SAFETY OF FRESH FRUIT AND VEGETABLES IN MALAYSIA

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ABSTRACT

There has been an increase in the volume of fresh fruit and vegetables traded worldwide. The increase in volume and expansion has been significantly important for many countries especially developing countries like Malaysia. In all markets, whether they are in developed or in developing countries, the issues remain the same: food safety, quality, and reliability of supply.

Production of fruit and vegetables should be geared toward increasing high quality and safety produce in the markets instead of just emphasizing the quantity alone. Fruit and vegetables are perishable in nature. Losses resulting from inadequate post-harvest handling, storage and improper marketing system result in diminished returns for producing countries. International markets have rejected exports of fruit and vegetables containing non-authorized pesticides, with pesticide residues exceeding permissible limits, with inadequate labelling and packaging requirements, with contaminants exceeding regulatory levels, without the required nutritional information, and/or with inadequate general quality.

To reduce the risks from contamination associated with production and trade of fresh fruit and vegetables and to promote market opportunities, The Government of Malaysia has launched the Malaysian Farm Accreditation Scheme (SALM) by the Department of Agriculture (DOA) under the Ministry of Agriculture aimed toward giving recognition to farms which adopt Good Agricultural Practices (GAP) in producing fruit and vegetables of high quality and safe to consumers. However, the food safety and quality control in Malaysia is under the Ministry of Health, so Malaysian food safety system operates by entrusting different authorities with the task of ensuring food safety at different stages, throughout the food chain to avoid and to control hazards.

Keywords: Quality, postharvest handling, pesticides residues, contaminants, regulatory

INTRODUCTION

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Fresh fruit and vegetables are highly perishable in nature. Proper handling practice is essential to avoid any undesirable changes that may reduce their quality and safety during handling, distribution, and marketing. Although postharvest handling covers all activities from harvesting to marketing, the technique varies according to the type of produce, mode of transportation, market destination, and consumer requirements. It may cause even faster deterioration if the produce is not properly prepared according to their requirements. For example, produce such as carambola, duku langsat/dokong, broccoli, cauliflower, and cabbage could not be washed as washing may cause contamination and rotting of the produce. Hot water treatment is suitable only for papaya and chili, while vapor heat treatment is currently applicable for mango. Different produce require different storage temperatures, and hence not suitable to be mixed in one cold room. Moreover, produce that are classified as ethylene producers, should be separated from produce sensitive to ethylene to avoid ripening during storage. Generally, handling technology of produce for export to distant markets and by sea is more sophisticated as compared with technology for distribution to local markets and export by air. It is very important for packers and exporters to use the correct technology as required by the specific market.

Food safety for fresh fruit and vegetables refers to quality of the food and production, distribution, and consumption practices that prevent the contamination and deterioration of the food (Prabhakar, Sano, and Srivastava, 2010). Safety factors in fruit and vegetables include naturally-occurring toxicants, such as glycoalkalosids in potato; natural contaminants, such as fungal toxins (mycotoxins) and bacterial toxins and heavy metals (cadmium, lead, mercury); environmental pollutants; residues of pesticides; and microbial contamination. While health authorities and scientists regard microbial contamination as the number one safety concern and many consumers rank pesticide residues as the most important safety issues (Kader and Rolle, 2004). This paper will focus on policies and strategies have been established, in order to produce safe fruit and vegetables.

**TRENDS IN FRUIT AND VEGETABLES CONSUMPTION**

Under the Tenth Malaysia Plan (2011-2015), agriculture has been identified as the Third Engine of Growth after manufacturing and services. With regard to agricultural industries, plans have been made to increase the area of production to cater the expanding demand for fresh and processed products both for the local and export markets. Realizing the significant contribution of fruit and vegetables production in the economic development of the country, the Malaysian government is implementing several policies to enhance the development of the industry. The Agro-Food Policy (2011-2020) is directed towards increasing production to meet the rising demand for high quality, nutritious, and safe produce in the market. As a result, the total area under fruit production has increased tremendously from 116,858 hectares in 1980 to 291,500 hectares in 2000 and has achieved 373,200 hectares in 2010. In terms of production quantity, more than 1.33 million metric tons of fruit were produced in 2005, 1.8 million metric tons in 2010 and is estimated to rise to 2.1 million metric tons in 2015. Meanwhile, the current vegetables production is estimated around 53,000 hectares including highlands production. The production of vegetables is estimated to be nearly 1.0 million metric tons in 2012.

