Role of Fruit Production in the Tropics and Subtropics

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Abstract

The tropics and subtropics are a rich receptacle of various fruits. People in these regions have lived on fruit for thousands of years. The most important role of fruit production in the tropics and subtropics is to provide food for local consumption.

The other important role of fruits in these regions is trade and processing for industry. Many people cultivate tropical and subtropical fruits for sale, in particular fruits such as banana and pineapple are cultivated in large scale plantations for industrial purposes to obtain foreign currency.

Nowadays, tropical and subtropical fruits are important commodities in international trade. Many factors, however, restrict this trade. In this presentation, I will discuss the role of fruit production in the tropics and subtropics from the standpoint of a Japanese professor engaged in research and education in the field of postharvest technology for horticultural crops.

Food for local consumption

People in the tropics and subtropics have lived on fruit for thousands of years. For example, bananas may have originated in Southeast Asia, probably in the Malay Peninsula and have been cultivated since the beginning of history. Surprisingly, the native people succeeded in breeding seedless fruit plants more than 5,000 years ago. Buddha made the banana plant the symbol of futility since no fertilization takes place, but it was the most useful food for the people to live on. Every family had several banana plants in the home garden and they never starved. It can be said that people have lived with bananas by planting them every year for thousands of years. At the same time, they selected good cultivars. The present banana production is indebted to these people.

According to FAO statistics, production of banana including plantains totals 76 million tons, ranking first among fruits, followed by 61 million tons of grapes, 57 million tons of oranges and 43 million tons of apples. The real banana production, however, should exceed this value as the statistics do not cover home use and trade in small and distant communities.

Also, mangoes native to the Indo-Burma region, have been cultivated for more than 4,000 years and are closely related to human life not only as food, but as custom, art and religion. Many people are surprised to hear that the world mango production amounts to 17 million tons and ranks fifth among fruits.

Besides bananas and mangoes, there are hundreds of useful fruits in the tropics and subtropics. In promoting scientific research on tropical and subtropical fruits we should realize that they have been closely related to the life of the local people for thousands of years.

Farming and processing industry

The other important role is industry. People cultivate tropical and subtropical fruits for sale. We

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can see many stores and open markets where fruits are sold in the tropics and subtropics. Some of the methods are old-fashioned and some are modern.

The unique system of industrial farming in the tropics and subtropics is the so-called plantation. Plantations started in the middle of the 19 th century as an overseas settlement and sometimes they acted as a system of exploitation of colonies by European countries. After World War II, all the colonized countries became independent and the system of plantation changed. However, there are many banana and pineapple plantations even now and they are being operated mainly for export. This is the reason why banana has become the major trading commodity among fruits and more than 10 million tons are exported every year from the tropics to other parts of the world.

The plantations also enabled the tropics and subtropics to develop a large scale processing industry. Since canning of pineapple was successfully achieved in the late 19 th century, many canning factories were built with the operation of plantations. Now, canning of not only pineapple, but of many tropical fruits such as litchies, rambutan and mangoes has become common.

As the processing of citrus fruit and freezing techniques were highly developed after World War II in the USA, fruit juice became a large industry. Especially, frozen concentrated orange juice became a large trading commodity. Recently, in Brazil approximately 10 million tons of oranges are squeezed per year and are being exported throughout the world.

Fruit trade

Except for plantation crops such as banana and pineapple, many tropical fruits are unknown to the people who live in other parts of the world. For example, most of the Japanese do not know mangosteen, so-called 'queen of the fruit'. Once a small volume was imported from Colombia, and it was sold at ¥1,350 per fruit. Japan is a large market for world fruits. One of the characteristic features of fruit marketing in Japan is the presence of quality fruit stores (Kitagawa, 1994). In the upmarket shopping area of a large city, there are stores in which fruits are sold at a very high price. Also, every department store has a counter to retail fruits. In this type of store, it is not uncommon to pay for a single musk melon ¥10,000. Also, the store sells rare and high quality tropical fruits at a very high price. For example, one piece of cherimoya ¥4,000, Mexican apple mango ¥1,500, and durian ¥10,000.

