

Thai Mango Export: A Slow-but-Sustainable Development

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Abstract

Mango is an indigenous crop of Thailand. It has been grown since the early history of the Kingdom, but mostly for domestic consumption. From 1975 onwards, development towards exportation started to develop, first by developing suitable cultivars, followed by adoption of production and post-harvest technologies, especially pruning technique to obtain low-stature plants, off-season production through the use of paclobutazol soil drench, vapor heat treatment to kill fruit fly larvae, and the use of specially-made paper bags to cover the fruits. The most significant development, however, was the adoption of cluster strategy in which mango growers join hands among themselves with supports from DOA, DOAE, the exporters, and several agro-chemical companies in producing quality fruits almost all year round from different areas of the Kingdom for export markets. The present mango export markets from Thailand include Japan, Malaysia, Laos PDR, South Korea, Indonesia, Hong Kong, Singapore, China, and the USA for fresh fruits, and Japan, the Netherlands, Australia, the USA, New Zealand, Russia, and South Korea for processed products. Many new markets have also been explored.

In 2006, the total amount of mangoes exported was 29,600 tons, valued at 1,147 million Baht - still negligible as compared to major agricultural commodities exported from Thailand. However, all mango exported across the border was not included in the official statistics. Yet the growth rates of 347.8 % in volume and 94.7 % in value in exporting fresh mango in 2005 as compared to 2004 were very impressive. This was mainly due to the clustering strategy of the mango growers' groups. With the signing of FTA with many countries, coupling with the setting up of the "One Stop Service Center" by the Department of Agriculture to facilitate the export procedure, the volume and value of mango exported from Thailand are expected to increase at a much higher rate in the near future. This should be supplemented with the setting up of an organization solely responsible for the long-term national strategic plan of mango production, marketing and export.

Keywords: Pruning, off-season production, fruit bagging, One Stop Service Center, VHT, FTA, GAP, MRL.

1. Introduction

1.1 Mango is a Native Crop of Thailand

Mango (*Mangifera indica* Linn.) is native to Indo-Myanmar region and has been cultivated for over 4,000 years. Indo-China, including Thailand, is believed to be the diverse places of mango. As many as 172 cultivars have been recorded in Thailand and about ten have been grown commercially.

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Mango is one of the most important fruit crops in Thailand with the cultivated area in 2006 of 286,697 ha, the production of 2,218,262 tons, and the yield of 7,738 kg/ha (Table 1). However, they are mainly produced for domestic consumption, although some (about 10%) are being exported in fresh as well as processed form (Tables 2 – 4).

Table 1. Mango production of Thailand, 2004-2006.

Category	2004	2005	2006
1. Area (ha)	310,116	281,988	286,697
2. Production (tons)	1,802,665	2,093,223	2,218,262
3. Yield (kg/ha)	6,494	7,425	7,738

Source: Office of Agricultural Economics (2006) and Department of Agriculture (2006).

1.2 Thailand has a Long History of Mango Development

Mango has been cultivated in Thailand for hundreds of years. It is one of the most ancient crops of the Kingdom as is evident from the writing on stone tablet of King Ram Khamhaeng the Great of Sukhothai Kingdom more than 700 years ago. It is now widely grown throughout the Kingdom. Although mangoes are also grown in other countries, Thai mangoes are quite unique in many respects. Many Thai cultivars have delicate flesh so sweet that they are eaten with glutinous rice as a delicacy, a favorite dessert for Thais and foreigners alike during the mango season. Another group of mango cultivars unique to Thailand is the ones that are eaten when the fruits are still green with nutty taste. Surprisingly enough, the majority of mango consumed in Thailand is the type which is eaten when it is green and sour, in the form of salad; one is a spicy Thai dish, called “Yam”, in which the flesh is cut into slender pieces, mixed with lime, chili and other spicy ingredients; the other is to cut the flesh into flat

pieces and eat with a sweet and spicy sauce, called “Nam Pla Wan”. There is no statistics, however, on the amount consumed in these ways.

2. Development Towards Exportation of Thai Mangoes

2.1 Development of Suitable Cultivars

Being grown as commercial crop for a long time, Thai mango cultivars are numerous, especially when many have been propagated originally through sexual reproduction. Thai farmers have been blessed with sharp eyes in selecting elite clones deriving from chance seedlings and bud sports. With their skill in plant propagation technique, many new cultivars have originated quite frequently. Within a short span of time, many have become commercial cultivars and replaced some of the old, obsolete ones. Major cultivars include ‘Nam Dok Mai’, ‘Maha Chanok’, ‘Chok Anant’, and ‘Khiao Sawoei’.

