TROPICAL FRUIT NET

Your Global Partner in Tropical Fruit Development

Issue No. 9 | July 2007

TFNet - Linking People, Technology & Market

International seminar on economics and marketing of tropical and subtropical fruits

The Honourable Minister of Agriculture and Agro-based Industry, Malaysia delivering his opening speech at the international seminar on economics and marketing of tropical fruits in Kuala Lumpur on 16 July 2007.

In this issue...

TFNet together with coorganisers Malaysian Agricultural Research and Development Institute (MARDI), Federal Agricultural Marketing Authority (FAMA) and Bioversity International successfully organised the "International Seminar on Economics and Marketing of Tropical and Subtropical Fruits" at the Putra World Trade Center, Kuala Lumpur on 16 - 18 July 2007. One hundred and seventy (170) participants from government agencies, institutions, international and regional organizations and the private sector attended the seminar, which was officiated by the Honourable Malaysian Minister of Agriculture and Agro-based Industry, Tan Sri Dato Hj. Muhyiddin Hj. Mohd. Yassin.

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Editor's Note...

For TFNet, 2007 signifies the beginning of an eventful year under the newly appointed Chairman, who is currently the Secretary General of the Ministry of Agriculture and Agro-based Industry of Malaysia. With his commitment, guidance and meticulous approach, we foresee, TFNet will continue to move towards its goal to be a relevant organisation in the global tropical fruit scenario. For most of the year, the TFNet secretariat has been responsive in implementing projects according to schedule. This includes the technical aid program to Syria, the study on PVP testing of tropical fruits in eight Asian countries and the CFC fast track project on building an information website on tropical fruits in the French language for the West African countries. All these three projects are scheduled to be completed by year end.

There have also been continuous joint activities with our partners, the Agricultural and Food Marketing Association for Asia and the Pacific (AFMA) of Thailand, Sentra Pengembangan Agribisnis Terpadu (SPAT) of Indonesia, Afro-Asian Regional Development Organisation (AARDO), which is based in India and Syngenta Crop Protection Sdn. Bhd, Malaysia. Most of the activities are related to human resource development such as training, workshops and study visits.

On 16 – 18 July, TFNet organised the International seminar on economics and marketing of tropical and subtropical fruits in Kuala Lumpur, which featured 20 presentations from experts from New Zealand, South Africa and the Asian region. Following the seminar, TFNet held its annual Board of Trustees (BOT) meeting. The meeting concluded with the drawing up of recommendations to enhance TFNets' membership base, initiate more joint collaboration with other international organisations and improve information dissemination and sharing among members.

In the midst of all these activities, the TFNet secretariat had to prevail over some inadvertent circumstances, which included the relocation of the office to a 'temporary' premise, while an alternative office is being readied, and some deficient resources due to changes in personnel.

As end of the year approaches, the activities for 2008 are been planned out, and we are hopeful that next year will be another fruitful year for TFNet.

Welcome New Members

TFNet welcomes the following members :

Associate Members

- Chan Luck Seh
  Expomal International Sdn Bhd, Malaysia

Ordinary Members

- Dr. George Oduro Nkansah
  Kade Institute of Agricultural Research. College of Agriculture and Consumer Sciences
  University of Ghana, Ghana
- Poh Meow Ming
  Leckat Corp. S/B, Malaysia
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- Dr. Bui Xuan Khoi
  South-East Fruits Research Center
- Jupikely James Silip
  School of Sustainable Agriculture, Universiti Malaysia Sabah, Malaysia

Note:
For those interested to contribute and participate in TFNet's activities, the membership application form is on page 19 of this newsletter.

Benefits as TFNet Members

- Sharing information, expertise and technologies;
- Participation in conferences and seminars;
- Market development and trade promotion;
- Participation in collaborative projects or studies;
- Assistance in implementation and harmonisation of international regulations; and
- Participation in human resource development programmes

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TFNet UPCOMING EVENTS

- **TFNet / SPAT HANDS-ON WORKSHOP AND STUDY VISIT TO EAST JAVA**
  Event date : 4 – 10 November 2007
  Venue : SPAT Center, Malang, Provinces of East Java, Indonesia
  This ongoing programme is a collaboration between TFNet and Sentra Pengembangan Agribisnis Terpadu, a training establishment, which is based in Malang, East Java. The workshop will focus on the vacuum fry technology of producing fruit chips. The study visits are to small and medium scale entrepreneurs involved in fruit and food processing in nearlby districts of Mojokerto, Jombang, Kediri and Batu.

  For further information please email : info@itfnet.org

- **TFNet / SPAT HANDS-ON WORKSHOP AND STUDY VISIT TO EAST JAVA AND CENTRAL JAVA**
  Event date : 11 - 17 November 2007
  Venue : SPAT Center, Malang, East Java and Jogjakarta, Central Java, Indonesia
  This study visits will focus on research, development and commercialization of Virgin Coconut Oil (VCO) and other coconut products in Central Java. Participants will also be brought to organic rice and fruit production areas *(zalacca sp)*. A hands-on workshop on processing sweet potato and a visit to the sweet potato research and processing of sweet potato is included in the itinerary.

  For further information please email : info@itfnet.org

- **TFNet / AFMA STUDY VISIT TO AGRO-INDUSTRY PROJECTS IN THAILAND**
  Event date : 25 – 30 November 2007
  Venue : Bangkok, Thailand
  This programme is a collaboration between TFNet and the Agricultural and Food Marketing Association for Asia and the Pacific ((AFMA) which is based in Bangkok, Thailand. The visit will take participants to fruit and vegetables producing areas in the Cantabhuri and Pathumthani provinces including Talad Thai, Asia's largest wholesale market.

  For further information please email : info@itfnet.org

- **SEMINAR ON DRAGON FRUIT (Pitaya) CULTIVATION AND MARKET IN MALAYSIA**
  Event date : January 2008
  Venue : to be determined
  Dragon fruit has gained popularity in Malaysia, even though it is a relatively 'new' fruit. The seminar will look at constraints and problems faced by the growers, especially the recent bacterial disease outbreak and potential markets. Growers, researchers and the public sector are invited to attend.

  For further information please email : info@itfnet.org

- **INTERNATIONAL SEMINAR ON CONSUMER TRENDS AND EXPORT OF TROPICAL FRUITS**
  Event date : 14 - 16 July 2008
  Venue : Century Park Hotel, Bangkok, Thailand
  Changing consumer trends dictate the development of fresh produce. Demands for good quality, fresh, nutritious and ready-to-eat fruit have been increasing since the advent of super and hypermarkets. This seminar looks at the various facets of consumer trends and the subsequent effects on the export of tropical fruits. The seminar is a collaboration between TFNet and the Agricultural and Food Marketing Association for Asia and the Pacific (AFMA), Bangkok, Thailand.

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OTHER RELATED EVENTS

- **BIO – ASIA 2007**
  Event date : 7 – 9 November 2007
  Venue : Queen Sirikit National Convention Center, Bangkok, Thailand
  The First International Trade Exhibition and Conference for Biotechnology to be held in Bangkok, Thailand provides the platform for biotechnology on its claim to be the gateway for a sustainable future.
  BioAsia 2007 Thailand is being touted as the biggest gathering in the Asia Pacific region of scientists and academicians, businessmen and other experts involved in biotechnology covering various fields—from food, agriculture, health, environmental and industrial aspects.

  For further information :
  http://www.bioasia-2007.com/exhibition.html

- **4th INTERNATIONAL SYMPOSIUM ON TROPICAL AND SUBTROPICAL FRUITS**
  Event date : 3 – 7 November 2008
  Venue : Bogor Agricultural Unversity, Bogor, Indonesia
  The Symposium will review current progress and explore potential application in the various research on tropical and subtropical fruits. The aims of the symposium are to facilitate discussion and exchange of technical and scientific information and to promote international cooperation amongst stakeholders who are involved in the development of the tropical and subtropical fruit industry.