Food safety and quality have become a serious concern in the production and marketing of fruit and vegetables. With the global trade liberalization through the World Trade Organization (WTO) and the ASEAN Free Trade Area (AFTA), it justified the need for higher quality and safer produce in the market, in order to be competitive in the domestic and international markets. Furthermore, many consumers have changed their lifestyles and growing concern towards healthy living and demanding for wholesome, tastier, healthier, nutritious, and safer foods. Similar trends have shown in Malaysia consumers where the fruit and vegetable consumption per capita shows an increasing trend over the years. Fruit consumption had increased from 80.4 kg in 2008 to 93.0 kg 2012, while per capita of
Vegetables had increased from 45.8kg in 2001 to 54.7kg in 2012 (Rozhan, 2014).

**POLICY AND LEGISLATION ASSOCIATED WITH FOOD SAFETY OF FRUIT AND VEGETABLES**

**Government policy**

The safety of fruit and vegetables in Malaysia is currently upheld through co-operation between the food quality control Division (FQCD), Ministry of Health (MOH) as the lead agency for food safety and the DOA, Ministry of Agriculture, and agro-based industries and the Ministry of Natural Resources and Environment (Chandran, 2013). The FQCD’s main objective is to protect the public against food related hazards and fraud as well as to motivate, promote the preparation, handling, distribution, sale, and consumption of safe and quality food. The DOA is one of the departments under the Ministry of Agriculture, and Agro-based Industries which is responsible to ensure safety of fruit and vegetables from farm to table. The Ministry of Natural Resources and Environment, has been tasked to deal with Genetically Modified Food (GMO).

For fruit and vegetables the safety aspect and traceability are currently given more priority by the respective government and non-government authorities in the international and domestic trades for consumers’ protection. Good Agricultural Practices (GAP) are therefore one of the key strategies for the development of successful fruit and vegetables industry in Malaysia. The Department of Agriculture (DOA) Malaysia launched the Malaysian Farm Certification Scheme for Good Agricultural Practices (SALM) in early 2002. The scheme aimed towards giving recognition to farms which adopt GAP in producing fruit and vegetables of high quality and safe for consumers. In August 2013, Malaysian Good Agricultural Practice (MyGAP) was launched. MyGAP is rebranding of SALM, Farm Practice Scheme (SALT), and Malaysian Aquaculture Farm Certification Scheme (SPLAM). MyGAP is a comprehensive certification scheme for planting, aquaculture, and livestock to certify commercial farms which adopted GAP to produce high quality and safe produce for the markets. The MyGAP incorporates highly recognized guidelines including the EUREP GAP/GLOBAL GAP, CODEX, Malaysian Standards, and other international code of practices. The farm refers to both practices either organic or inorganic. Major aspects under the scheme include conditions relating to the environmental setting of the farm, farmer’s adherence to GAP, and safety of the produce. It should be noted that the scheme also incorporated traceability and workers welfare within the rules or protocols required. This scheme has received overwhelming responses from the growers in the country, particularly on the produce targeted for international and regional markets.

Strategic plan in marketing fresh produce has also been adopted through the launching of the Malaysia’s Best branding program by the Federal Agricultural Marketing Authority (FAMA) in 2003. This program is targeted towards promoting and marketing of high quality and safe produce, preferably from SALM farms, using Malaysia’s Best stamp of approval. The program is not only intended for the application of a common brand for Malaysian fresh produce, but also as an assurance that the produce sent to consumers are delivered in excellent quality and are safe. In order to improve the efficiency and effectiveness of agricultural products marketing, the Grading, Packaging, and Labelling (GPL) Regulation have been introduced by FAMA in 2008. This regulation will be able to trace the origin of the products for safety and food hygienic purposes.

