Priorities and Constraints of Postharvest Technologies in Vietnam

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Abstract

This paper presents the characteristics of grain production and the fruit situation in Vietnam as follows: dispersed and small-scale operations, postharvest loss still high (up to 15% in the dry season, 20% in the rainy season for grain, and around 25% for fruits and vegetables). On the basis of the analysis of the current conditions of postharvest technology and losses, the paper stresses the constraints and priorities of postharvest technology in Vietnam, for example, silo has been used for storage successfully in many countries but in Vietnam it is necessary to solve some problems relating to technology and management so as to extend the effectiveness of the preservation of grain by silo.

Vietnam is one of the three leading rice exporters in the world. As for rice milling, two systems operate concurrently : Japanese type and conventional one, in which the latter can be used for processing rice at a moisture content of 16±17%. Although the quality of exported rice increases continuously, rice must be refined after purchase from the small private rice milling factories. Rice refining is a distinctive aspect of Vietnam's rice processing industry for export, to cope with present difficulties. Coffee beans and aquaculture have a potential for high export turnover. However, the technology and equipment should be further improved.

The author also indicates the need for increasing the quality of agro-products and sea products in Vietnam which requires not only the modernization of equipment, introduction of new and adequate technologies, but also good planning and appropriate policies.

Introduction

Agriculture and rural development are considered by the Vietnamese Government as the first national priority in the process of industrialization and modernization of the country. Vietnam's economy in general and Vietnam's agriculture in particular have been experiencing an extensive renovation that resulted in a remarkable increase of the standard of living of the people.

From a country that had to import rice, Vietnam developed and became the third largest rice-exporting country in the world during the past 8 years, after Thailand and the United States. Although Vietnam has a thousands-of-year history of rice production and has been using machines in rice processing for over 100 years, up to now, postharvest technologies for rice in particular and for agro-products and aqua-products, seafood in general are still a problem that needs to be addressed.

During the period 1976-1996, especially from 1990 up to now, rice production in Vietnam

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markedly improved. While the population has become 1.5 times larger for the past 20 years, rice production has been increasing 2.2 times. Presently, as the possibility of extending the cultivated area is limited in agriculture, the increase of production output in combination with the improvement of postharvest technologies to minimize postharvest losses is a major challenge to be addressed. This requires the participation of individual farmers themselves.

Overview of rice production and postharvest technology methods to improve the quality of rice

Vietnam is a tropical country with a long and narrow shape and high population : 76 million with an average density of 200 persons per km^2. Agriculture is the main production sector. The two major food producing areas are :

o Red River Delta in the North ; and

o Mekong Delta in the South

Mekong Delta occupies only 12% of the total area of the country but provides half of the national rice production.

Since 1989 (renovation period), government policies have changed aiming at encouraging farmers to increase production and the production of grains has increased since then (Table 1).

Table 1 Paddy Production and rice exports in Vietnam in the last 8 years
(in million metric tons)

Paddy production	1990	1991	1992	1993	1994	1995	1996	1997
Whole country	19.5	20.0	21.5	21.85	23.4	24.93	26.39	27.65
Mekong Delta	9.67	10.5	10.91	11.08	12.8	13.97	13.86	13.96
Rice exports	1.6	1.03	1.95	1.72	1.93	2.1	3.04	3.7

In the Mekong Delta, conditions for rice growing are favorable due to the interlacing of the irrigation system which leads water from Cuu Long river to rice fields. In some areas, farmers can obtain three crops of rice per year. Summer-autumn crop is harvested in the rainy season (July-September).

1 Threshing

A major feature of Vietnamese agriculture is the scattering of cultivation over small rice fields: In North and Central Vietnam, each household cultivates about 0.2-0.3 ha; in the Mekong Delta, fields are larger but the average planted area per household is also only 1 ha. As a result, in the northern and central regions, farmers harvest their crops and thresh them mainly by hand, while in the Mekong Delta, threshing machines are commonly used (Table 2).

Low production with different varieties leading to the lack of homogeneity in raw material for processing is one of the actual challenges for rice production in Vietnam, not only in terms of mechanization of field work but in the stage of postharvest processing as well.

