

CURRENT DIFFICULTIES AND SOLUTIONS FOR ENHANCING PRODUCTION AND EXPORT OF VIETNAMESE FRUIT

Duy Lam NGUYEN

**Food Quality Control Center, Vietnam Institute of Agricultural Engineering and
Postharvest Technology (VIAEP)**

4- Ngo Quyen Str., Hanoi; Tel. (84-4) 9351481; E-mail. lam_viaep@yahoo.com.vn

Summary

Fruit plantations in Vietnam have expanded over the past few years, yet the sales performance for international and local markets has not grown proportionately. The situation stems from weaknesses in postharvest handling of fresh fruit, unplanned plantations, low productivity, and an ineffective sales system. The growth of the country's fruit exports is unstable and the fruit sector has introduced inappropriate master plans for developing and expanding fruit growing areas. If foreign customers order a large contract, output at a specific location is not enough to meet such a big deal. In addition, the quality of fruit varieties, and the technology to grow and postharvest handling are poor, sometimes not meeting the strict requirements of importers. While China is the biggest fruit importer, representing less than half of the total export earnings every year, it has applied a quota system for fresh fruits as well as higher requirements on SPS. Exporting fruit from Vietnam is risky because most of it - about 80 percent - goes to China, which is an unstable market for domestic exporters.

To improve the situation, need to increase technical support for enterprises that export fruit; reduced diversification of fruit types grown in specific areas; establishment and development of a trade mark for Vietnamese fruit; formation of groups to export fruit; and increased promotion of international co-operation. To overcome the poor performance, the fruit industry has to focus on improving the product's quality by applying advanced and appropriate technologies for plant breeding, growing and postharvest handling to meet requirements of international consumption markets.

1. Introduction

The area of fruit plantation in Vietnam has grown rapidly in the 1990s at 6.5 percent per year. The area has also increased in stage of 2000-2005 but with lower expansion rate. In 2005, total area of fruit-tree was 766.1 thousand hectares, an increase of 2.6 compared with 2004 mainly due to improvement on miscellaneous gardens and increase in area of trees of highly commercial value. In spite of this growth, fruits still account for a small proportion of total crop area, just about 5 percent of the total. Growth rates vary widely across commodities. The fastest growing commodities are the litchi family (litchi, longan, and rambuttan), citrus fruits and dragon fruits, while banana area is stagnant and pineapple area has fallen in the last 10 years. Although

fruits production is more widespread in the North, but the degree of commercialization is greatest in the Mekong River Delta (MRD). The MRD is not only the nation's richest rice producer, but also the largest fruit planters, especially commercial rice and fruits. The MRD has an average per capita more than 2,300m² of natural land area. It is also very fertile and creates favorable conditions to rice growth, fruit trees strength and commerce-oriented plant diversification. According to preliminary estimates, the area of fruit in the MRD has reached more than 300 thousand hectares.

The sales performance for international and local markets has not grown proportionately. The situation stems from weaknesses in preserving fresh fruit, unplanned plantations, low productivity, and an ineffective sales system. About 12 per cent of the whole output is exported and the remainder is locally consumed. Major export fruits are pineapple, longan, litchi, blue dragon, banana, mango, and others. If foreign customers order a large contract, output at a specific location is not enough to meet such a big deal. In addition, the quality of fruit varieties, and the technology to grow and process fruit are poor, sometimes not meeting the strict requirements of importers. While China is the biggest fruit importer, representing less than half of the total export earnings every year, it has applied a quota system for fresh fruits as well as higher requirements on quarantine. For the domestic market, the sale of fruit prices is high due to many trading intermediaries, discouraging consumers to buy fruit. Each Vietnamese consumes about 56kg of fruit every year, a figure that is regarded low in comparison with other nations.

To overcome the poor performance the industry has to focus on improving the products's quality by applying advanced preservation and growing technologies to meet requirements of international and domestic clients.