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A Mangosteen A Day - Xanthones Anyone?

Article and photos by:
Yacob Ahmad
TFNet

The mangosteen *(Garcinia mangostana)*, often called 'the queen of fruits', is a tropical fruit which is believed to have originated from the Indonesian Islands of Sunda and Moluccas. It is commercially grown in Thailand, Indonesia, Malaysia, Vietnam and the Philippines, and has been recognised as an underutilized fruit, which is quickly gaining popularity because of its medicinal qualities. In South East Asia, the mangosteen has long been used in traditional medicine for ailments such as diarrhea and skin disorders like eczema, diarrhea, dysentery and arthritis among others. These traditional cures have prompted more researchers to elucidate the inherent medicinal properties and health benefits of this fruit.

Scientists and researchers have validated that the medicinal and health benefits of mangosteen comes from a group of chemicals known as xanthones and other nutritional properties. In fact, xanthones were identified when researchers studied the health benefits of mangosteen based on traditional medical uses. Compared to other fruits, mangosteen is known to contain the most amounts of xanthones, which are present mainly in the rind or pericarp of the fruit.

Biochemically, xanthones are unique chemicals found in nature, composed of a tricyclic aromatic system with a variety of phenolic, methoxy, and isoprene substituents, giving rise to numerous derivatives. Currently, researches have identified and classified approximately about 200 xanthones, 40 of which are found In the mangosteen fruit. Some of the important xanthones in mangosteen include alpha-mangostin, beta-mangostin, gamma-mangostin, garcinone, garcinone A, garcinone C, garcinone D, mangostanol and gatanin. These xanthones among others are known to have properties which include anti-inflammatory, anticonvulsant, antiallergic, antitumor and antiplatelet. Researchers have also shown and suggested that xanthones can help alleviate conditions related to gastro-intestinal disorders, skin disorders, inflammation, allergies, infections and cholesterol levels.

Xanthones are also powerful antioxidants in a family of phytonutrients. It is well known clinically and scientifically, that supplementation with antioxidants play a role in lowering incidences of heart disease and strokes. As a powerful antioxidant, xanthones neutralize the harmful effects of free radicals that oxidizes Low Density Lipoproteins (LDL) and the subsequent build up of plaques in the arteries. Plaques formed by damaged LDL molecules narrow the blood vessels which in turn can cause heart ailments.

Mangosteens in a market in Chiangmai, Thailand.

There have been research done on cancer chemopreventive agents to show the antioxidant properties of xanthones. In a study at Ohio State University, USA, it was found that crude alpha-mangostin inhibited preneoplastic lesions, induced by 7,12-dimethylbenz (alpha) anthracene in mouse mammary organ.

In another study at the University of Ryukyus, Japan, it was shown that crude alpha-mangostin had potent chemopreventive effects in a short-term colon carcinogenesis bioassay system suggesting that longer exposure might result in suppression of tumor development. At the Gifu International Institute of Biotechnology, Japan, the effects of six xanthones from the pericarp of mangosteen on the cell growth inhibition of human leukemia cell line HL60, were investigated. It was reported that all xanthones displayed growth inhibitory effects. Among them, alpha-mangostin showed complete inhibition as 10 microM through induction of apoptosis (programmed cell death).

The antimycobacterial, antituberculosis potential of xanthones was studied from prenylated (addition of hydrophobic molecules to a protein) xanthones, isolated from the pericarp, edible arils and seeds of *Garcinia mangostana*. It was found that the xanthones ,alpha- and beta-mangostin and garcinone B exhibited strong inhibitory effects against *Mycobacterium tuberculosis*.

Medical researchers in Thailand and Taiwan have found that gamma-mangostin showed more potent antioxidant properties than vitamin E. Studies in Australia have also shown that Gamma-mangostin successfully protected LDL from being oxidized by free radicals. Another study reported that gamma-mangostin is able to inhibit the production of the COX-2 enzyme, which causes the low-level inflammation often associated with high cholesterol levels. These studies have indicated that the antioxidants in mangosteen can help retard LDL oxidation, thus, reducing the risk of heart diseases.

In two recent studies, it was found that the use of the whole mangosteen fruit, as a vehicle for photonutrient delivery lead to a much higher and consistent level of xanthone absorption. Another study established a reliable scientific method for testing and putting in place a xanthone measurement standard, which can determine how they are best absorbed and therefore made available to the human body.

Xanthones in mangosteen are marketed as supplements in the form of fruit juice (combination with other fruit juices). Due to lack of clinical studies, as xanthones have been marketed as supplements rather than medications, skeptics have brushed of claims that they are beneficial in warding of cancer or heart diseases. It is however, heartening to note that, currently, research and studies are still being carried out on the beneficial effects of the fruit. On a positive note, the use of mangosteen in traditional medicine, cannot be trivialized, and it will not be long before the true goodness and benefits of mangosteen in sustaining a healthy cardiovascular system, supporting cartilage and joint function, promoting a healthy respiratory system, maintaining gastro-intestinal health and neutralizing free radicals, are unraveled.

Attractive, hygienically packed mangosteen.

After all you do not call mangosteen 'the Queen of Fruits' for nothing…..xanthones anyone?

References:

1. Websites :
   http://EzineArticles.com/
   http://www.wisegeek.com/
   http://xanthonesresearch.com/
   http://www.mangozsteen.com

2. Chairungsrilerd N, Furukawa K, Ohta T, Nozoe S, Ohizumi Y (1996). Histaminergic and serotonergic receptor blocking substances from the medicinal plant *Garcinia mangostana*.

3. Jung HA, Su BN, Keller WJ, Mehta RG, Kinghorn AD (2006). Antioxident xanthones from the pericarp of *Garcinia mangostana* (Mangosteen). Division of Medicinal Chemistry and Pharmacognosy, College of Pharmacy, Ohio State Unversity, Columbus, Ohio, USA.

4. Matsumoto K, Akao Y, Kobayashi E, Ohguchi K, Ito T, Tanaka T, Iinma M, Nozawa Y(2003). Induction of apoptosis by xanthones from mangosteen in human leukemia cell lines. Gifu International Institute of Biotechnology, Gifu, Japan.

5. Nabandith V, Suzui M, Morioka T, Kanashiro T, Kinjo T, Matsumoto K, Akao Y, Iinuma M, Yoshimi N (2004). Inhibitory effects of crude alpha-mangostin, a xanthone derivative, on two different categories of colon preneoplastic lesions induced by 1,2-dimethyhydrazine in the rat. Tumor Pathology Division, Faculty of Medicine, University of the Ryukus, Okinawa, Japan.

6. Suksamrarn S, Suwannapoch N, Phakhdee W, Thanuhiranlert J Ratananukul P, Chimnoi N, Suksamrarn A (2003). Antimycobacterial activity of prenylated xanthones from the fruits of *Garcinia mangostana*. Department of Chemistry, Faculty of Science, Srinakharinwirot University, Bangkok, Thailand.

Workshop on PVP testing of Tropical Fruits – 14 – 16 August 2007

The PVP workshop which was held in Petaling Jaya, Malaysia on the 14 – 16 August 2007, was attended by country representatives involved in the TFNet – GTZ cooperation to study and assess the status of PVP testing on tropical fruits in Asian countries. The countries involved in the study are Bangladesh, China, India, Malaysia, Indonesia, Philippines, Thailand and Vietnam. The workshop was attended by representatives from 5 countries – Malaysia, Indonesia, Philippines, Thailand and Vietnam. Participants from Bangladesh, China and India were not able to attend the workshop.