Table 2 Statistical data of threshing machines and rice mills in Vietnam

(in units)

Machines	1990	1991	1992	1993	1994	1995
Threshing						
Whole country	28,819	35,577	36,882	98,630	103,267	106,874
Mekong Delta	19,238	22,550	24,761	25,477	26,270	26,540
Rice mills						
Whole country	25,403	33,038	35,501	52,105	76,311	79,938
Mekong Delta	4,970	5,086	4,584	6,196	6,184	6,173

2 Drying

Drying of paddy, especially during the wet season is a major problem due to the lack of adequate drying facilities. Consequently, mould becomes an obvious threat which causes damage due to high aflatoxin contents and even grain loss especially in the case of groundnut and maize. Postharvest loss is still high, 15% in the dry season and 20% in the wet season. Sun-drying is the main practice to dry large volumes of paddy. For households, flat-bed dryers seem to be suitable because of the low cost (7cent/kg) even though this technique has been applied in the United States and Japan since the 1950s. In 1983, it was improved and brought into use in Vietnam. In 1997, there were approximately 1,500 dryers of this type in the Mekong Delta and plans are tentatively made to install within the next 3 years 1,200 more machines in a project financed by Denmark. High-capacity dryers (made in Denmark) are used in both dry and wet seasons to secure the quality of paddy. At present, Vietnam intends to invest into the following forms of dryers : small dryers for farmer-households, dryers for milling enterprises and high-capacity dryers for companies that have warehouses containing a large quantity of paddy.

3 Warehouses for paddy storage

From 1977 to 1987, four modern silo systems were erected in Can Tho, Soc Trang, Cao Lanh and Ho Chi Minh City but none of them are used effectively. The silos are usually neither in operation nor in under-capacity utilization due to the high cost and poor management of state-owned enterprises. Paddy and rice grains currently are still stored by farmers in simple warehouses which become easily infested with insects and pests. Based on a study carried out by the Postharvest Technology Institute, Ho Chi Minh City (PHTI HCMC), paddy and rice grains preserved by farmers experience an annual loss of 1-2%.

In future, to solve the problem of paddy and rice grain preservation, it will be necessary to develop systems of small silos (2-8 tons) for farmers to prevent paddy and rice grains from being damaged by insects and rodents while systems of larger warehouses should be located near large rice mills for paddy storage in the provinces and systems of high-capacity silos should be available at ports for rice exports. As a result, the signature of export contracts first and collection of paddy and rice grains later could be avoided.

4 Rice-milling technologies and equipment

In contrast to the United States where 60 large mills are operated, Vietnam has about 80,000 small rice mills, mainly owned by private individuals, with a capacity of 0.5-2 tons per hour, thus meeting 90% of the milling demand of the whole country. Where mills are not available, milling services are provided by small mobile mills put on trailers or trucks. Large mills run by the state, equipped with good machines usually do not receive paddy as raw material but only collect rice grains from private small enterprises through traders for re-processing for export. Re-processing of rice grains was a particular feature and a solution to improve the quality of exported rice in Vietnam during the last 10 years.

As rice belongs to different varieties, has a high moisture content and is milled by a small, incomplete line of production, the end-product contains a large number of small brokens, foreign materials, paddy, etc. and cannot meet export standards. This type of rice grains instead of paddy is then used as material in large mills to produce rice of export quality. Due to re-processing, exports of Vietnamese rice increased in quantity and the quality improved during the past few years (Table 3).

Table 3 Exports of Rice from Vietnam 1991-1997

(in thousand metric tons)

Rice	0 - 5%	10%	15%	20%	25%	35%	Total*
Year 1991	60	289	55	85	279	227	1,015
1992	354	284	167	60	282	449	1,765
1993	478	344	209	57	100	230	1,575
1994	847	437	96	180	180	130	1,882
1995	569	455	241	149	439	66	1,921
1996	681	431	146	27	84	132	2,953
1997	492	564	226	62	1,226	163	3,270

* Total of all grades from 100% whole kernels to 5-45% brokens

This process—a particular feature of Vietnam—is shown in the chart below:

The reasons for the application of this process are as follows. One of the reasons is that the rubber roller mills imported from Japan are durable but they require homogeneous raw materials with a low moisture content. Importation of rubber rollers leads to high cost in rice milling while the cost of low-capacity milling and re-processing in Vietnam is rather low, US$ 7/ton compared with US$ 36/ton in the United States. This is a challenge for rice processing technologies in Vietnam as low-capacity milling, heterogeneous material, sun-drying result in a return rate (whole kernel and brokens) of 60-66%, of which 40-48% consist of whole kernel and in a high loss in the milling rate while high-capacity mills with standard milling process can achieve 68% and 52-54%, respectively and a much larger quantity of high-grade rice can be obtained (5% of brokens require that the ratio of whole kernel over the whole weight remains below 60%).

In Vietnam, there are 2 types of high-capacity mills: Japanese style and European one. The Japanese style consists of rubber-roller mills and horizontal shaft mills. The European style

includes disk disintegrators and underrunner mills. Although the use of high-capacity mills helps to reduce the loss in milling and to get better quality, they are still operated under-capacity because of the above-mentioned reasons. Even so, with the assistance of Denmark, within 1998, Vietnam will have 3 additional mills with a capacity of 42,000 tons of paddy per year each to solve difficulties in future.

Postharvest technologies for coffee in Vietnam

Coffee has been grown in Vietnam for over 140 years but up to 1975, the whole country had only 14,000 hectares of land under coffee with an output of about 5,000 tons per year. During the past 8 years, the output increased and coffee became one of the 10 major export products of Vietnam (Table 4).

Table 4 Production and exportation of coffee in Vietnam

	1990	1991	1992	1993	1994	1995	1996	1997
Production 1,000MT	92	100	119	136	180	218	320	350
Export value Million US $				150	200	519	550	
Export to Japan 1,000MT	0.199	1.780	5.081	6.553	10,254	17.4		

In recent years, Japan importation of coffee beans from Vietnam as well as India has increased remarkably. Particularly, the amount of coffee imported from Vietnam in 1995 reached about 17,400 tons, taking the fifth place in comparison with the importation from other countries.

In spite of having obtained some good results in postharvest studies, Vietnam still is confronted with many problems in postharvest technologies to improve the quality of coffee and economic efficiency.

Although coffee is grown in a concentrated way in Daklak province, it is mainly cultivated by small landowners who have poor facilities for drying. Coffee normally is dried in the sun on roads or on yards before hulling. Thus, the coffee usually has a low quality, becomes easily musty and fermented in the wet season, resulting in a high rate of postharvest loss in both quality and quantity. It is therefore difficult to store this coffee without effect on the quality.

There are some advantages in the wet processing method, by which the quality of coffee is improved, leading to an increase of the export value. Unfortunately, this method is only used in large enterprises that have a capacity of 3-4 tons/hour but is not suitable for individual households. When the wet processing method is applied on a large scale, serious attention should be paid to the prevention of environmental pollution. In future, it will be necessary to extend wet processing technology of a scale of 500-600kg/hour to coffee growers.

Presently, even though large processors and joint-venture enterprises have invested in warehouses (for coffee, storage), in installing classifiers, polishers, color sorters, only a small

part of the processing demand can be met.

Lack of market information and capital is the reason why Vietnamese exporters sell coffee at a low price. For instance, in May and June 1997, Vietnamese exporters sold most of the coffee in stock at US$ 1,300/ton while the price of the same coffee in the world market had reached US$ 2,400-2,500/ton.

Vietnam have made some progress in postharvest technologies for rice but those for coffee and other crops such as maize, groundnut, etc. still need further research to improve the quality.

Postharvest technologies for fruits in Vietnam

After a long period when emphasis was placed only on rice production due to the shortage of rice, now Vietnam is able not only to satisfy its domestic consumption but also to export large volumes of rice. Attention is thus increasingly being paid to vegetables and fruits. However, currently investment only involves fruit growing. Presently, there are about 370,000 hectares of land under fruit trees of various types with a total output of about 3-4 million tons of fruits per year, with 75% of the area being located in the Mekong Delta. However since fruit trees are scattered throughout the country and grow spontaneously, they belong to many kinds of varieties which creates difficulties in postharvest processing and export. Some fruit-processing mills have operated for 20-30years. Some are newly built, applying new technologies, of which 2 consist of joint-venture units. However intensive fruit-growing areas have not yet been developed, which explains why, even though Vietnamese fruits offer a good potential, up to now their exploitation has been limited.