2. Fruit Production

2.1. Fruit growing

Vietnamese people have had many experiences in plantation and intensive cultivation of fruits, especially commercial fruit trees. In many provinces, local people consider horticulture as an occupation and fruit production as a poverty reduction method. According to the latest survey and calculation, socio-economic efficiency of fruit trees is relatively high, esp. in the MRD obtaining a value of 4-5 times as high as rice cultivation. Furthermore, the economic value of a horticulture-specialized area can be 10 times as high as that of rice cultivation.

Most of the growers started growing fruits since 1990. This reflects the rapid growth in fruit production and the expansion in the number of growers since the economic reforms were launched. Commercial fruit growers tend to specialize in one crop. The management systems for fruit production are not particularly advanced. The majority of producers rely on mechanical irrigation systems and canal irrigation where possible, but the usage of tube and drip irrigation is at low scale. The vast majority of producers use pesticides to control for insect attack, with biological control and integrated pest management being rare. In general, producers rely on other farmers to provide seeds and organic manure, and on private traders to provide virtually everything else. Some specialty items, such as cuttings and seedlings for fruit production are purchased from state enterprises and government institutions, particularly in the South.

Almost all fruit output was sold in fresh form. Less than 2 percent of the output was kept for home consumption or reserved for further processing. Produce sold on the fresh market does, however, undergo post-harvest activities such as grading and washing. The majority of produce is sold to assemblers and wholesalers, with very little sold to processors, exporters, or retailers. About 80 percent of the fruit and vegetable output was sold to wholesalers and assemblers. Processors, exporters, and state-enterprises play only small roles in farm-level marketing, although the some of the output ends up there at a later stage in the marketing process.

Fruits are diverse in terms of size and legal status. Small traders tend to be unregistered private enterprises, while medium and large ones are often registered private enterprises. Also among the large traders are provincial and central state-owned enterprises. The use of cold storage is quite rate. Although a large majority of traders have storage facilities, just 3-4 percent use cold storage facilities. This percentage is somewhat higher among larger traders and exporters. Traders purchase most of their produce from farmers in spot-market transactions. About one-third is purchased from other traders, such as assemblers. Traders are reluctant to contract with growers because of uncertainty regarding the market price. The main customers for domestic traders are processors, while exporters mainly sold directly to foreign customers.

2.2. Fruit postharvest activities

Vietnam's fruit production is now facing a number of constraints in the postharvest handling. The postharvest losses are still very high (25-30% in average) due to weakness in postharvest system leading to difficulty in competitiveness for domestic consumption and export markets. Therefore, the improvement of postharvest handling system and technologies plays a vital role in the fruit development programme in period up to 2010. Good postharvest practice (GPP) also contributes a remarkable income and livelihood for people whom directly (the farmers) or indirectly (trader, processors) are involved in fruit production and marketing. Currently, dissemination of research results and transferring of the established technologies for production are still limited and do not meet the current increasing production demand.

Up to now, the income from postharvest activity is quite small. Longan and litchi producers had the greatest income from processing activities, corresponding to the drying activities of these growers. For fruit production (not including processing) citrus, mango and dragon fruit producers had the highest income. Overwhelmingly, postharvest activities are carried out on the individual farm level rather than at cooperatives or centralized processing facilities. The most common post-harvesting activities carried out by producers are grading and drying.

Farmers are lack in knowledge on proper care techniques for the crops during preharvest period also cause many problems for postharvest handling and marketing. It also decreases the commercial and edible values of the produce. Proper harvest stage plays a role not only in increasing the postharvest handling ability but also in improving quality of the produce. Packaging for produce is one of the major factors that considerably affect the results of storage and processing. Currently, research on development and application of packaging materials and techniques for fruit and vegetables produces is still limited. Most of farmers are still using primitive packages such as bamboo baskets, jute bags etc. They are not aware of importance of packages for their produce.

