General discussion	
12:40 – 14:00	LUNCH BREAK	
	Session 3: Fruit antioxidants	Chair: Dr. Susanta K. Roy

14.00	Main class of polyphenols and antioxidants in indigenous fruits.	Dr. Max Reynes, CIRAD, France
14:20	Studies on extraction, characterization and antioxidant activity of anthocyanins extracted from plum pomace.	Dr. Shailendra K. Dwivedi, AU, India
14:40	NIRS and Its Applications In Assessment of Fruit Quality	Dr Justine Phuong Boffo, CITAA, France
15.00	General discussion	
15:15 – 15:45	TEA BREAK	
	Session 4: Fruit quality characterization	Chair: Dr. Le, Dinh Don
15:45	Introduction about Nong Lam University	Dr. Le, Dinh Don, NLU, Vietnam.
16.00	Training: Application of High Performance Liquid Chromatography (HPLC) and Atomic Absorption Spectrophotometric (AAS) in nutritional assessment for fruits	Ms Phung, Vo Cam Hong, NLU, Vietnam
16:30	Training: Sensory evaluation in characterization of fruit quality	Ms Lam, Thanh Hien, NLU, Vietnam
17:00	Day 1 workshop closing	
24th July Day 2	TRAINING AT LABS: FRUIT ASH AND VITAMIN ANALYSIS - FRUIT SENSORY EVALUATION	
08:30	A short tour around the RIBE's labs	Dr Le, Dinh Don, RIBE, NLU, Vietnam
09:00	On-site method training of ash and vitamin analysis by HPLC and AAS	Ms Phung, Vo Cam Hong, NLU, Vietnam
09:30	Sample preparations for magnesium and vitamin C analysis (participants working in groups)	Ms Phung, Vo Cam Hong, NLU, Vietnam
10:30	Sensory evaluation (participants working in groups)	Ms Lam, Thanh Hien, NLU, Vietnam

12:00 – 13:30	LUNCH BREAK	
13:30	Running the ash and vitamin tests (participants working in groups)	Ms Phung, Vo Cam Hong, NLU, Vietnam
15:00 – 15:15	TEA BREAK	
15:20	Tests result discussion	Ms Phung Vo Cam Hong and Ms Lam Thanh Hien, NLU, Vietnam
17:00	Day 2 workshop closing	
25th July Day 3	VIETNAMESE MARKET VISIT, SESSION 5 AND WORKSHOP CLOSING	
7:30	Visit traditional market in Hochiminh city.	
12:00 – 14:00	FAREWELL LUNCH	
	Session 5: Post-harvest storage and marketing	
14.00	Low Cost Storage Technology for Small Scale Farmers	Dr Neeru Dubey, Amity University, India.
14.20	An overview on the quality of some indigenous fruits in North Vietnam.	Dr Chu, Ky Son, HUT Hanoi, Vietnam
14.40	Market Access through Competency Based Education and Training in Horticulture	Mr Le, Nguyen Doan Duy, CTU, Vietnam
15.00	E-learning programme on Post-Harvest Technology	Ms. Naga Laxmi M. Raman, Amity University, India.
15.20	General discussion	
15:35 – 16:00	TEA BREAK	
16.00	Workshop closing and certificate distribution	Dr Kate Schreckenber and Mr Hamid Malik, CUC, University of Southampton
16.15	Internal project discussion on mini-research and Cambodia workshop (continued)	