2.2 Development of Suitable Production Technologies

2.2.1 Pruning Techniques: Pruning practice in mango in Thailand is done in two periods:

2.2.1.1 At the Age of Two Years: When the plant is two years old, at a height of 1.5 m, pruning is performed to initiate a canopy. This is done by cutting off the central shoots in order to have open center with three to five main scaffold branches. When the plant is 2.5 m high, flower forcing to produce off-season fruits can be done.

2.2.1.2 After Fruit Harvest: If the plant has been properly pruned earlier, the branches which protrude out of the canopy are cut off while the long vertical shoots have also to be trimmed off to maintain the standard canopy size. Such practice is done after harvesting the main crops every year. After pruning, the plant will flush new sets of leaves. When the young leaves fully expand, treatment of paclobutazol can be done to induce the plant

to flower to produce off-season fruits for the next season. In this way, the plant remains in low stature, enabling easy manipulation, especially for fruit bagging and harvesting.

2.2.2 Off-season Production: Thanks to our research scientists, induction of off-season flowering in mango has been successfully achieved in Thailand for many years. The use of paclobutrazol as a soil drench has been adopted by mango growers to enhance uniform off-season flowering. This technique has now been widely practiced within the Kingdom and internationally recognized later by many other producing countries. The key factors for this technique include appropriate preparation to obtain healthy trees and proper stage of tree development at which the chemical is applied. Up to 2-3 different cropping times can be induced provided trees are properly prepared and orchards are well managed. Success of induction may vary among cultivars, for example, ‘Fa Lan’ and ‘Nong Saeng’ are much easier to induce than ‘Khiao Sawoei’ and ‘Raet’. Although off-season blooming can be obtained, the chemical must be carefully applied to avoid any possible damage to the trees.

2.2.3 The Use of Specially-made Paper Bags to Cover the Fruits: In order to prevent oriental fruit fly from laying eggs in the fully mature fruits, specially-made paper bags, imported from Taiwan, have been used to wrap the fruits. Two types of bags are available. One is called “carbon” bag, the other is “white” bag. The “carbon” bag does not allow the light to penetrate to the fruit. This provides suitable environment for perfect skin color appearance of the ripe fruit; for example, the green-color cultivar of ‘Nam Dokmai’ turns to be beautiful yellow color similar to the yellow-color cultivar of ‘Nam Dokmai’. However, for colorful ‘Maha Chanok’ and yellow-color strain of ‘Nam Dok Mai’ cultivars, this type of bagging prevents color development of the fruit. Two approaches have been used to solve the problem; (i) by wrapping the fruit later than usual, about 30 days before fruit ripening – this applies to yellow-color strain of ‘Nam Dokmai’, and (ii) by using the “white” bag to

allow light to penetrate inside the bag – this applies to ‘Maha Chanok’ cultivar. Other practices include eradication of fruit fly, the use of integrated controlling technique based on ecological data of the fruit fly, coupling with the use of poison bait and repellent.

2.2.4 Fruit Thinning: In order to obtain optimum fruit size, fruit thinning has been attempted. Normally only one fruit per stalk is allowed to develop so that the fruit is fully developed and turns out to be mostly of grade-A quality. This can be done when the fruit is of a thumb size, although it consumes a lot of labor. To avoid labor shortage problem, some orchards, especially in the north, thin the fruits during the time of fruit bagging.

2.2.5 The Measure on the Use of Agrochemicals: The measure on the use of agrochemicals on mangoes aiming at exporting to Japan is quite strict as the importing markets have specified on the list of chemicals not allowing to be used on imported mangoes. Specification on the amount of residue permissible based on “positive list” has been issued. Thus, all concerned parties in the exportation of mangoes to Japan must follow closely and update this specification from time to time.

As for the growers, they must be GAP-registered, following the regulation set up between the growers and the exporters. The use of chemicals is of prime importance in exporting mangoes, particularly to the Japanese markets. Therefore the growers must follow the regulations set by the exporters and closely examined by the Department of Agriculture. The exporters would provide the “positive list” to the growers while the latter must record the kind and the period of chemicals used. Certain mango growers’ groups have managed to buy chemicals from large and dependable agrochemical companies by themselves on their own behalf. Some asked the companies to bid their chemicals and made legal negotiation afterwards.