Participants who attended the workshop were :

1. Mr. Phan Xuan Liem, Vice Director, National Centre for Variety Evaluation and Seed Certification (NCVESC), Hanoi, Vietnam
2. Dr. Vivencio R. Mamaril, Head, Plant Variety Protection Secretarieat, Bureau of Plant Industry, Manila, Philippines
3. Ms. Chutima Ratanasatien, Senior Agricultural Scientist, Plant Variety Protection Division, Department of Agriculture, Bangkok, Thailand
4. Ms. Nurdini Khadijah, Sub Division of Testing Services, Center for Plant Variety Protection, Jakarta, Indonesia
5. Mr. Esa Sulaiman, Assistant Director, Registration of Plant Variety Protection Section, Crop Quality Control Division, Department of Agriculture, Putrajaya, Malaysia
6. Ms. Florence C. Ginibun, Agriculture Officer, Registration of Plant Variety Protection Section, Crop Quality Control Division, Department of Agriculture, Putrajaya, Malaysia
7. Ms. Sudarti Asri, Agriculture Officer, Registration of Plant Variety Protection Section, Crop Quality Control Division, Department of Agriculture, Putrajaya, Malaysia

The workshop was conducted by Dr. Erik Schulte, External Consultant from Bundessortenamt, Germany and Mr. Yacob Ahmad, Technical Officer of TFNet.

The objectives of having the workshop were :

- To deliberate, discuss and complete a draft report of the study on PVP testing of tropical fruits in Asian countries.
- To compile and disseminate information from involved countries to help enhance the experience of developing an effective PVP system for tropical fruits.
- To jointly discuss some examples of test guidelines for selected tropical fruits
- To establish networking contacts among participants of the workshop that will enhance future exchange and sharing of information.
- To explore the possibility of future collaboration among involved countries on the conduct of DUS testing and on the harmonization of test guidelines for tropical fruit species.

Participants of the Workshop on PVP testing of tropical fruits in Petaling Jaya, Malaysia – 14 -16 August 2007.

Beside a short presentation of each country representative on the current status of PVP implementation in the particular country, the summarized outcome of the questionnaires and the referring country visits were presented, intensively discussed and, where necessary, completed or corrected in this report. In addition to this, comprehensive information on the selection of suitable characteristics and their use, the main principles for elaborating national guidelines, as well as methods and beneficial aspects of co-operation in DUS testing of tropical fruit species, were presented by the external consultant and lively discussed in the plenum.

One of the main outcome of the workshop is that it managed to identify the possible areas of future cooperation among the countries involved in the study. It is apparent that PVP testing of tropical fruits is still in its infancy in most of the countries and there needs to be some kind of forum to facilitate the exchange of information or carrying out cross borders PVP activities, where possible.

Another outcome is the need to carry out capacity building workshops to determine the relevant characteristics for each fruit type and to harmonize test guidelines for the common tropical fruits.

Feedback from the workshop will be published in a report in November 2007.

Benefiting from the potential of underutilized fruits

Article and photos by :
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In the South, South-East and East Asian region a rich diversity of tropical fruits plays an important role in people's livelihoods and provides for a broad range of livelihood support including household income, food, employment, traditional medicine, timber, and livestock fodder and also plays a role in the stability of eco-systems. Many of these species, although locally abundant and of major cultural importance are less well-known in other parts of the region and there is a lack of scientific knowledge about them and these species are therefore often referred to as 'underutilized'. Some strategies aiming at conserving these plant species are focussed on the promotion of their use and on farm conservation, including the strengthening of market systems. This will provide farmers with an economic incentive to maintain these species on farm. In this article we describe the potential utilization of a few of these fruits by highlighting three cases from India, Indonesia and Thailand that were studied in the context of a project by Bioversity International (formerly know as the International Plant Genetic Resources Institute) on the conservation management and use of tropical fruit trees. This shows how the utilization of these tropical fruits can make a major contribution to farmer income and provide them with an incentive to maintain a broad range of tropical fruit trees on their farm.

Garcinia cowa (cowa) from Thailand

Garcinia cowa, commonly known as cowa-mangosteen or cowa and in Thailand as 'cha muang', belongs to one of the five genera in the Clusiaceae (Guttiferae) family that are represented in Southeast Asia. In Thailand 22 Garcinia species have been reported of which mangosteen (*Garcinia mangostana*) is probably the most well-known. Cowa is a small to medium-sized tree that in Thailand is found in lowland, undulating areas and peat swamp forests. Both the fruit (berry) and the young shoots are edible, the latter of which is said to contain a high level of vitamin A and vitamin C.

A Cowa tree.

A case study was carried out with a group of women based in Chanthaburi province in Thailand that is processing several products derived from a range of tropical fruits including cowa. The group, established in 1983, consists of 40 members who provide wage labour for processing. The women decided to start processing tropical fruits after a major storm damaged the community's durian and mangosteen trees and caused the still immature fruits to drop. Quality of these fruits was considered to be too low to be marketed as fresh products and therefore it was decided by some of the female members of the community to process the fruits in their homes. With assistance of the district's agricultural extension office they established a cooperative. This encouraged the group to process more frequently from their homes and start including other species. Presently the cooperative is producing and packing a local Thai dish with cowa leaves called *Moochamung*, shampoo from citrus cultivar Bergamoc and durian, tamarind and mangosteen paste. Cowa leaves for the *Moochamung* dish are procured from the members of the cooperative, who harvest the fresh, young shoots from their homegardens and in some cases from the wild. When trees become too high to easily harvest the leaves, trees are either cut halfway or new seedlings are planted. The final product is canned and sold to local shops and the Bangkok market. This product *Moochamung*, based on cowa leaves, has become an important source of additional income for these women, both through the sales of these products with an estimated annual profit of up to US$5000, and through income from wage labour (paid at US$3 per day).

Cowa product sold in a supermarket.

Garcinia indica (kokum) from south India

One of the underutilized fruit species that is of importance in India is *Garcinia indica* or kokum, an evergreen tree that is native of the Western Ghats in India and Malaysia. In India it mainly grows in the western parts of Maharashtra, Karnataka, Kerala and Goa. It is found in evergreen and semi-evergreen forests and as a homegarden tree. Because these trees are part of the natural forest vegetation and thus available in the wild, they are utilized by collectors of forest resources (such as non-timber forest products) and form an important source of livelihood support for the families dwelling close to these natural habitats.

Products of kokum.

The kokum fruit is bright red, has a sweetish acid taste and its different parts are used for a range of purposes. The pulp and the seed of the fruit are separated and the rind is dried (which is called 'sole') and used as a souring agent in traditional dishes and for the preparation of syrup and juice. Oil is extracted from the seed through an elaborate process and used for cooking purposes and as an ingredient in cosmetic products. The rind is considered to have medicinal purposes, for the treatment of piles, dysentery, tumours, and heart complaints. The main active component in kokum is hydroxycitric acid (HCA) which is regarded as a fat reducer; however clinical research has failed to show any significant losses in weight with the tested subjects. Most of these products are used domestically by the collectors and homestead farmers. Their commercial preparation is undertaken by small- to medium-scale processors. The extraction of oil from the seed is a labour intensive task and is therefore mostly done by processors that have the appropriate equipment.

A case study that was carried out at several kokum growing locations found that in Karnataka state collectors have limited access to markets for kokum and the price has severely decreased because of this. Commercial processing units are only present on a very limited scale and collectors are unable to market their product collectively. Whereas kokum used to provide an important source of income support for these collectors, presently they have abandoned collection and are forced to look for alternative resources. In Maharashtra state however, kokum growers are more effectively linked to the market through a horticultural society and therefore have a secure (although still limited) outlet for their products and an additional source of income.

Citrus maxima (pomelo) from Indonesia

Citrus maxima (or *C. grandis*) with the common name pomelo originates from the Rutaceae family and is believed to be closely related to the grapefruit. Although the fruit is widely known in the Southeast Asian region, where it is native, it is much less known in other parts of the world. The place of origin is most likely Indonesia, Malaysia and Thailand. It is a bushy tree with fruits that are the largest among the citrus species and a rough light green to yellow skin. Underneath the skin the fruit has a thick white spongy layer that encloses the actual edible part of the fruit. The flesh of the fruit is white, light yellow, pink or rose-red, juicy with a sweet sour or spicy sweet.