In Vietnam, there are some special fruits that do not exist in other Asian countries. For instance, "Thanh Long" (English name : Dragon Fruit and scientific name *Hylocereus tricostatus*), and "vú sûa" (English name: Milk Fruit and scientific name: *Chrysophyllum cainito*). In 1997, the production of Dragon Fruit was about 25,000-30,000 MT and the fruits were exported mainly to Taiwan, Hong Kong and Singapore (US$ 800-1,200/tons).

Although Vietnam has made some progress in postharvest technologies for rice, fruit growers seem still to have not yet acquired any knowledge on the technologies for valorizing their products. Shortage of packing houses and systems of transportation, classification, handling and preservation for fruits is one of the reasons for serious postharvest loss (25-40%). Realizing that postharvest technologies for fruits in Vietnam should be further promoted, the Post-Harvest Technology Institute in Hochiminh City (PHTI HCMC) has organized some training courses for people from universities, institutes, provincial extension centers and invested in equipment, instruments for pilot studies and production improvement.

Outline of postharvest technologies for aquaculture in Vietnam

Aqua-products and sea food are 1 of the 3 main export commodities of Vietnam. Their exportation value increased during the past 5 years (Table 5) but loss after harvest is a problem that needs to be addressed, as the loss rate is estimated at about 15-20%. Thus, in this paper, some aspects of aqua-product and seafood preservation and processing are outlined.

Up to now, aqua-products and seafood had been mainly exported in minimal processed or

Table 5 Export value of aqua-products and seafood in Vietnam (1993-1997)
(in US $ million)

1993	1994	1995	1996	1997
368	460	560	670	776

frozen forms (frozen shrimps, 60-70%; frozen fish, 10-12%; frozen squids, 5-7%; dried seafood, 11-12%). Export value achieved therefore was low. In 1996, in Vietnam there were 170 aqua-product, seafood-processing enterprises which operate 21 IQF production lines with a freezing capacity of 830 tons per day, cold rooms with a capacity of 23,000 tons and ice production with a capacity of 3,300 tons per day but the ice produced by some plants is not pure enough and is infected with bacteria which facilitates the penetration and multiplication of microorganisms during transportation and preservation. As aquaculture is highly profitable, around 300,000 laborers have been spontaneously engaged in such activities along the coast. As a consequence, mangrove forests were destroyed, with an adverse effect on the environment. Vietnam must thus tackle this problem and strike a balance between the need to further develop such activities and the need to preserve the environment.

Summary and priorities for postharvest technologies in Vietnam

As stated above, it is obvious that the low quality of the agro-products is due to poor postharvest technology and processing practices. Vietnam should focus on the following problems of postharvest technologies:

1 Formulate adequate policies in conjunction with technical measures. For example: Purchasing price for paddy must be set in taking account of the quality of rice after milling using a standard mill but not only based on the moisture content of paddy as currently applied.
2 Formulate policies and introduce adequate technical growing measures to prevent overuse of agro-chemicals and destruction of mangrove forests for shrimp raising.
3 Improve the organization of milling systems to minimize the loss in small mills and enhance the economic efficiency of large mills.
4 Improve the drying of grains, coffee, etc. to reduce loss and damage caused by mould and insects.
5 Formulate integrated protection measures against fungi and insects and control pesticide residues in Vietnam, particularly in fruits and vegetables.
6 Build up systems of warehouses, milling facilities for farmers in villages, communes, districts, etc. and silos at ports.
7 Improve processing systems for coffee, especially Arabica which strictly requires wet processing and fermentation technology.
8 Stimulate agricultural diversification and rural industrialization.
9 Promote studies on postharvest technologies for fruits and vegetables - the current weak point of Vietnam. As most of the growers and relevant organizations have no concept of postharvest technologies, training courses should be offered extensively and pilot plants,

packing houses should be set up for studies and for supporting production.

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