Prior to exporting the mangoes, the exporters will take samples of the mangoes for analysis of chemical residues either by sending the samples to the Regional Research and

Development Office in the area, or to send them to the “One Stop Service Center” (see later). If the amount exceeds the maximum residue limit (MRL), the growers are not allowed to harvest the fruits until further analysis reveals that they have not exceed the MRL

2.3 Development of Suitable Post-Harvest Technology

2.3.1 Grading: This includes separation into different sizes with optimum quality such as clean skin with no blemish, good color and shape. This has provided the growers with maximum income as the price for grade-A mango is 40-50% higher than grade B.

2.3.2 Vapor Heat Treatment: In order to be accepted by the Japanese market, the fruits must be subjected to vapor heat treatment (VHT) to kill fruit fly larvae (oriental fruit fly – *Batrocera dorsalis*, and melon fly – *Batrocera cucurbitae*) and pathogens causing anthracnose and blossom end rot adhering to the fruits harvested from the field. The treatment of vapor is at 47°C for 20 minutes. During the first period of increasing the temperature up to 43°C, the air must have a relative humidity between 50-80%, and at 43°C, the air must be saturated with heat at the relative humidity over 95%. After the treatment, reduction of heat must be done by blowing wind or spraying water. The following cultivars have been accepted by the Japanese markets: ‘Nang Klangwan’, ‘Raet’, ‘Phimsen Daeng’, ‘Nam Dokmai’, and ‘Maha Chanok’.

2.4 Cluster Strategy of Thai Mango Growers’ Groups

After the Thai Government has successfully implemented the VHT, the export of Thai mangoes to Japan has steadily increased in both volume and value year after year, in spite of a strict control on chemical residue. This was mainly the result of the adoption of the cluster strategy of the mango growers to join hands in the production of quality fruits throughout the year. The roles of

each party in developing cluster strategy are described below:

2.4.1 Mango Growers’ Role:

2.4.1.1 Grouping of Growers: Mango growers’ groups have been set up throughout the Kingdom. Each group is managed by the committee members to set up the policy to run the activities of the group. Some of them formed a cooperative organization while the others formed a community business group. They have a meeting plan to set production schedule for any members to meet the exporter’s order. They have their own chemical stock which was purchased directly from chemical companies and distributed to their members. The mango growers’ groups managed their organization like a cluster by sharing their input resources, production planning, packing shed, the markets, and many others. Agricultural experts have been invited to train the members on how to manage the orchards including tree pruning, fruit wrapping, harvesting, grading, packing, chemical spraying, especially to meet the Japanese’s strict requirement not to exceed the maximum residue limit (MRL) set by Japan.

2.4.1.2 Distribution of Production Sites: There are many locations in Thailand that are producing mangoes mainly for export. At present there are 20 growers’ groups around the country, from eastern to central northern, north and northeastern areas. At the moment Thai mangoes are available nearly all year round. These successful tasks were accomplished by the well-organized clusters of mango growers, a joint venture among growers, DOA, DOAE, chemical supply company, and exporters.

2.4.2 Department of Agriculture’s Role:

2.4.2.1 Application of Good Agricultural Practice: The Department of Agriculture (DOA) has provided a guideline for good agricultural practice (GAP) to every member of the mango growers’ group. Of particular concern is about the use of agrochemicals in which the growers must use

only those which are recommended in order to satisfy the importing countries' requirements. The DOA has certified the orchards that practice GAP. It also registers the mango exporters for Japanese markets. The accepted exporters must be satisfied with all criteria set such as having a number of GAP orchards which have been certified by DOA, and must exhibit the chemicals which are acceptable to the Japanese importers – the so-called “positive list”. These include the list of prohibited chemicals, namely chlorpyrifos and propiconazol. The growers are advised to select those among the positive list the chemicals that have low MRL and avoid those with high MRL.

2.4.2.2 Establishment of “One Stop Service Center”: The DOA has set up the “One Stop Service Center” to facilitate the exporting procedure. This is done by coordinating the activities of three partners, namely the growers, the exporters, and the government agencies. Each has its own duty to work in harmony with the others. The crucial point is the management on the use of agrochemicals in which the importing countries have set up a very strict regulation, particularly Japan. In this connection, the DOA has liaised with the Japanese Government in quality control of mangoes exported to Japan through the “One Stop Service Center” with support from various agencies (see below).

In order to make the exportation of mango to Japan as smooth as possible, the DOA has set up the project on “the management of chemicals in the mango orchards aiming for export to Japan”, which is under the “One Stop Service Center”. This will provide the exporters with the privilege in that the Japanese Government will not re-examine the samples, as there is an accompanying document issued by the DOA, while those exporters who do not join the project will have to pay fee for examination of the samples, which costs several tens of thousand Baht. There are at present 25 exporters who join in the project.