Pomelo fruit ready for harvesting.

Edible portion of pomelo.

This case study was carried out in the district of Magetan in East-Java in Indonesia. In this district the main source of income is generated by agriculture and the main crop is pomelo, followed by mango. The district has four sub-districts: Sukomoro, Bendo, Takeran, Kawedanan, of which in the first three, pomelo is grown. It was introduced there from another district Madiun, where a large area of pomelo trees were planted and land resources became scarce. Three main varieties are grown in all sub-districts however the distribution differs between the geographical locations. This diversity is maintained because of differentiation in taste and appearance and the differences in market share of the varieties. The variety Nambangan can be stored for a long time and has a sweet taste and is harvested seven to eight months after flowering (June/July); Sri Nyonya has a short shelf-life due to its thinner skin, has a more sour taste and is harvested six months after flowering (May); and Magetan has a very sweet fruit that is also picked six months after flowering (May).

Although in Indonesia fresh pomelo is sold on a large scale, we consider a women group that processes the white spongy skin of the pomelo into sweets. The group, consisting of 25 female members, was founded in the year 2000 when a disease was attacking pomelo (fruitfly and fruitbores). Fruits fell down and were unsuitable for fresh sales. A governmental agency developed a method to produce candy from the white skin of the reject fruits. Raw material is procured from both members and non-members. Annual profits made are estimated at US$150 and income for a total of about 420 labour days at US$1.66 per day.

Processing pomelo skin into candy.

Acknowledgements

Case studies were carried out in collaboration with national partners in the three countries. The author is especially grateful to Dr. Sudha Mysore of the Indian Institute of Horticultural Research in Bangalore India, Dr. Songpol Somsri of the Department of Agriculture in Bangkok Thailand and Dr. Anto Hardiyanto of the Indonesian Center for Horticulture Research and Development in Jakarta Indonesia.

References

- Kamat, N.M. 2005. "Non-traditional Products from Kokum: Inland and Global Opportunities". Proc. 2nd National Seminar on kokum (Garcinia indica Choisy). University of Goa, India, March 4-5, 2005.
- Korikanthimath, V.S. and A.R. Desai. 2005. "Status of Kokum (Garcinia Indica Choisy) in Goa". Proc. 2nd National Seminar on kokum (Garcinia indica Choisy). University of Goa, India, March 4-5, 2005.
- Kruijssen, F. and S. Somsri. 2006. Marketing local biodiversity in Thailand: Identification of a possible good practice for on-farm biodiversity management of tropical fruit trees. Contributed paper for the Deutscher Tropentag, "Prosperity and Poverty in a Globalised World—Challenges for Agricultural Research", 11-12 October 2006, Bonn, Germany.
- Kruijssen, F. and M. Sudha. Forthcoming. Enhancing biodiversity conservation and utilization for improved livelihoods – a case study of kokum in India. International workshop on tropical and sub-tropical fruits. 27-30 November 2006, Chiang Mai, Thailand. Forthcoming in Acta Horticulturae.
- Patil, B.P., M.S. Gawankar, V.V. Sagvekar, and N.D. Jambhale. 2005. Status of existing kokum plantation in Maharashtra. Proc. 2nd National Seminar on kokum (Garcinia indica Choisy). University of Goa, India, March 4-5, 2005.
- Yapwattanaphun, C., S. Subhadrabandhu, A. Sugiura, and K. Yonemori and N. Utsunomiya. 2002. Utilization of some garcinia species in Thailand. In: Drew, R. (ed.) Proceedings of the International Symposium on Tropical and Subtropical Fruits, *Acta Horticulturae* 575, ISHS.

TFNet CEO together with Vietnam PVP Senior Officer, Dr. Nguyen Thanh Minh and Dr Nguyen Quoc Hung, Head of Science and International Relation Department, at the litchi germplasm plot, Research of Fruit and Vegetables Institute, Gialam, Hanoi, Vietnam during the country visit for the study of PVP testing on tropical crops. – 17 May 2007.

Inspecting a PVP application for mango in Thailand during the visit by TFNet's technical officer while carrying out the study details on PVP testing of tropical fruits. – 2 May 2007.

Mango research plot at the Research Institute for Fruits and Vegetables, Hanoi, Vietnam.

TFNet CEO together with Head of PVP office, Indonesia Mdm Hindarwati and PVP officer Ms. Syalmiati, being briefed by the Head of Fruit Research, University of Bogor Dr. Sobir, on the vegetative propagation of mangosteen. – 9 May 2007.

TFNet CEO, Dr. Izham Ahmad in a meeting with the Indonesian Plant Variety Protection office in Jakarta on 8 May 2007 on the status of PVP testing of fruits.

En. Md. Khairuddin Tahir of FruitReg, presenting his paper 'Case study on traceability on starfruit - Malaysian Food Information and Traceability Project'.

The Honourable Minister of Agriculture and Agro-based Industry, Malaysia delivering his opening speech.

l seminar on economics and marketing of cal fruits, Kuala Lumpur 16 – 18 July 2007.

Mango germplasm at the Bangladesh Agricultural Research Centre – during a visit by consultants for TFNet –GTZ study on plant variety protection testing of tropical fruits.- 5 April 2007.

German consultant Dr. Erik Schulte, discussing with the Horticultural Division Head and officers from Bangladesh Agricultural Research Centre in Dhaka, on PVP testing of tropical fruits in Bangladesh. – 5 April 2007.

Increasing Consumption of Tropical and Subtropical Fruits

By Izham Ahmad and Chua Piak Chwee
Paper presented at WHO/FAO Workshop on Fruit and Vegetables for Health, 15 – 16 August 2006 Seoul, Korea

The tropical and subtropical fruit industry is an important sector in many countries in generating income and employment, provides foreign exchange earnings and as an important source of nutrition and dietary requirements for a healthy population. It is a vibrant sector with progressive expansion in production, international trade and consumption.

Your Global Partner in Tropical Fruits Development

WORLD CONSUMPTION TREND of MAJOR TROPICAL & SUBTROPICAL FRUITS

- 2000-2004: Annual consumption = 213 million tonnes with growth rate of 3.3%
- Watermelons rank highest in global consumption:
  - Average annual consumption of 71 million tonnes; Annual Growth Rate of 4.9%

Fruits	Year (1,000 tonnes)						% of 2004 Total	Annual Growth Rate 2000 - 2004 (%)	Annual Average ('000 tonnes/ yr)
	1995-1999 (average)	2000	2001	2002	2003	2004			
Watermelons	44,669	61,501	66,651	72,933	77,381	78,741	34.6	4.9	71,441
Bananas	47,588	52,219	53,204	56,534	57,410	59,482	26.1	2.6	55,770
Mangoes	20,593	22,138	22,298	23,812	24,148	22,827	10.0	0.6	23,045
Other melons	13,435	15,936	19,853	20,916	21,850	22,401	9.8	6.7	20,191
Pineapples	12,055	13,187	13,600	14,212	14,794	14,687	6.4	2.2	14,096
Lemon & Limes	8,966	11,226	11,043	11,072	11,307	11,171	4.9	-0.1	11,164
Papayas	4,280	4,970	5,329	5,588	5,798	5,844	2.6	3.2	5,506
Other citrus	4,599	4,987	5,183	5,380	5,537	5,555	2.4	2.2	5,328
Grapefruit & pomelo	4,440	4,335	4,094	4,264	4,274	4,431	1.9	0.4	4,280
Avocados	1,994	2,337	2,488	2,613	2,812	2,699	1.2	2.9	2,590
Total	**162,617**	**192,836**	**203,743**	**217,325**	**225,312**	**227,837**	**100.0**	**3.3**	**213,411**

(Data Source: FAOSTAT)

Global Production

During the last five years (2000-2004), global production of tropical and subtropical fruits registered an annual growth rate of 3.5 percent. The production of all fruit types has increased by 19.2 percent, from 227 million tonnes in 2000 to 270 million tonnes in 2004. Watermelon registered the largest production volume in 2004. With an annual growth rate of 4.8 percent, watermelon production of 95.3 million tonnes in 2004 accounted for 35 percent of global tropical fruit production. The other major fruits with significant production volumes and annual growth rates are bananas, mangoes, pineapples and papayas.