Grade standards recognize the degree of quality in a produce. Standards also help the producers and handlers to perform better job in preparing and labeling fresh fruit and vegetables for market, and more importantly they provide a basis for pricing and payments rewarding better quality. Malaysian standard Quality Certification is benefiting the health and safety of the public, protecting the consumers, facilitating the domestic and international
trade, and furthering international cooperation in relation to standard and standardization. Standard Industrial Research Institute of Malaysia (SIRIM) is appointed by the Department of Standards Malaysia to be the sole agency to develop and manage Malaysia standards (Ahmad Tarmizi, Abdullah, and Mohd Salleh, 2007).

Apart from the efforts to increase fruit and vegetables production, access to external markets is also important. The demand for fruit and vegetables are increasingly seen and exploiting this opportunity, however, poses many challenges. As the movement of fruit and vegetables into the importing countries, Sanitary and Phytosanitary (SPS) agreement has to be considered. SPS measures are imposed against quarantine pests where the pests are not present in importing countries.

**Legislation**

Food safety is addressed throughout the food chain from farm to table. The establishment and updating of food safety legislation throughout the food chain is essential in establishing an effective food safety system. Food safety legislation has been developed and updated taking into consideration specific needs of consumers and food producers, development in technology, emerging hazards, changing consumer demands, and new requirements for trade, harmonization with international and regional standards, obligations under the WTO agreements, as well as social, religious, and cultural habits (Anonymous, 2011).

The mandate for food safety rests with the Ministry of Health (MOH) and other government agencies which are also responsible for food safety in the country. Table 1 shows the summary of responsibilities of various governmental agencies on food safety aspects in Malaysia. The Food Act 1983 and the Food Regulations 1985 are the Malaysian food legislations that form the backbone of the food safety programme. The objective of the Food Act 1983 and the Food Regulations 1985 is to ensure that the public is protected from health hazards and fraud in the preparation, sale and use of foods, and for matters connected therewith. It is enforced by the Ministry of Health and the Local Authorities. The legislation, applicable to all foods sold in the country either locally produced or imported, covers a broad spectrum from compositional standards to food additives, nutrient supplements, contaminants, packages and containers, food labelling, procedure for taking samples, food irradiation, provision for food not specified in the regulations and penalty.

Table 1. Responsibility of different government agencies on various food safety aspects in Malaysia.