In 1993, 3.6 million tons of fruits were imported as indicated in Table 1, but among them 2.0 million tons were processed and the volume has markedly increased as shown in Table 2. This phenomenon is due to the trade liberalization of apple and pineapple juice in 1990, orange juice in 1991 and all the trade concerning fruits became free. However, imports of many tropical fruits are negligible as shown in Table 3. For some fruits, even figures of recent import volumes are not available, mainly due to plant quarantine problems. Japan does not harbor fruit flies such as Oriental fruit fly, Mediterranean fruit fly and Queensland fruit fly. Fruits grown in areas infested with these pests cannot be shipped except for fruits which are not infected with these pests, like pineapple, coconut and green banana. When the government, however, certifies that a shipment will not spread these pests in Japan due to strict control including

Table 1 Production, import, export and consumption of fruits in Japan

Year	Production	Import	Export	Total consumption	Per capita consumption	% of domestic supply
		1,000 metric tons			kg	%
1975	6,686	1,387	80	7,993	59.8	84
1980	6,196	1,539	97	7,635	54.6	81
1985	5,747	1,904	90	7,486	51.5	77
1990	4,895	2,978	29	7,763	52.3	63
1991	4,366	3,033	29	7,391	49.6	59
1992	4,837	3,440	27	8,166	54.5	59
1993	4,400	3,604	13	8,111	54.1	54

Table 2 Imports of fresh and processed fruits by Japan

Year	Fresh	Processed	Total
	1,000 metric tons		
1975	1,190	197	1,387
1980	1,159	380	1,539
1985	1,205	699	1,904
1990	1,405	1,573	2,978
1991	1,472	1,561	3,303
1992	1,531	1,909	3,440
1993	1,643	1,961	3,604

Table 3 Fresh fruits imported by Japan

	Volume (Metric ton)			Exporting country or area and % of the total in 1993 or 1991
	1991	1992	1993	
Banana	803,340	777,175	913,335	Philippines 73, Ecuador 17, Taiwan 7, Indonesia 2, Vietnam, Colombia, Honduras
Grapefruit	260,783	244,578	237,488	USA 94, Israel 3, Swaziland 1, S Africa 1, NZ
Orange	82,017	171,700	165,420	USA 94, S Africa 3, Australia 3
Pineapple	137,786	127,466	120,963	Philippines 99, Taiwan 1, USA, Thailand, Indonesia
Lemon & Lime	89,079	93,416	89,276	USA 97, Mexico 1, S Africa 1, Australia, NZ
Kiwfruit	42,651	52,265	47,058	NZ 92, Chile 8, USA
Melon	21,359	20,695	22,420	USA 75, Mexico 23, NZ 2, R Korea
Cherry	5,814	12,617	12,667	USA 100, NZ
Mango	6,885	8,059	9,264	Philippines 87, Mexico 12, USA, Taiwan, Thailand
Grape	7,568	7,732	7,776	Chile 54, USA 42, Taiwan 3, NZ 1, Thailand
Avocado	2,665	3,559	4,573	USA 70, Mexico 30
Papaya	5,271	5,197	4,774	USA 100, Taiwan
Strawberry	3,638	3,416	3,903	USA 99, NZ 1, Australia
Coconut	1,724	2,027	1,678	Philippines 95, Costa Rica 2, Palau 1, China 1, Srilianka, Malaysia, Vietnam
Litchi	1,211	889	1,228	Taiwan 100
Pomegranate	565	—	—	USA 100
Persimmon	246	—	—	NZ 100, R Korea
Pomelo	134	—	—	USA 100
Durian	98	—	—	Thailand 99, Philippines, Singapore
Raspberry	34	—	—	USA 87, NZ 13
Cherimoya	28	—	—	USA 89, Mexico 6, NZ 5
Cactus	18	—	—	Vietnam 68, Mexico 32, USA
Passionfruit	16	—	—	NZ 77, USA 17, Mexico 6
Pepino	13	—	—	NZ 100
Feijoa	6	—	—	NZ 69, USA 29, Mexico 2
Tamarillo	5	—	—	NZ 100
Total	1,473,381	1,553,840	1,645,523	

Source: Statistics of Japan Fresh Produce Import Facilitation (NISSEIKYO), Tokyo
Note: —Not available

Table 4 Tropical and subtropical fruits given special entry permit by the Japanese Govenment