Asia is the largest tropical fruit producing region, with a production of 178 million tonnes in 2004 which accounts for 66 percent of total global production. The other major regions are America (53 million tonnes) and Africa (25 million tonnes). Among the Asian countries, China is the world's largest producer of tropical fruits. Total production by China in 2004 amounted to 96.3 million tonnes which accounted for 54 percent of total global production.

Export of Fresh Tropical Fruits

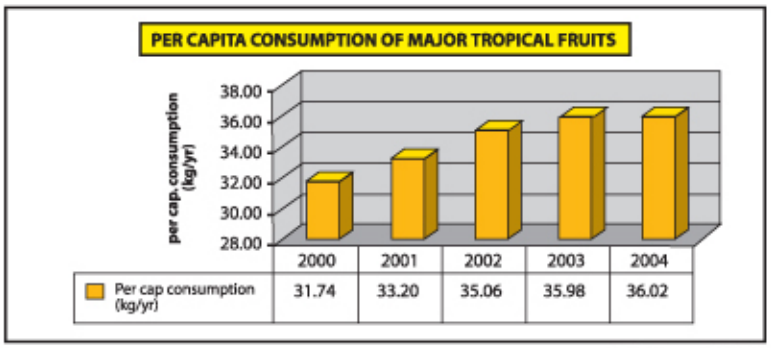
During the last five years, there has been significant growth in the international trade of tropical and subtropical fruits. The volume exported has increased by 31 percent from 27.5 million tonnes in 2000 to 35.9 million tonnes in 2004. In terms of value, the global export market in 2004 is estimated at USD15 billion. The export market is dominated by bananas and pineapples. In 2004, the export of bananas (15.8 millions tonnes valued at USD6.7 billion) accounted for 44 percent of the global export trade. The export value of pineapples in 2004 is estimated USD2.4 billion.

Trade data for the last five years indicate that although Asia is the largest producing region, it ranks second to America in terms of exports. The export value from America in 2004 was estimated at USD6.1 billion as compared to Asia's export value of USD2.5 billion. America's export in 2004 accounted for 46 percent of total global exports, with an increase of 6.6 percent from 14.4 million tonnes in 2000 to 16.5 million tonnes in 2004. The major fruit exported by the American region is bananas, especially from Ecuador (4 million tonnes) and Costa Rica (1.84 million tonnes). In the Asian region, the major exporting countries are the Philippines (bananas and pineapples) and Thailand (pineapples).

Your Global Partner in Tropical Fruits Development

GLOBAL PER CAPITA CONSUMPTION

- Healthy increasing trend in per capita consumption
- 2000-2004: average annual per cap. consumption = 34.4 kg/yr
- 2004 global per cap. consumption = 36 kg / yr = 24% of recommended intake of fruits (150 kg/yr)



(Data Source: FAOSTAT)

Imports of Tropical Fruits

On the demand side, global imports of tropical and subtropical fruits during the last five years have expanded by 25 percent from 28 million tonnes in 2000 to 35 million tonnes in 2004. Global imports in 2004 was estimated at USD18 billion, with the major European countries (Germany, Netherlands, France and United Kingdom) accounting for about 50 percent of these imports. USA is the single largest importing country in 2004 with a volume of nine million tonnes valued at USD3.4 billion. In the Asian region, Japan is the largest importing country, particularly for bananas, grapefruits and pineapples.

Consumption of Tropical and Subtropical Fruits

Fruits constitute an important nutritional component in the daily diet. The FAO/WHO Expert Consultation Meeting in 2003 has recommended a daily intake of more than 400 grams of fruits or 150 kg per person per year.

There is a healthy increasing trend in the consumption of tropical and subtropical fruits during the last five years. Global consumption has increased by 18 percent from 193 million tonnes in 2000 to 228 million tonnes in 2004, representing an average annual per capita consumption of 34.4 kg. The average per capita consumption in 2004 is estimated at 36 kg which is equivalent to 24 percent of the recommended intake of all fruits. Watermelons and bananas rank the highest in terms of global intake of tropical and subtropical fruits. The per capita consumption of watermelons and bananas in 2004 is estimated at 12.3 kg and 9.3 kg, respectively.

Regionally, Asia registered the highest consumption quantity with an annual average of 137 million tonnes. This can be attributed to the fact that Asia is the largest producer of tropical fruits. In terms of per capita consumption of tropical fruits, Asia ranks third in the world with an average of 36 kg/cap/yr.

Nutrition and Health Properties of Tropical and Subtropical Fruits

Tropical and subtropical fruits are important sources of vitamins and minerals and many of these fruits are also high in dietary fibre. Research findings also indicate that these fruits contain micronutrients, phytochemicals and antioxidants which could contribute to human well-being and health. Some of, these fruits have been traditional used for the prevention and as healing remedies for a number of illnesses and diseases. With these properties, there is a vast potential for innovation and development of new products from these fruits in the functional food and nutraceutical industries.

Various campaigns to promote fruit consumption have been initiated by WHO and national organisations. The most prominent campaign is the "5 A Day Programme" promoting the consumption of at least five servings of fruits per day and increasing the availability of fruits in schools and worksites.

Conclusion

The tropical and subtropical fruit industry has registered healthy expansion in production, international trade and consumption trends. This important sector has the vast potential for further exploitation for the development of new products, especially processed products as tropical and subtropical fruits are highly perishable with short storage life. There is also commercial potential for the extraction of phytochemicals, nutraceuticals and metabolites from these fruits.

The following partnership projects are proposed for further development of the tropical and subtropical fruit sector:

- Tropical Fruit Consumption Campaign and Human Health
- Conservation and utilization of traditional fruit species
- Clinical and nutritional studies such as nutrient contents of fruit species, epidemiological studies, and phytochemicals / metabolites in fruits.
- Organic fruit cultivation
- The development of a Global Information System for Tropical and Subtropical Fruits (production, trade, consumption, and nutritional and health information).

International seminar on economics and marketing of tropical and subtropical fruits

TFNet with coorganisers Malaysian Agricultural Research and Development Institute (MARDI), Federal Agricultural Marketing Authority (FAMA) and Bioversity International successfully organised the "International Seminar on Economics and Marketing of Tropical and Subtropical Fruits" at the Putra World Trade Center, Kuala Lumpur on 16 – 18 July 2007. One hundred and seventy (170) participants from government agencies, institutions, international and regional organizations and the private sector attended the seminar, which was officiated by the Honourable Malaysian Minister of Agriculture and Agro-based Industry, Tan Sri Dato Hj. Muhyiddin Hj. Mohd. Yassin.

Participation by Dr. Ahmad Dimyati from Indonesia.