Currently, there are more than 20 state-owned fruit and vegetable processing factories with total capacity of 100,000 tons over year. Most of their equipment is out of date so the products quality is low while the production cost is high. Moreover, most of the factories are located far from raw material area; it causes considerable added costs due to cost and losses during transportation. Besides the processing factories as mentioned above, there are also private enterprises with small and medium scale production. This sector does contribute an important part in product diversification and provoke competition between private and state-owned sectors. As usual, most of them are now facing difficulties in capital needs, production site, and human resources.

3. Fruit Export

3.1. Situation and difficulties for fruit exports

The fruit export sector was hard hit by the collapse of the COMECON and the shift toward a market economy. Exports of bananas and pineapples to east bloc countries declined sharply over the period 1989-1994. However, the fruit export sector has recovered well in 1995-1998 stage, opening up new markets in Southeast Asia and elsewhere. This transition has been facilitated by export liberalization, which has allowed private exporters to seek new markets for new products. In the last five years, there has been a significant shift in attention toward fruit and vegetable production, particularly for export. The returns to growing many kinds of fruits and vegetables are quite high, providing opportunities to generate more income per hectare. In period of 1998-2001, fruit export turnover increased sharply and continuously and reached the top in 2001. The main reason was rapidly expanded market, especially in China. But, right this Chinese market affected the Vietnamese export in period of 2001-2003. Last year, total export of vegetables and fruit was 235 million USD, increasing by 31.3% compared with 2004. In 2006, the Ministry of Agriculture and Rural Development (MARD) expects to maintain export volume of key agricultural commodities at a stable rate, in which fruits value will be at US\$ 330 million.

Ministry of Trade just has reported that fruit export in the first 3 months of 2006 was decreased by 4.16% compared to that at the same time of 2005. Furthermore, export to China and Japan was sharply downed, while the export to Russia was remarkably increased.

According to FAO, in the next few years, demand for fruit in the world will increase 3.6%, while fruit production for providing to market will increase 2.8% only. This provides to Vietnam with a good opportunity to introduce its fruit to new markets.

Table 1 Vietnamese fruit export turnover during last 5 years.

Year	Export turnover (M USD)
2000	213.1
2001	344.3
2002	221.2
2003	151.5
2004	178.8
2005	235.0
2006 (expected)	330.0

The plan to export US\$1 billion fruits and vegetables by 2010 is both promising and worrisome. It is promising that the government is devoting greater attention to strategies to expand rural income through diversification into high-value agricultural commodities. It is worrisome because it appears to resemble centralized management of the agricultural sector, in which provinces and districts will be given responsibility for reaching targets. It is also worrisome because it is not clear if this is a plan to expand the role of state enterprises in fresh fruit exports, an area in which international experience suggests that state enterprises are not well suited.

Achievements of the plan are in future, while difficulties are being to face in 2006. In this year the Vietnamese fruit is still inferior with fruit of other regional countries, especially of Thailand. Results from a recent survey of the Vietnam Fruit Producers Association (Vinafruit) carrying out at border provinces showed that Vietnamese fruit has been low score evaluated. In details, Vietnamese fruit has many weaknesses such as damaged (from harvesting, packaging, transportation...), infested, quick perishable, uninformed, bad appearance, bad packaging without label, too much SO₂ content. Therefore, Vietnamese fruit can enter to Chinese South border provinces only with limited amount. They cannot enter to Central China.

At present, Vietnamese fruit is not meeting international standards of competitiveness due to the following reasons:

- Export prices have become increasingly less competitive because the fruit production sector has recently focused on cultivating high value fruit.
- Fruit crops are of low and fluctuating quality, and losses during harvest season tend to be extraordinarily costly.
- Lack of a Vietnamese fruit trademark and an inability to adjust to market changes has also contributed to the drop in revenue.
- Exporting fruit from Vietnam is risky because most of it (about 80 percent) goes to China, which is an unstable market for domestic exporters.
- Vietnam competes directly with neighboring Thailand, which accounts for 16 percent of the total amount of fruit exported in the world. One part of why the sector has suffered is because China signed a tariff preference agreement with Thailand in June of 2005.
- Price fluctuations and unstable consumption market demands.
- In market economy, especially the AFTA market, price fluctuation is unavoidable. However, to help fruit planters understand and accept such fluctuation is another aspect of the matter, which is macro-economic management. At present, planters fail to know how to access consumption markets and the best clients. Consequently, fruit planters are in shortage of information about market demands both domestically and abroad.