2.4.3 Department of Agricultural Extension's Role: DOAE has been active in

promoting GAP among the mango growers' group. In addition, DOAE also provided facility for VHT. Such a practice was found to be effective in controlling fruit fly larvae such that some mango growers' groups have set up their own facility with their own fund.

2.4.4 Exporters' Role: The exporters provide guidance to the growers, especially on the chemicals to be applied, based on the positive list. They must provide the list of chemicals and application method for each period of growth of the mango plants. This information has to be shown to the DOA through the “One Stop Service Center” which, in turn, passes on to the Ministry of Public Health of Japan.

2.4.5 Agrochemical Companies' Role: Since there is a very strict regulation on the use of agrochemicals to be applied to mangoes aiming at exporting to Japan, the agrochemical companies must provide the positive list of chemicals to the DOA. The major agrochemical companies that sell their chemicals to the growers have set up a very strict practice in selecting a list of chemicals to be sold to the mango growers. The manufacturers of the quality chemicals or their representatives are fully trusted by the growers' groups in choosing those chemicals for use in their orchards.

2.5 Achievements

The clustering strategy of the mango growers' groups gives the following mutual benefits:

2.5.1 Provides Supply Chain for Export Market: In general, the fruits produced by the growers' groups are superior to those of other growers as they follow the guidelines strictly. Moreover, since the production sites are scattered throughout the Kingdom, and with proper practice of application to produce out-of-season fruits through the use of paclobutazol, mangoes are produced almost all year round. This has provided the supply chain from the orchards to the consumers, utilizing capital investments of the growers' groups and

with supports from the local administration, without the budget of the Government.

2.5.2 Earlier Success in Exporting Thai

Mangoes: One of the earlier companies which was active in exporting mangoes to Japan is Taniyama Siam Co. Ltd. that has encouraged the development of mango growers' groups to export their mangoes to Japan seriously up to the present time, particularly using 'Nam Dokmai' as the main cultivar of mango for export to Japan. Many other companies have also been launched to export Thai mangoes. From the Japanese market, the foreign markets of South Korea, New Zealand, Middle East, and Russia soon followed.

2.5.3 Export of Thai Mangoes:

Thailand has exported both fresh and processed mangoes for more than three decades. In 2004, export volume of fresh mangoes was 2,494 tons, valued at 133 million baht; and of processed mangoes such as canned, dried and frozen mangoes (Tables 2-4). The major international markets for Thai fresh mangoes are still in the Asian region, partly because of the lower transport costs and relatively short distances. The major export markets for fresh mangoes are, in descending order: Japan, Malaysia, Indonesia, Singapore and Hong Kong. As for canned mango, the importing countries are Japan, Australia, England, Germany, etc.

Although the export volume of Thai mangoes is relatively small in comparison with the country's total production of 2.2 million tons, export volume of Thai mangoes is rising, particularly to the European markets and also other parts of the world. With due concern for consumers' health and to meet the international quality standards, all the organizations involved are working together, aiming to produce both fresh and processed mangoes of superior quality. A quality assurance system is being introduced and practiced in all production sites.

In 2006 total amount of mangoes exported was 29,600 tons, valued at 1,147 million Baht (Table 2) - still negligible figures as compared to major agricultural commodities exported from Thailand. Two points have to be

brought into consideration. One is the fact that the statistics were obtained from official exported items recorded by the Department of Custom, without those exported across the borders to Malaysia, Lao PDR, Vietnam and China, which were sizable indeed. Second is the exceptionally high growth rate in 2005 as compared to 2004 which were 347.8% in volume and 94.7% in value in exporting fresh mango (Table 2). This was mainly due to the clustering strategy of the mango growers' groups, as described earlier. The total amounts of mangoes exported were also higher, 72.7% for volume and 36.7% for value in 2004 as compared to 2005 (Table 2).

3. Discussion

From the foregoing discussion, it looks like Thailand has considerable success in producing and exporting mangoes such that it can be said that mango is the ideal fruit crop, which at present is one of the champion products of Thailand.

3.1 Slow Development

Mango development took place around 1975 through the cooperation of various government agencies such as Kasetsart University, Horticultural Research Institute, Department of Agricultural Extension, in cooperation with the mango experts of the private sector. One of the achievements was the development of 'Nam Dokmai No. 4' cultivar which is an off-season cultivar. It was adopted as the most important commercial cultivar. Various planting techniques have been developed and extended to the growers, e.g. the change of cultivar through top grafting, close-space planting, and off-season production through the use of paclobutazole.