Altogether, there were 20 papers presented by international and local speakers on topics related to:

a. Trends and issues in the marketing of tropical and subtropical fruits
b. Country papers on economics and marketing of tropical fruits
c. Changes in the retailing sector and its implications on small players in the tropical fruit industry
d. Supply chain management and traceability in the marketing of tropical and subtropical fruits and,
e. Biodiversity and marketing of tropical and subtropical fruits

The keynote address, 'The global supply and demand prospects of tropical and subtropical fruit' was delivered by Mr. Kaison Chang, Senior Economist, FAO, Rome (Secretary, FAO Sub-Group on Tropical Fruits)

The other papers and presenters at the seminar were :

- Outlook on the domestic and export market for tropical fruits and subtropical fruits in China
  Dr. Yi Ganjun, Director, Institute of Fruit Tree Research, Guangzhou, China
- The marketing of tropical fruits in Indonesia with reference to the involvement of small growers
  Dr. Ahmad Dimyati, Director General of Horticulture, Department of Agriculture, Indonesia
- Market trends and export of tropical fruits in Thailand
  Prof. Dr. Narong Chomchalow, Assumption University, Bangkok, Thailand
- Increasing the global market potential for tropical and subtropical fruits
  Mr. Bruce Mulligan, Consultant, Malaysian AgriFood Corporation Bhd.
- The potential of Malaysian fruits in meeting global demand
  Tn. Hj. Samah bin Hassan, Deputy Director General, Federal Agricultural Marketing Authority (FAMA), Malaysia
- Marketing of fruits in India - Present practice and future needs
  Prof. Dr. Sisir Kumar Mitra, Faculty of Horticulture, Bidhan Chandra Krishi Viswavidyalaya, West Bengal, India
- Exploring the link between supply chain management and transaction costs economics: A cursory evaluation ot export mango and small-hold banana marketing in the Philippines
  Dr. Albert P Aquino, Director, Socio-economics Research Division Philippines Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD), Los Banos, Philippines
- Supply and demand trends of tropical fruits in Indonesia
  Dr. Roedhy Poewanto, Institute of Fruit Research, Bogor Agricultural Institute, Indonesia
- Market trends and export of tropical fruits from Vietnam
  Dr.Nguyen Minh Chau, Director, Southern Fruits Research Station, Ho Chi Minh City, Vietnam
- The impact of supermarkets on traditional market chain in Asia, with reference to tropical and subtropical fruits
  Dr. Juejan Tangtermthong, Agricultural and Food Marketing Association for Asia and the Pacific (AFMA), Bangkok, Thailand
- Thailand's experience in wholesale, distribution and retailing of tropical fruits
  Ms. Parichat Angkanawattana , Assistant Manager, Business Promotion/Public Relations, Thai Agro Exchange Co Ltd. (Talad Thai), Bangkok
- International cooperation in marketing of tropical and subtropical fruits to facilitate marketing (Volume coordination between competing countries)
  Mr. Stephan Crafford., General Manager, South African Subtropical Growers' Association (SUBTROP), Tzaneen, South Africa
- Food Safety Program on Fruit Crops in relation to quality control in Thailand
  Mr. Somcai Chamnarongkul, Deputy Secretary General, National Bureau of Agricultural Commodity and Food Standards (ACFS), Bangkok, Thailand
- Case study on traceability on starfruit – Malaysian Food Information and Traceability Project
  Mr. Khairuddin Md. Tahir,. FoodReg, Malaysia
- Post harvest requirements, quality and traceability for the marketing and export of tropical fruits and subtropical fruits
  Prof. Dr. Errol Hewett, Emeritus Professor of Horticultural Science, Institute of Food, Nutrition and Human Health, ,Massey University, New Zealand
- Guava intercropping - management for citrus greening disease.
  Mr. Le Quoc Dien, Research Officerr, Southern Fruits Research Station, Ho Chi Minh City, Vietnam
- Markets, Fruit Diversity and Livelihoods
  Ms. Froukje Kruijssen, Associate Scientist, Bioversity International, Malaysia
- Promotion of underutilised plants and biodiversity: Lessons for fruits and markets
  Dr. Hannah Jaenicke, Director, International Centre for Underutilized Crops (ICUC), Sri Lanka
- Market as incentives for sustainable fruit producing systems: Lessons learnt from tropical and subtropical fruits in India
  Dr. Sudha Mysore, Senior Scientist, Indian Institute of Horticultural Research, Bangalore, India

Display of local fruits during the visit to Selangor Fruit Valley.

The seminar ended with a panel discussion on 'Strategies to increase the market share of tropical fruits in the global market'. The discussion was chaired by Tengku Mohd. Ariff Tengku Ahmad from MARDI, Malaysia with Hj. Sahbani Saimin, Dr. Hannah Jaenicke, Dr. Narong Chomchalow, Dr. Ahmad Dimyati and Mr. Stephan Crafford as panelists.

A field trip to Selangor Fruit Valley at Rawang and the Agricultural Heritage Park at Putrajaya was organised on the third day of the seminar. At the 800 hectare, plantation-style managed Selangor Fruit Valley, participants were briefed by the management and given the opportunity to visit the largest starfruit growing area in this region, besides other fruit types like papaya, pineapples, honey mandarin, jackfruit, mango and dragon fruit. At the Agricultural Heritage Park, participants were briefed on the transformation of Malaysian agriculture and also toured the park compounds to view the collection of local fruit trees, herbs, spices and plantation crops.

The seminar was successful in providing a forum for the private sector, public sector, farmers organizations, exporters and other stakeholders in the tropical fruit industry to share knowledge, information and views on issues related to economics and marketing of tropical and subtropical fruits. The seminar also managed to establish networking and linkages among participants.

Papers presented in the seminar will be publish in a proceedings which will be available in December 2007.

Under Utilised Tropical and Subtropical Fruit Crops: Postharvest Considerations

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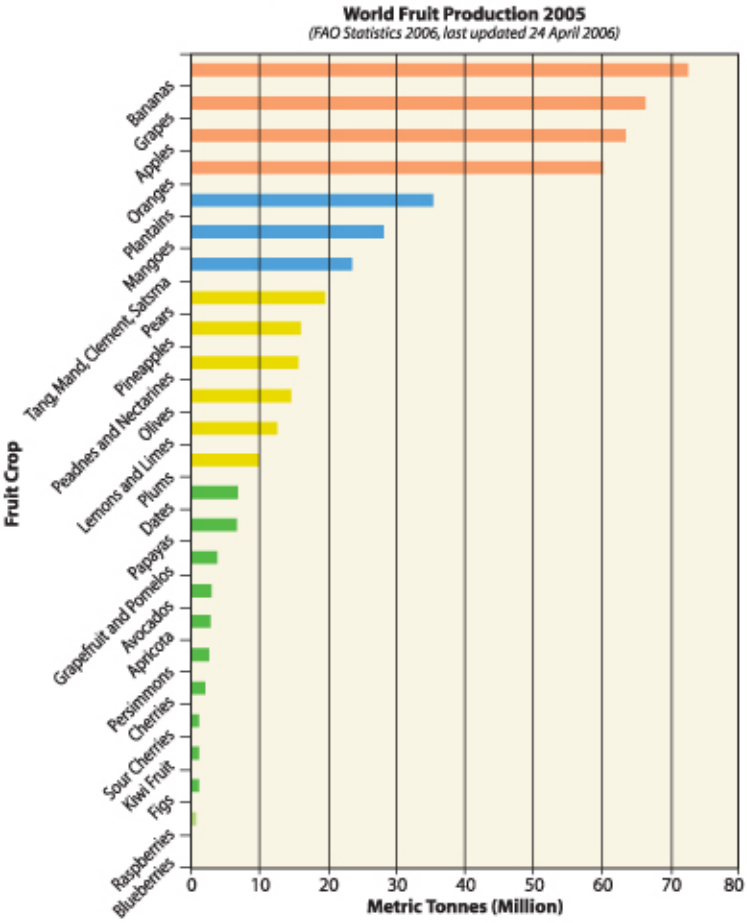
INTRODUCTION

Consumers in countries around the world are seeking new eating experiences. Wealthy supermarket consumers in many parts of the world are seeking diversity and novelty in fruits and are prepared to pay high prices for products that look attractive, have a striking colour and/or shape, are new on the shelves and are known to possess some new or traditional health benefit. They are prepared to experiment with exotic fruits with novel tastes and new flavours, as long as it is safe, nutritious and healthy.

Only a limited range of fruits are commercially produced for world trade (Fig. 1), with few tropical and subtropical fruit types listed. Many indigenous genera and species exist; more than 400 edible tropical fruit species known in Asia, and native American fruit include more than 1000 species in 282 genera in 66 families (Anon, 2006).