3.2. Solutions for Enhancing Competitiveness in Vietnam Fruit Exports

3.2.1. Support policies from the Government

Investment policies should be considered for modifying and amending based on the issued regulations so that they match with the current situation of production. In order to eliminate or at least minimize weakness in fruit production sector, need to readjust investment and credit policies in production, marketing, import-export; encourage direct investment for farmers, factories and enterprises to upgrade and renew technology and equipment. Government should also implement and amend incentive policies in agricultural extension and technology transferring for farmers, householders and enterprises in order to make close connection between research institutions with production. The current VAT tax imposed on fruit also required to be readjusted so that farmers do not need to pay VAT tax while selling their raw produces. They will need to pay the tax of 10% in case of investment on processing products.

To expand fruit exports, the government should focus on soft infrastructure, such as research and institutional development, rather than production targets and hard infrastructure, such as storage facilities and processing plants. Storage facilities and processing plants are commercial investments that the private sector will undertake under the right circumstances. Public investment in this type of infrastructure will often lead to excess capacity and implicit subsidies for state-owned enterprises. The government should focus instead on agronomic research to improve fruit productivity and raise quality, research to satisfy the sanitary and phyto-sanitary requirements of importing countries, a more effective extension service, the development of farmer associations and business associations, and institutions to provide market information to growers and traders.

3.2.2. Planning for fruit-specialized area

The Vietnamese fruit sector is not yet become an industry. Its product is fruit unlike as industry one, i.e. is still ununiformed in sharp, size, quality, taste, maturity. This explains why Thailand with 260.000 hectares, but their products across the world and overflow Vietnam where has fruit planted area 3 times higher, 750.000 hectares. Thailand has converted their fruit production into true industry.

Vietnam needs shift its focus to the development of its staple fruit, including pineapple, dragon fruit, pomelo, mangosteen, longan, and litchi and milk fruit. But to ensure that these varieties are suitable for foreign customers, we have to improve the quality of our fruit. Also, reduce the diversification of fruit varieties grown in specific areas is a measure for export purpose.

Aiming to enter into the world fruit market, Vietnam is planning to adjust its agricultural and rural structure, gradually make planning for fruit-specialized area; making planning and locate processing zones in order to exploit strengths of separate areas. By then the entire country have had 27 fruit-centered areas with a total area of 242,000ha, inclusive of 100,000 ha of fruits for export, mainly in the MRD. Banana

and mango gather in riverside areas of the Tien River and Hau River. Pineapple trees gather in the Ca Mau Peninsula, the West of Hau river, Binh Son (Kien Giang province), Bac Do (Tien Giang province). Longan, rambutan, durian and mangosteen mainly gather up in riverside areas of Tien River and Hau River. Vinh Long province is the top leading large fruit tree garden. Annually, it harvests more than 300,000 tones of fruits. And it has made planning for fruit specialty zones such as Nam Roi Pomelo in Binh Minh district, longan in Long Ho district and King orange in Tam Binh district. Some households planting Nam Roi Pomelo can obtain a profit of more than 100 million dong/ha every year.

3.2.3. Market expanding

Further liberalization of fruit markets would consolidate and expand the benefits of market reform. Market reforms have reduced poverty, expanded fruit production and exports, and contributed to greater diversity in fruit consumption. The process of market liberalization is mostly, but not entirely, complete. State-owned enterprises continue to play a large role in agricultural markets, including seed production, fertilizer distribution, fruit processing, and exports.