Country or area	Fruit (Cultivar)	Designated pests	Disinfection methods	Year when permit was granted
Australia	Orange	Md, Qu	CT (1.0°C, 16days)	1982
	Lemon	Md, Qu	CT (1.0°C, 14days)	1992
China	Litchi	Or	VHY (46.5°C, 10min) +CT (2.0°C, 40hr)	1994
Hawaii	Papaya	Md, Or, Me	VHT (47.2°C)	1969
Israel	Orange	Md	CT (0.5°C, 14days)	1972
	Grapefruit	Md	CT (0.5°C, 13days)	1972
	Sweety	Md	CT (1.5°C, 16days)	1990
Philippines	Mango (Carabao)	Or, Me	VHT (46.0°C, 10min)	1975
	Papaya (Solo)	Or, Me	VHT (46.5°C, 70min)	1994
Spain	Lemon	Md	CT (2.0°C, 16days)	1988
South Africa	Orange, Lemon, Grapefruit	Md	CT (−0.6°C, 12days)	1970, 1973
Swaziland	Orange, Grapefruit	Md	CT (−0.6°C, 12days)	1973
Taiwan	Orange	Or	CT (1.0°C, 14days)	1969
	Mango (Irvin, Haden, Keitt)	Or, Me	VHT (46.5°C, 30min)	1976, 1991
	Papaya (Solo)	Or, Me	VHT (46.5°C, 30min)	1991
	Litchi	Or	VHT (46.2°C, 20min) +CT (2.0°C, 42hr)	1980
Thailand	Mango (Nang Klarngwun)	Or, Me	VHT (46.5°C, 10min)	1987
	(Nam Dorkmai, Pimsen Dang, Rad)		VHT (47.0°C, 20min)	1993

Note: Cd; Codling moth, Md; Mediterranean fruit fly, Me; Melon fly, Or; Oriental fruit fly, Qu; Queensland fruit fly, CT; Cold treatment, VHT; Vapor heat treatment

proper disinfection treatment, a special permit will be given. Recently, the introduction of many fruits has been authorized as shown in Table 4. Litchies from China and papayas from the Philippines were introduced in April 1994.

Besides Japan, many countries restrict the import of tropical fruits by plant quarantine. To apply for a permit, special studies are necessary. In the case of processed fruits there are no quarantine problems and many kinds of canned or frozen tropical fruits are available. People, however, are not familiar with these fruits and do not buy them willingly.

Collaboration

In order to develop the fruit industry in the tropics and subtropics, collaborative research between the producing country and consuming country is necessary.

Philippine mango used to be fumigated with EDB (ethylene dibromide) as an approved method of disinfection. EDB, however, was found to be carcinogenic and the Government banned the use of EDB on all fruits after December 1987. As a substitute, vapor heat treatment was developed. When fruits treated in that way were shipped to Japan, severe internal breakdown was observed in many fruits. It was so serious that I thought that commercial mango exports from the Philippines would be discontinued.

Fortunately, our program of research collaboration on the postharvest physiology and handling of tropical fruits supported by JSPS (Japanese Society for the Promotion of Science) started at that time and Dr. Lizada of the University of the Philippines visited us. She inspected the fruits in Japan and under-

took research immediately. She and her team found that the disorder was caused by anaerobic respiration during the treatment with vapor heat (Esquerra *et al*., 1990). Therefore they recommended that the fruit temperature should be raised and lowered as quickly as possible. As a result the severity of the disorder was reduced and mango trade could be pursued. The import of Philippine mango amounted to 4,346 tons in 1987, but increased thereafter to 8,031 tons in 1993.

Preharvest and postharvest research

Although research on postharvest physiology and handling during packaging, transportation and ripening is important to increase the fruit trade, problems are often associated with the preharvest condition of fruits.

In 1987, the Japanese Government authorized the import of mangoes from Thailand. Thai growers were glad to be able to export mangoes to Japan and in the first year 62 tons of mangoes were exported. However, the volume decreased thereafter to 19 tons in 1991, a small value compared to the 5,768 tons of Philippine mangoes.

It was eventually found that anthracnose was responsible for the decrease in the volume of fruits exported. Infected fruits were sent to Japan as it is difficult to diagnose the disease in the packing house and the symptoms developed during the transportation. The fruit stores said that Thai mango is large and has a good eating quality, but the disease is so serious that the fruits cannot be sold.

During the symposium entitled "Frontier in Tropical Fruit Research" held in May 1991 in Pattaya, we recommended bagging of fruit on the tree (Kitagawa *et al*., 1992). The use of paper for bagging fruits on the tree to prevent diseases is a common practice in Japan. All the loquats, most of the pears, peaches and apples, some kiwifruits and grapes, and a few citrus fruits are being bagged. Bagging is very laborious, but if the fruit is bagged before the infection, the disease does not develop. Bagging also enhances the appearance of the fruit and reduces the amount of chemical residues.

Bagging is by no means a modern technique according to recent scientific research, but the actual fruit industry is based on such techniques. Both preharvest and postharvest research including genetic research is urgently needed to increase the role of fruit production in the economy of the countries located in the tropics and subtropics.

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