Underutilized crops exist across a spectrum from those that are well known but have never been developed to their full genetic and commercial potential (such as figs, pomegranates, dates, pistachio, jackfruit, litchi and durian, mangosteen, carambola, longan, cherimoya, passion fruits, pineapple, papaya), to those that exist in the wild, are totally undeveloped and have little commercial impact away from the site of production; these include indigenous species and seedlings of fruits from species such as Actinidia, Annona and Passiflora.

Figure 1. World Fruit Production 2005.
(Source FAOSTATS (2006, last updated 26 April 2006).



POSTHARVEST FEATURES

What attributes that will enable an underutilized fruit crop to become a significant and mainline commercial crop? The answer is of course CONSUMER DEMAND. If enough of a new product can be put in front of prospective buyers, if they are persuaded to taste the fruit and if they like it, then it is most likely that they will demand more and a success may be created.

Consumer appeal. What are the attributes most likely to appeal to consumers? While each of the quality attributes listed below are important, their significance will vary as specific requirements will ultimately reflect cultural and/or individual preference of consumers. Such attributes would include:

- Colour – generally a highly coloured (red, yellow, orange) fruit is more likely to appeal then a dull colour. Initially external colour is important, but internal colour plays a part in subsequent purchases;
- Size –should not be too large or too small; most people resist buying a large unfamiliar fruit;
- Taste and aroma – in general fruit should be sweet with an appropriate sugar/acid balance; unique taste and aroma attracts repeat purchases;
- Easy to eat – an 'easy to peel' fruit will be more popular than one that 'challenges' consumers to obtain the edible portion, giving them wet, messy hands or that has many large seeds.
- Freedom from defects – physical, pathological or physiological defects induces resistance among most consumers who will avoid products with scars, scabs, decay and insect infestations;
- Texture – mouth feel, crisp or melting texture must be appropriate for the specific product; traditional expectations play role in consumer perception of quality;
- Juiciness –this is a key quality attribute; one experience with a fruit that is dry, woolly or mealy when it is expected to be really juicy will negatively impact on future purchase decisions by consumers;
- Safety –international, national and proprietary standards must be attained such as EUREPGAP;
- Environmentally sustainable production systems- also required in EUREPGAP and other standards.

These attributes must be considered when making a decision on what neglected and underutilized fruits from developing countries could be the basis of research and development as part of a strategy to create market opportunities. The following indicates briefly some key factors that must be taken into account when considering if a currently underutilised fruit has potential, and should be developed, for increased production and marketing. More detailed additional information can be found in Kitinoja and Gorny (1999) and Kitinoja and Kader (2002).

Fruits packed in padded cartons.

Harvesting. There are two aspects to this topic: how to decide when a fruit crop is ready to harvest; and then what techniques to use to minimise or physical damage during the harvesting process. It is important to understand the nature of the physiological development of a fruit type when attempting to determine the most appropriate method for assessing the correct maturity stage for harvest.

Methods of harvesting. Tools are available that reduce physical damage to fruit during harvesting, many of which have been created by farmers to cope with the particular characteristics of the fruit being harvested (Kitinoja and Kader, 2002). Fruit are often found on large trees creating difficulties in harvesting; and special devices are used (such as long sticks, sometimes with catching bags). Fruit should be accumulated in appropriate sized picking bags that protect fruit from physical handling damage.

Harvest maturity. Establishment of optimum harvest maturity is essential. It may be different for different purposes (fresh or processed markets; local or international markets); this will mean undertaking developmental analysis (physical, physiological and biochemical) during fruit growth and development to understand the progress of maturation and ripening. A wide diversity of techniques is used for estimating optimum harvest maturity for many crops (Reid, 2002), but specific indices are required for any one crop. Any technology developed should be robust, give consistent results, be easy to use in the field, and not require sophisticated equipment.

Role of ethylene. Because ethylene plays such an important role in modulating ripening and senescence it is important to determine the production of, and susceptibility to ethylene of any new crops. Knowledge of whether or not fruit are climacteric is important, especially if it is transported in mixed loads. Availability of chemicals that can inhibit both ethylene biosynthesis (aminovinylglycine or AVG – sold as ReTain™) or ethylene action (1-methylcyclopropene or MCP - sold as SmartFresh℠) create opportunities for extending postharvest life of fruit crops (for information on effects of MCP on fruit crops see website of Watkins http://www.hort.cornell.edu/department/faculty/watkins/ethylene/index.htm).

Fruit sorting and packing. Fruit sorting technologies, grade standards, and packaging systems need to be developed for each potential new fruit. Most markets require fruit sorted according to size, colour, firmness and freedom from defects. Sorting may be done in the field or in a shaded facility. Numerous devices are available to facilitate hand sorting based on appearance, to sophisticated high tech equipment than can sort for internal attributes at speeds of up to 15 fruits per second. Substandard fruit that does not meet specific market requirements must be removed, perhaps to a processing option. Washing, sizing, waxing (where needed) and packing systems should be designed for optimum flow of product and to minimize handling damage. Packages should be designed to protect, preserve, and promote the product, and if fruit respond to MA then appropriate polymeric films should be used to reduce moisture loss and maintain quality. Do not overfill packages and leave space for cool air to circulate. Fruit should be treated gently at all times to avoid physical damage that leads to deterioration.

Consumer's choice - minimally processed fruits.

Optimise storage conditions. Optimum temperature and humidity conditions for storage after harvest must be established. Deterioration rate is a function of temperature. Most tropical fruits are chilling sensitive and can sustain chilling injury (CI) at temperatures between 5-15°C. For most crops harvested fruit should be placed in the shade, and field heat should be removed as rapidly as possible after harvest and product should be maintained at a temperature that will slow deterioration rate but not allow the fruit to sustain CI. Cooling facilities range from relatively inefficient evaporative cooling systems to highly sophisticated computer controlled containers and cool stores. In addition responses to enhanced CO_2 and reduced O_2 should be determined; controlled (CA) and/or modified (MA) atmospheres, in conjunction with low temperature conditions can extend postharvest life of many fruits. Responses to atmosphere variations are required to determine potential for MA packaging to extend shelf life.

Fruit composition. Fruit should be analysed changes in mineral, vitamin, sugar, acid contents during development and maturation, and also screened for antioxidant and other health conferring properties. Some of these attributes may be useful as a appropriate harvest index, while others may have very important marketing value if specific compounds can be demonstrated to have health providing and special nutritive properties. Changes that occur in these components should be measured after harvest and during storage under different conditions.

Processing and value added. Fruit must be evaluated for both fresh and processed market options. Opportunities exist for developing new products with specific nutritional or health conferring properties, and in some cases could be combined with other foods to enhance flavour, appearance or nutritive value. Refine and improve efficiency of any existing processing methods with potential for growth to become a community or co-operative industry. Instigate a product development project to deliver new processed products.

Develop a vertically integrated supply chain from field to market. Modern businesses have adopting highly efficient supply chain management systems that involve: *strategic alliances* of key companies with specific skills and experience; organisational structures that allow instant communication, information sharing and transparency among partners; use of current *information technology* systems for communication of prices, volumes supply and demand information , as well as increasingly compatible billing and payment systems.; and *human resource partnerships* that develop trust, common vision and commitment to excellence to flourish. In developing systems for commercializing new fruit crops, it would be worth considering these concepts when planning a production, distribution and marketing strategy.

Consumer satisfaction and market development. Evaluate consumer preference in different markets and undertake market promotion in select markets. It is critical that a consumer demand is created in order that a new industry can be sustained. Not only should new fruit appeal to consumers, they must be made aware that it exists if new markets are to be developed. This means that consumer taste panels should be undertaken with individuals representing the target market. Also there pathological stresses that lead to enhanced rates of deterioration; the influence of temperature on rate of deterioration; the affect of rough handling on postharvest disease incidence and deterioration; the importance of correct packaging; the need to adhere to basic supply chain concepts from farmer to consumer. Transferring information about Best Postharvest Practices should be a primary objective in any management system for commercializing underutilised fruit crops.