Import liberalization, including the reduction of tariffs and quotas on fresh and processed fruits, would generate net benefits for Vietnam. Although such imports will undoubtedly put competitive pressure on domestic growers of fruits, they yield three types of benefits for the country. First, consumers gain from greater choice and lower prices. Second, fruit exporters gain from reciprocal trade liberalization by Vietnam's trading partners. Third, although painful in the short run, imported fruits impose a useful discipline on domestic growers, forcing them to improve efficiency, respond to consumer demand, and provide the packaging and quality that consumers respond to.

Change to avoid loss in the existing markets: Exporting fruit from Vietnam is risky because most of it - about 80 percent - goes to China, which is an unstable market for domestic exporters. China has become the most important market for Vietnamese fruits. This trade has been stimulated by import liberalization in China, the long porous national border between the two countries, and the low level of quality and sanitary requirements on the part of Chinese consumers and traders. However, trade with China is subject to intense competition and instability related to Chinese import policy. Changes in Chinese policy or market conditions can have a dramatic effect on marketing opportunities for Vietnamese produce. The government should focus on the Chinese market by the following measures:

- Establishing wholesale markets at the border. Arranging fruit gradation, cleaning and carton packaging in Vietnam side in order to raise the export value.
- The Vietnam Fruit Producers Association (Vinafruit) together with export enterprises needs to search and know well the Chinese SPS regulations and documents.
- Boosting official exports and promoting market research in order to export fruit to the Central and North-East areas.
- Maximally exploit tax benefit in EHP. According to the agreement, the Chinese import tax level decreased to zero percent starting from 2006. This

requires paying more attention on fruit quality because it is vital factor in competition of similar produces from other country like Thailand.

- The Vinafruit should research to bring the trademarked fruits such as Nãm Roi grapefruit enter to Chinese market through cooperation with great international supermarket companies. Many such corporations such as Wallmark (US), Parkson (Malaysia), Itoyokado (Japan), Metro (Germany) have a supermarket network in China.

For markets in Europe and the United States, need to improve quality control and development of e.commerce. Exports to higher-income markets such as the European Union, Australia, Japan and the United States are small but growing. Quality requirements, packaging, and sanitary and phyto-sanitary requirements are the main impediment to these remunerative exports. Last year, Vietnam has registered 16 kinds of fruit for approving to enter to the US market by introducing. In the list of 16 fruits, some kinds have high competition such as durian, longan, litchee, grapefruit, and dragon.

The expanding to other potential markets such as Taiwan, Korea, Japan, Russia, France, United States, and Germany, Hong Kong...is very necessary in order to avoid deep independence on Chinese market. Therefore, the Vietnamese fruit sector waits and hopes the government will promote to sign soon the SPS agreement with other countries such as United States, Korea, Japan, Australia and New Zealand.

3.2.4. Institutional development

Market information is increasingly important in fruit marketing. As fruit marketing extends over longer distance, the need for timely and accurate information about prices and market conditions grows. Because fruits are highly perishable, storage is less able to moderate prices, and market information is particularly valuable when prices are volatile. Market information services must focus on key products and markets to avoid over-extension. Furthermore, they must incorporate regular feed-back from users to ensure that they remain useful and relevant. The size of litchi and longan exports to China, as well as the volatility of the market, suggest that market information in this area would be valuable to producers and traders.

By facilitating the creation of professional associations, the government would make fruit markets more efficient. Producer and trader associations make it easier to cooperate on matters of common interest, examples being the creation of a system for collecting and disseminating marketing information, the establishment of grades and standards, the provision of feedback to agricultural researchers regarding producer priorities, support to extension services for members, and the exchange of views on policy with the government.