<table>
<thead>
<tr>
<th>Sector</th>
<th>Agency</th>
<th>Food Safety Responsibilities</th>
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<tbody>
<tr>
<td>Legislation</td>
<td>MOH</td>
<td>• Reviewing and updating Food Act 1983 and Food Regulations 1985</td>
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<td>• Promulgation of the following legislations:</td>
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<tr>
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<td>- Food Hygiene Regulation</td>
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<td>- Food Analyst Regulation</td>
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<td>- Food Import Regulation</td>
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<td>- Food Irradiation Regulation</td>
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<td>- Food Analyst Act</td>
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<td>- Genetically Modified Food Regulation</td>
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<td>• Harmonization of Food Regulations 1985 with Codex and ASEAN standards.</td>
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<td></td>
<td>MOA</td>
<td>• Reviewing and updating:</td>
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<td></td>
<td></td>
<td>- Veterinarian Surgeon Act 1974</td>
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<td>- Animal Ordinance 1953</td>
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<td></td>
<td>- Fisheries Act 1983</td>
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<td></td>
<td></td>
<td>- Animal Feed Act</td>
</tr>
<tr>
<td>Laboratories</td>
<td>MOH</td>
<td>• Setting up food lab and conduct analysis for purpose of enforcement and monitoring</td>
</tr>
<tr>
<td></td>
<td>MOA</td>
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</table>
| **CDM**                                                                 | **Analyses for food safety monitoring**  
| **Identification and optimizing utilization of all facilities under all relevant ministries, agencies, private laboratories, etc.** |
| **Monitoring and surveillance**                  | **MOH MOA**  
| **Conduct studies to strengthen monitoring and surveillance activities**  
| **Food Consumption Pattern**  
| **Guidelines on Risk Management**  
| **Conduct risk assessment for purposes of food safety management decisions**  
| **Monitoring & surveillance of zoonotic/animal diseases** |
| **Implementation of food safety system**                  | **MOA JAKIM MOH DSM**  
| **Ensure safe food products through certification schemes**  
| **Strengthening the implementation of food safety system**  
| **Utilizing guidelines, certification, accreditation and policy building:**  
| - Farm Certification Scheme  
| - Good Agriculture Practice  
| - Aquaculture Farm Certification Scheme (GAqP)  
| - Good Husbandry Practice  
| - Certification of Abattoirs and Processing Plants  
| - Good Manufacturing Practice in animal feed  
| - Guideline on Organic Farming  
| - Veterinary Health Mark Scheme (VHM)  
| - Halal Certification Scheme  
| - HACCP Certification Scheme  
| - ISO MS 9000, 14000, 17025 Quality System |
| **Food inspection and certification**                  | **MOA JAKIM MOH DSM**  
| **Farm Certification Scheme**  
| **Good Agriculture Practice**  
| **Aquaculture Farm Certification Scheme (GAqP)**  
| **Good Husbandry Practice**  
| **Certification of Abattoirs and Processing Plants**  
| **Good Manufacturing Practice in animal feed**  
| **Guideline on Organic Farming**  
| **Veterinary Health Mark Scheme (VHM)**  
| **Halal Certification Scheme**  
| **HACCP Certification Scheme**  
| **ISO MS 9000, 14000, 17025 Quality System** |
| **Education and training**                  | **MOH MOA MARDI**  
| **Training of relevant stakeholders in food safety system**  
| **Food Handlers Training and Training of Trainers**  
| **Human Resource Development e.g. in HACCP, ISO, auditors**  
| **Training of enforcement personnel for prosecution purposes**  
| **Training and extension program on GAP, GAHP, VHM, GAqP by respective agencies**  
| **HACCP - Auditing and verification** |
| **Information sharing**                  | **MOH MOA**  
| **To make available relevant details on food safety to relevant agencies, consumer, public, etc**  
| **Inter-agency information sharing through website and linkage with local, regional and international organizations i.e. OIE, Codex and IPPC** |
| **Research and Development**                  | **MOH UPM UKM MOA**  
| **To upgrade capability in handling new emerging issues**  
| **Strengthen research methodologies**  
| **Research and development in food safety by relevant agencies to meet current needs and interest**  
| **Strengthening collaboration among relevant agencies**  
| **Conduct animal disease investigation and diagnosis** |
| **International participation**                  | **MOH DSM MOA**  
| **To ensure relevant programmes related to food safety is been acknowledge and participate if necessary Malaysia continues to play an active role in Codex and other international activities on food safety**  
| **1. Codex**  
| The Codex Contact Point with Ministry of Health serves as the Secretariat of the National Codex Committee as well as the |
Contact Point for other international food safety activities. In parallel with Codex, Malaysia is continuously formulating national positions through the National Codex Committee, 21 Codex Su-Committees and 3 Task Forces

2. ASEAN
   Food safety and Codex activities are addressed mainly in SOM-HD and to some extent in SOM-AMAF through the ASEAN Expert Group on Food Safety, ASEAN Task Force in Codex, etc

3. APEC
   Malaysia is an active member and participant of the Sub-Committee on Standards and Conformance (SCSC)

4. WHO/FAO
   Malaysia has served in expert consultations on food safety as well as consultancies in food safety and Codex under WHO and FAO

5. Bilateral arrangements for attachments
   There are bilateral arrangements between Malaysia and other countries for attachment of officers to relevant agencies on food safety

6. WTO/SPS
   The Focal Point for food safety, animal health and plant health has been established for at relevant agencies and coordinates by the Ministry of Agriculture as the National Enquiry Point and National Notification Point

7. OIE/SPS
   Malaysia is an active member and participant of OIE

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<th>Consumer participation in food safety</th>
<th>MOH</th>
<th>MOA</th>
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Since food safety is addressed throughout the food chain, legislations pertaining to food safety under the jurisdiction of other agencies are also enforced by the relevant agencies. At the primary production level, the Pesticide Act 1974, the Fisheries Act 1983, the Veterinary Surgeon Act 1974, and the Animal Ordinance 1953, all under the Ministry of Agriculture and Agro Based Industry are implemented. At the processing and retail levels, apart from the Food Act 1983 and the Food Regulations 1985, other legislations that were mentioned earlier are also applicable to a certain extent. The Trade Description Act under the Ministry of Domestic Trade and Consumer Affairs also play an important role in terms of protecting consumers from misleading and false labelling of food product.