Table 1. List of neglected and underutilized fruit crops.
(Source: IPGRI, http://www.ipgri.cgiar.org/system/page.asp?frame=Institute/NewStrategy.htm)

Botanical name	Common name	Europe	Asia Pacific Oceania	Central West Asia North Africa	Sub Saharan Africa	Americas
Fruits and nuts						
Adansonia digitata	baobab				x	
Artocarpus spp.	bread fruit, jackfruit		x			
Butyrospermum kirkii	shea butter tree				x	
Carissa edulis	natal plum				x	
Ceratonia siliqua	carob			x		
Cordeaxia edulis	yeeb nut				x	
Cydonia oblonga	quince			x		
Durio zibethinus	durian		x	x		
Dyosphyros kaki	Japanese persimmon		x			
Ficus carica	fig			x		
Garcinia mangostana	mangosteen		x			
Irvingia gabonensis	dika nuts				x	
Litchi chinensis	litchi		x			
Metroxylon sagu	sago palm		x			
Nephelium lappaceum	rambutan		x			
Phoenix dactylifera	date palm			x		
Physalis alkekengi	Chinese lantern	x				
Pistacia vera	pistachio			x		
Plyllanthus spp.	Indian gooseberry		x			
Punica granatum	Pomegranate			x		
Prunus spp.	wild Prunus spp.			x		
Schlerocarrya birrea	marula				x	
Tamarindus indica	tamarind		x			
Treculia africana	African breadfruit				x	
Zizyphus spp.	jujube		x	x		

A niche market for square melons?

CONCLUSION

Any crop has the potential to become commercially successful, in reality this does not occur frequently. Only 4 new fruits were introduced successfully to international trade during the 20th century: avocados, blueberries, macadamia and kiwifruit (Janick, 1992). To become commercially successful, a new crop must have a tireless champion to promote its important attributes; this champion might be an individual or a company, but without continuous, imaginative and ruthless determination nothing significant will occur without a committed champion. Any new fruit must have some new and/or distinctive attribute that provides real or perceived consumer benefits that can be used as a marketing tool to achieve, and then secure, space on supermarket shelves. It is desirable that the fruit has gained success locally and domestically before launching onto international markets, because it will be producer 'push' rather than consumer 'demand' that will enable initial success.

A number of technical details must be determined for any new crop and these have been described above. My challenge to horticulturalists internationally is to succeed in introducing at least 8 new fruit crops, double the amount from 1900-2000, to meaningful world trade during the 21st century. It will not be easy.

Literature cited

- Anonymous 2006. Conserving and increasing the use of neglected and underutilized crop species. International Plant Genetic Resources Institute. http://www.ipgri.cgiar.org/system/page.asp?frame=Institute/NewStrategy.htm
- Janick, J. 1992. New fruits from old genes. Acta Hort. 297:25-42
- Kitinoja, L. and Gorny, J. 1999. Postharvest technology for small scale marketers; economic opportunities, quality and food safety. Postharvest Horticulture Series, Postharvest Technology Research and Development Centre, University of California, Davis USA.
- Kitinoja, L. and Kader, A.A. 2002. Small-scale Postharvest Handling Practices: a manual for horticulture crops. Postharvest Horticulture Series 8E, Postharvest Technology Research and Development Centre, University of California, Davis USA, 4th edition, pp.260.
- Reid, M. S. 2002. Maturation and maturity indices. p. 55-62. In: A.A. Kader (ed.). Postharvest Technology of Horticultural Crops. Postharvest Horticulture Series, Postharvest Technology Research and Development Centre, University of California, Davis USA, 55-62.
- Photos by Yacob Ahmad

Durians for sale on a street cart in Bangkok, Thailand.

Fruit corner in a market in Hanoi, Vietnam.

Achras sapota (sapodilla) sold in a sidestreet, Hanoi, Vietnam.

** Photos by Yacob Ahmad*

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No. 231-233, Jalan 18/23, Taman Sri Serdang
43300 Seri Kembangan, Selangor, Malaysia

TFNet Board of Trustees Meeting

The TFNet Board of Trustees (BOT) Meeting was held in Kuala Lumpur, Malaysia on 19 July 2007, in conjunction with the international seminar on economics and marketing of tropical fruits which was held on 16 – 18 July 2007. The meeting was attended by 11 of the 12 board members, 3 observers and 3 members of the secretariat. It was chaired by the Chairman of TFNet who is also the Secretary General of the Malaysian Ministry of Agriculture and Agro-based Industry, H. E. Dato' Dr. Zulkifli Idris.

The meeting began with the Chairman's welcoming address, which centered on the past activities and projects of the organisation, the self financing stance that TFNet needs to work on and the task of the board members in helping TFNet to remain relevant.

This was followed by a report by the CEO of TFNet, Dr. Izham Ahmad on the past year activities of TFNet, which included past, ongoing and planned projects, financial report and membership status.

The meeting also endorsed the appointment of additional BOT members as follows :

1. Mr. Chan Seng Kit, Managing Director, K-Farm Sdn. Bhd, Malaysia
2. Ir. Unggul Abinowo, Director, Sentra Pengembangan Agribisnis Terpadu SPAT, Indonesia
3. Mr. Azizi Meor Ngah, CEO, Malaysian Agrifood Corporation Bhd., Malaysia
4. Dr. Nguyen Minh Chau, Director, Southern Fruit Research Institute, Vietnam
5. Mr. Stephan Crafford, Manager, SUBTrop, South Africa
6. Mr. Mazlan Ahmad, Managing Director, Selangor Oil Palm Industries Cooporation Sdn, Bhd., Malaysia.

The meeting continued with the future directions of TFNet proposed by a subcommittee headed by Prof. Dr. Errol Hewett and members Dr. Sisir Mitra, Mr. Chan Seng Kit and Dr. Izham Ahmad.

The overall recommendations proposed were :
1. To encourage more countries, companies, institutions and individuals to become TFNet members
2. To ensure members are furnished with adequate information on the status and trends in the tropical fruit industry
3. To ensure that all relevant expertise is utilized to assist in meeting TFNet's goal
4. International linkages with other organizations

Members of the meeting discussed and deliberated on the details of the recommendations, which have included in the report of the meeting.

The CEO of TFNet later presented a proposal on the exchange of tropical and subtropical fruits genetic materials among member countries, which saw some positive response from the Vice President from China, Dr. Yi Ganjun.

The Chairperson concluded the meeting by asserting that TFNet will continue receiving support from the Malaysian Government.

***Sitting from left** : Dr. Juejan Tangtermthong (AFMA, Thailand)–observer, Dr. Nguyen Minh Chau (Southern Fruits Research Institute, HCM, Vietnam), Mr. Stephan Crafford (SUBTROP, South Africa),Mr. Unggul Abinowo (SPAT, Indonesia), Dato' Dr. Zulkifli Idris (Secretary General, Ministry of Agriculture and Agro-based Industry Malaysia) also the Chairperson of the Board, Dr. Yi Ganyun, (Fruit Tree Research Institute, Guanzhou, China), Prof. Dr. Errol Hewett (Massey University, New Zealand), Prof. Dr. Sisir Kumar (VSNL, India), Dr. Izham Ahmad (CEO, TFNet)*

***Standing from left** : Mr. Chan Seng Kit (K-farm, Malaysia), Mr. Chua Piak Chwee (TFNet secretariat), Mr. Azizi Meor Ngah (Malaysian Agrifood Corporation), Mr. Yacob Ahmad (TFNet secretariat), Mr. Kaison Chang (FAO, Rome), Mr. Aziz Sakiman (SOPIC, Malaysia), Dr. Percy Sajise (Bioversity International)-observer, Dr. Zheng Ji Wu (Fruit Tree Research Institute, Guangzhou) – observer.*