The Vietnam Fruit Association (Vinafruit) is a non-governmental organization uniting enterprises operating in the fruit industry. The association was established in March 2001. Vinafruit mobilizes and enhances cooperation among fruit enterprises to develop the fruit industry, in response to the increasing demands of the international and domestic markets, and to help integrate the Vietnamese fruit industry to international agricultural markets. Vinafruit promotes domestic business and serves as a bridge between Vietnamese exporters and foreign importers. The association provides research, training, information dissemination and technical assistance to support

members in the areas of quality improvement and price reduction. Vinafruit also promotes cooperation among all stakeholders in the industry to further these goals. The government needs support more strongly to the Vinafruit for functioning its activities.

The establishment of a number of associations and collectives for fruit production and for exporters is necessary at this moment.

3.2.5. Establishment and development of a trade mark for Vietnamese fruit

In the current process of international integration, promotion on brand name establishment and protection registration for agro-products is very importance so that rights and legal interests of Vietnamese agricultural specialties are protected legally, which benefit those Vietnamese farmers who produce these products in their homeland. Promotion on establishment and protection registration for names of origin is necessary and of great importance in the current process of international integration. This will help Vietnamese farmers produce special products of high competitiveness, which serves as a contribution to poverty reduction program, gradually raising farm household income, taking part in the process of regional and global integration.

Trademark for fruit specialties is new to Vietnam; as a result, the number of registered fruits is small regardless of having a variety of famous agricultural specialties. Vietnam is now completing laws, establishing mechanism and policy that pave a way for the promotion on establishment and protection registration for Vietnamese products' names of origin. It is expected that Vietnam will have more fruits to be registered for origin protection in the coming time.

According to information presented at Conference on geographical instruction held by EC-ASEAN Cooperation Program on Intellectual Property Rights (ECAP II) at Hanoi on November 15-16, 2005, there are 150 agro-products including fruits from different provinces of Vietnam which are being considered in the project on Protection of geographical instruction in 10 years' time.

To support the troubled sector, the Vietnam Agricultural Trademark Club was set up late last year to help farmers develop effective trademarks for their products.

3.2.6. Fruit quality control: sanitary - phytosanitary issues

The government should devote more attention and resources to sanitary and phytosanitary (SPS) issues in fresh fruit exports. SPS issues are perhaps the greatest obstacle to fruit exports to middle- and high-income countries. As AFTA and WTO agreements reduce the ability of countries to protect their domestic agricultural producers from imports with tariffs and quotas, sanitary and phyto-sanitary issues will probably be used for protectionist purposes. Even without the protectionist motive, consumers in high-income countries are becoming increasingly concerned with pesticide residues, bacterial contamination, and other food safety issues.

The government should prepare a strategy for controlling the use of pesticides in fruit and vegetable production. This strategy should include four components: supply (import) control, research on the agronomic and economic aspects of pesticide use, farmer education campaigns, and more systematic testing of fruits and vegetables in the market place. This strategy should improve both the safety of the domestic food

supply and the marketability of exported fruits and vegetables. As part of this strategy, there needs to be more systematic testing of pesticide residues in fruits and vegetables. This will require coordination between the Ministry of Health and the Department of Plant Protection of the Ministry of Agriculture and Rural Development. The testing could rely on the AChE methods being used by the FCC in Ho Chi Minh City and would involve a combination of random testing in the markets and stores of the major urban centers and a testing service for retailers (probably supermarkets) that wish to provide a higher level of assurance of food safety.

At present, the quality assurance system and the quality certification of Vietnam is still limited. Only few standards just have been issued recently. But they are not systematic and uncompleted. For example, although Vietnam has standards for some fruit planting materials, but whole procedure for cultivation, take care of and planning has not yet issued.

3.2.7. Research and extension services

Strengthening agricultural research and extension in fruits would yield large significant benefits to farmers and consumers. International experience shows that public investment in agricultural research yields high returns. Furthermore, the returns to fruit research are likely to be particularly strong since funding for this sector has lagged behind its growing importance in production and exports.

Vietnam is inferior to regional countries such as Thailand, Malaysia, and Philippines not only in preharvest stage but also in the postharvest handling like sorting, grading, packaging, labeling, storage. Thus, firstly, need to raise fruit value through promoting postharvest activities. In Vietnam, the pre-harvest and post-harvest activities were not good linked to each other including in research and production.