PREVAILING MONITORING SYSTEM

The implementation, monitoring, and enforcement of the law at the stage of agricultural food supply, primary and secondary food processing, local and international market food distribution, food retailing, and domestic food production is also charged under FSQD at MOH. The Food Act 1983 and the Food Regulations 1985 of Malaysia govern the various aspects of food safety and quality control including food standards, food hygiene, food import
and food exports, food advertisement, and accreditation of laboratories. FSQD implements an active food safety program which includes routine compliance, sampling, food premises inspection, food import control activity and licensing of specified food substances required under the Food Act 1983 and its regulation 1985. As preventive approach, the FSQD has been implementing food handlers training program, vetting of food labels, giving advice to the industry and consumers, and food scheme such as Health Certification and HACCP certification.

For production of fruit and vegetables, DOA regulators are responsible for inspecting and auditing the performance of the food system through monitoring surveillance activities and for enforcing legal and regulatory requirements. For imported fruit and vegetables (including seeds into Malaysia) it is governed by the plants (import and export) Regulations 1981. This regulation is formulated to prevent introduction of pests and diseases from foreign countries. All produce must conform to the phytosanitary requirements that are specified in the permits applied. Most of the phytosanitary measures are carried out in the countries of origin and therefore would require certificating documents from the country of origin. Similarly, for fruit and vegetables for export, the government also requires phytosanitary certification of the produce before exportation. The Malaysian Phytosanitary Certification Assurance (MPCA) Scheme aims to maintain and expand an existing market access, to overcome prevailing phytosanitary and quality problem. DOA is the implementers of this scheme and is responsible for the preparation of regulation and enforcement.

**RESEARCH AND DEVELOPMENT EFFORTS RELATED TO FOOD SAFETY CONTROLS OF FRUIT AND VEGETABLES**

These are some of the research and development activities which are aiming for improving quality as well as safety of fruit and vegetables.

**Planning for postharvest quality**

Selection of seeds is one of the important criteria in determining postharvest performance of any commodities including fruit and vegetables. Cultivars chosen for certain traits may be suitable for small-scale production and domestic market, but would be disastrous choices for the distant market. Farm management may have dramatic impacts on postharvest quality.

**Reduction of postharvest losses**

The characteristics of fresh produce which are highly perishable and susceptible to physical and mechanical injuries, accelerate both physiological and microbiological decay. Because of these reasons, produce needs proper handling, packaging, and transportation systems. In addition, the marketing system for the commodities is operated by many individual entrepreneurs resulting in frequent handling and transfer of the goods from middleman to another. Improper execution of these systems may cause damage to the produce, enhance deterioration, allow undesirable ripening process, trigger physiological and biochemical changes, reduce quality and shorten shelf life, resulting in high rejection and spoilage, and losses. Worldwide postharvest fruit (and vegetables) losses are as high as 30 to 40% and even much higher in some developing countries. Although, limited information is available on postharvest losses in Malaysia, the losses have been estimated at 20 to 50%, depending on the perishability of the produce, handling method, market distance, and management of the produce right after harvesting up to delivery to the consumer. Preventive measurements in reducing postharvest losses should be taken throughout the handling chain. Knowledge and information on the causes of physical, mechanical, and physiological injuries need to be delivered to the operators and handlers involved in the operation.

**Quality Assurance System**

Consistent quality is the key factor to sustain the consumer demands and to be competitive in the global market. Quality Assurance (QA) system is established in the horticultural industry in Malaysia covering postharvest and fresh-cut processing in order to deliver produce of high quality and safe for human consumption. The components in QA system include control of raw materials upon arrival at packinghouse, control of handling and processing
operations, management of finished-produce, and sanitation at the packinghouse and processing plant. The system incorporated the highly relevant and recognized standards such as Codex, HACCP, and the Malaysian Standards. This QA system serves as a management tool to support operation, preparation, and maintenance of produce for both fresh and fresh-cut. The total quality assurance approach is recommended to be used continuously in the horticulture industry to ensure consistent product quality and safety, and hence increase buyer’s confidence to consume the produce.