Public research institutions should focus on the following issues in order to increase the technical support for enterprises that export fruit:

- Development and transferring technology of production of fruit tree planting materials (disease-free and good quality)
- Development and transferring technology of postharvest handling.

a) Approach on fruit seed and planting materials

It is easy to recognize those farmers, then breeding by themselves, created most of well-known fruit in MRD area such as Chín hóa durian, Hai Hoa grapefruit, Thanh Son mango. They were not originated from scientific work of institutes and researchers. These results are well recorded, but a true fruit industry could not based on such activities of farmers. Need to more support from government management in fruit seed and other planting materials.

One reason of weakness of Vietnamese fruit quality is due to lack of the government management in seedlings and cuttings for breeding. Farmers have not been supported for purchasing new seedlings. Therefore, seed plants became degraded, infested and fruit quality gradually decreased.

The government needs to have good policy, seedling production network and their distribution system. The supporting policy needs reach farmers, i.e. they have not to purchase seedlings at higher price. This policy has not been being so good, as a result,

farmers do not have good impression with new plant breeding programme. This leads to slowly increasing in plantation area, fluctuating in productivity and bad quality.

The technical approaches on fruit plant breeding are as follows:

- Identify good domestic fruit varieties to develop and conserve them.
- Import new good varieties from other countries (as have been done with Cayen pineapple, Thai specialties: durian, mangosteen and rambutan...).
- Industrialization in seedling production (Application of biotechnology, Utilization of machinery for substrate preparation).
- Seedling and cuttings production using the tissue culture and green house.
- Establishing network of seedling production units with support from government and scientific institution.

b) Postharvest handling

In Vietnam, researchers have not yet provided much support to producers and exporters in the fruit harvesting, preservation, storage, packaging and transportation. For a long time, since postharvest has not been interested, so the loss is still very high leading to difficult in reducing the produce cost. Recently, a number of technologies have been established but are still limited. The poor and inadequate post-harvest technology and management system is constraints to the expansion of fruit trade. The causes of losses can be summarized as careless post-harvest handling, poor technology dissemination and adoption system, low investment, and poor infrastructures such as small-scale farm, unpaved road, agro-facility, transportation, and marketing facility. In addition, many advanced post-harvest technologies are available but not being used in the fields due to unawareness of or unenabling to commercially adopt them by industries. Even appropriate technologies are not applied to the field due to poor technology transfer and adoption system. There is a lack of communicating information from researchers to users and vice versa.

The main approaches and activities in the field of postharvest handling are suggested as followings.

- Quality of raw material (input): it is one factors influencing product quality and handling effectiveness. Researchers should give the guidance on key indicators of fruit quality to the farmers, traders. Harvesting maturity: It is the stage of maturity when fruits have reached full physiological mature (size, firmness, taste, flavor, color). In order to ensure the effective handling and produce quality, it is essential to define the proper harvest maturity. The main indicators of harvest maturity of some fruits including lychee, longan, apricot, plums, orange, tomato, onion and garlic have been defined. But need to continue the work and to find the way for application in production. And, farmers and producers have to follow proper care technique during the pre-harvest period (irrigation; fertilization; pruning; thinning; insect, pest and disease control) to ensure the produce quality.
- Harvesting is one important step of a postharvest handling chain to maintain quality of produce during before reaching to the final consumers. Harvesting methods depend on habits and experience of local people. In Vietnam most harvest is being done by hand without any special tools. Therefore, research work needs to introduce the proper harvest methods and tools or equipment to

the farmers (for example, lychee fruits must be harvest early in the morning, when it is not rainy etc).