**Maintenance of quality and safety**

Delivering high quality produce is extremely essential for successful marketing of agricultural produce in the competitive market worldwide. Quality of produce should be maintain along the handling and marketing chains to ensure the produce received is in good condition and accepted by the buyers. This could be done by proper harvesting, handling, preparation, storage, and transportation systems. Harvesting should be done at the right stage of maturity, followed by appropriate packinghouse operations such as sorting, cleaning, washing, disease treatment, disinfection, grading, and packaging. Distribution to markets should be done soonest possible to ensure the produce is delivered on time. Produce should be managed correctly in storage and market displays to provide fresh, quality, and safe produce to the consumers.

**Fresh-cut processing**

Fresh-cut fruit are ready-to-eat products, while still maintaining the freshness, flavor, aroma and their nutritional values. It also offers convenient and easy in serving portions for larger and difficult fruit which require peeling. In Malaysia, the fresh-cut products have been in the market since early ‘80s, however, the previous outlets are limited mostly at mini-markets, supermarkets, and by street hawkers. For these market sectors, the fresh-cut products are prepared mainly by the hawkers themselves or supermarket workers with limited knowledge in fresh-cut processing, storage, and sanitation. Recently, the demand for fresh-cut fruit and vegetables is rapidly increasing due to the consumer’s trend on ready-to-use, quality, and safe products. The demand is expanding not only within the traditional market outlets, but also in other market sectors such as food services, fast foods, hypermarkets, and food processors. Research on fresh-cut fruit and vegetables focus towards the determination of suitable maturity and varieties, method of preparation, prevention of discoloration and microorganisms, technique of packaging and storage, and establishment of quality assurance system. The processing involves in the preparation of fresh-cut produce would basically depend on the type of fruit, and the way they are normally consumed. Currently, the fresh-cut technology has been developed for pineapple, citrus, durian, jackfruit, and mangosteen. The fresh-cut processing consists of cleaning, washing, temporary storage, ripening, peeling, cutting, immersing in solutions containing calcium chloride and acid ascorbic followed by draining, packing and storage. The fresh-cut pineapple, citrus, durian, jackfruit, and mangosteen could be stored at 2 °C for duration of 2-3 weeks. Handling trials of fresh-cut pineapples, jackfruit, and durian were conducted successfully in the Netherlands and Hong Kong. For fresh-cut vegetables, cabbage, onion, chili, long bean, cucumber, and others have been developed.

**Cold chain handling system**

Cooling the produce rapidly after harvest and maintaining at the required temperature during handling chain help to avoid deterioration, maintain quality, and extend shelf life of fresh produce. The low temperatures should be maintained continuously throughout handling, distribution, and marketing activities by implementing a total cold chain system. This system includes pre-cooling after harvesting, packinghouse operations under low or air-conditioned temperature, pre-cooling after packaging, delivering using refrigerated transport, keeping in refrigerated storage, and displaying under chilled temperatures. Recently, cold chain system is becoming an important technique in delivering of highly perishable fruit in Malaysia. The system is a necessity in tropical countries like Malaysia, where the surrounding temperatures are relatively higher as compared to the requirements for the fresh produce.

**Export technology**

There is a need to verify the feasibility of the technology developed in the laboratory under the actual commercial environment. Several export trials by sea have been conducted since 1984 on bananas (Hong Kong, Japan, United Arab Emirates [UAE] and Denmark), pineapples (Saudi Arabia, United Kingdom and Germany), carambola (Hong
Kong and Belgium), papayas (Hong Kong, Saudi Arabia and UAE), melons (Hong Kong), and ginger (United Kingdom). These trials were conducted by MARDI in collaboration with private companies, farmers, and other relevant agencies. Recently, shipment of several commodities in one container or mixed loads was also conducted to the UAE. Three fruit types namely pineapples, carambola, and pummelo were mixed-loaded into a 40-foot refrigerated container set at 8°C and transported by sea to Dubai. The technique was able to maintain the quality of all fruit upon arrival, as well as after one week additional storage in a warehouse at Dubai. The technique could be used to cater to small market demands of more than one commodity per consignment, as well as to deliver several produce together in one container to new markets or during low production season.

**CONCLUSION**

The safety and quality of fruit and vegetables will be improved by the implementation of food safety policy and legislation of horticulture produce. This will benefit all parties involved in producing fruit and vegetables from farm to table including farmers, workers, produce handlers, marketers, and consumers.

**REFERENCES**