- Sorting and pre-treatment are most important step. Handling will not be effective if the quality of input raw materials does not meet the requirements. Up to now there is no packinghouse system across the country. Need to establish this system with domestic equipment. Vietnam can design and manufacture the machinery for the system. But first work is finding the appropriate technologies (washing, grading, packaging, preservation, storage...) and defining the investment scale and where packinghouse will be installed and what fruit will be handled.
- Packaging technique influences to fruits and vegetables during transport and storage. Lack of knowledge of packaging technique leads to considerable losses. Need to provide to farmers, traders and exporters the proper packaging technique for specific fruits.
- Transportation facilities and equipment play an important role in ensuring the effectiveness of posharvest handling. Refrigerated trucks are considered to be essential facilities for fresh fruit and vegetable transportation. Vietnam is a narrow-long country with different fruit specialties. The railway network should be exploited for North-South transportation. However, there was no any development in the field of fruit transportation. Needs to develop different transportation equipments including those with and without cooling machines. This will contribute to reduce loss and keep good quality for export fruit and for domestic consumption.

References

1. ANZDEC/IFPRI/Lincoln, 2000. *Agricultural Sector Program æ Phase I Technical Report*. Prepared for the Asian Development Bank by ANZDEC Limited in association with the International Food Policy Research Institute and Lincoln International.
2. Food and Agriculture Organization (FAO), 1998. *Vietnam Crop Diversification and Export Promotion Project Draft Final Report*, Volume 1 of 7 Volumes. Report No. 98-052 ADBVIE. Hanoi.
3. Minot, N., 1998. *Competitiveness of food processing in Viet Nam: A study of the rice, coffee, seafood, and fruit and vegetable subsectors*. Report prepared for the Development Strategies Institute, Ministry of Planning and Investment, and the Medium-term Industrial Stragegy Project of the United Nations Industrial Development Organization. Hanoi.
4. Nguyen Tri Khiem, To Dung Tien, and Nguyen Thi Thanh Thuy, 2000. Vietnam. In Mubarik Ali (editor). *Dynamics of vegetable production, distribution, and consumption in Asia*. Asian Vegetable Research and Development Center. AVRDC No. 00-498.
5. Quilici, S., 1998. Phytosanitary constraints related to fruit flies for fruit exporting countries and main post-harvest treatments. “Proceedings of a workshop on Commercialization of Tropical Fruits in South Vietnam. 12-13 June 1998. Southern Fruit Research Institute, Tien Giang, Vietnam.

6. Tran Cong Thang, 2000. Overview of fruits and vegetables subsector. Discussion Paper No.1. Development of Postharvest Activities to Improve Rural Livelihood in Viet Nam. Hanoi.
7. Truong Dinh Luc, 2001. Canned fruit and vegetable products: Real situation and solutions“. *Economic and Development Magazine* 44, February 2001.
8. Vu Cong Hau, 1997. *Fruit-Trees in Vietnam*. The Gioi Publishers. Hanoi.
9. VietNamNet. "Vietnamese agricultural products will be inferior when participate to WTO" 24 April 2006.
10. <http://www.vinonet.com.vn>. "Solution to expand fruit export to China in next comming time". 14 March 2006.
11. <http://www.vinonet.com.vn>. "For fruit becomes important export commodity when Vietnam enter to WTO". 13 October 2005.
12. <http://www.vinonet.com.vn>. "Crosslink in fruit production for export". 23 March 2006.
13. <http://www.vneconomy.com.vn> "Vietnam: fruit plantations seek better growth". 22 December 2005.
14. <http://www.vneconomy.com.vn>. "Current difficulties for Vietnam fruit exports". 5 August 2004.
15. <http://www.vinonet.com.vn>. "For increase fruit export turnover in next comming period". 23 February 2006.
16. <http://www.vinonet.com.vn>. "Thailand establish center for export fruit to China". 27 April 2006.
17. <http://www.vinonet.com.vn>. "Export turnover of our fruit decreased in the year first 3 months". 19 April 2006.
18. <http://www.vinonet.com.vn>. "Vietnamese fuit export turnover continueously increased". 17 January 2006.