3.2 Sustainable Development

From 1975 onwards, development towards exportation started to develop, first by developing suitable cultivars, followed by adoption of production and post-harvest technologies, especially pruning technique to

obtain low-stature plants, off-season production through the use of paclobutazol treatment, vapor heat treatment to kill fruit fly larvae, the use of specially-made paper bags to cover the fruits, etc. The most significant development, however, was the adoption of cluster strategy in which mango growers join hands among themselves with supports from the exporters, DOA, and several agro-chemical companies in producing quality fruits almost all year round from different areas of the Kingdom for export markets. It can be said that development of mangoes for export was slow in the beginning, but would be sustainable in the long run.

3.3 Future Trend

With the signing of FTA with many countries, coupling with the setting up of the “One Stop Service Center” by the Department of Agriculture to facilitate the export procedure, the amount and value of mango exports from Thailand are expected to increase at a much higher rate in the near future.

3.4 The Need for Long-term Strategic Plan

There is at present no government agency responsible for developing mango as a system

of production in Thailand. Thus, there is a need to set up an organization solely responsible for the long-term national strategic plan of mango production, marketing and export.

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Table 2. Various types of mango exported from Thailand, 2004-2006.

Unit: Volume (tons), value (million baht)

Types of mango	2004		2005		2006		Growth rate (%)			
							2004/2005		2005/2006	
	Vol.	Value	Vol.	Value	Vol.	Value	Vol.	Value	Vol.	Value
Fresh mango	2,494	133	11,169	259	11,282	294	347.8	94.7	13.5	13.5
Canned mango	10,689	367	12,446	432	12,488	438	16.4	17.8	0.0	1.4
Dried mango	180	49	217	59	637	101	20.5	20.4	193.5	71.2
Frozen mango	832	48	679	66	5,253	314	-18.4	37.5	673.6	375.8
Total	14,195	597	24,511	816	29,660	1,147	72.7	36.7	21.0	40.6

Source: Office of Agricultural Economics (2006).

Note: No statistic available for across-the-border export, which is sizable figures.

Table 3. Major export markets of Thai fresh and frozen mangoes, 2004 – 2006.

Unit: Volume (tons), value (million baht)

Country	2004		2005		2006 (Jan-Oct.)		Growth rate (%)			
							2004/2005		2005/2006 (Jan-Oct)	
	Vol.	Value	Vol.	Value	Vol.	Value	Vol.	Value	Vol.	Value
1. Japan	821	86.46	964	120.99	1,243	135.50	17.42	39.94	36.59	17.21
2. Malaysia	620	9.02	8,363	84.18	7,152	70.93	1,248.87	833.02	-14.48	-15.74
3. USA	11	0.81	2	0.27	9	2.45	-81.82	-66.33	350.00	296.69
4. Lao PDR	44	0.29	694	6.98	508	4.97	1,477.27	2,293.16	-26.48	-28.41
5. So. Korea	74	9.80	106	13.98	87	10.02	43.24	42.74	-8.42	-19.43
6. Indonesia	428	7.34	315	6.06	511	4.54	-26.40	-17.3 6	62.74	-25.18
7. Hong Kong	76	3.72	131	5.52	68	2.49	72.37	48.33	-48.09	-54.64
8. Singapore	128	2.53	34	2.23	44	2.24	-73.44	-11.81	29.41	0.03
9. China	67	2.45	190	3.32	68	1.98	183.58	35.62	-60.69	-24.75
Total	2,269	123.42	10,799	243.53	9,690	235.43	375.93	97.32	-10.27	-3.46

Source: Department of Customs (2006).

Table 4. Major export markets of Thai canned mango, 2004 – 2006.

Unit: Volume (tons), value (million baht)

Country	2004		2005		2006 (Jan-Oct)		Growth rate (%)			
							2004/2005		2005/2006 (Jan-Oct)	
	Vol.	Value	Vol.	Value	Vol.	Value	Vol.	Value	Vol.	Value
1. Japan	2,787	101.23	4,490	159.28	3,736	127.49	61.11	57.35	-9.95	-13.76
2. Netherlands	885	29.24	529	20.87	312	11.01	-40.23	-28.64	-29.89	-34.24
3. Australia	1,595	56.50	1,552	56.07	1,041	35.34	-2.70	-2.53	-13.32	-18.53
4. USA	692	20.18	566	16.80	638	25.29	-19.65	-16.76	19.70	57.27
5. New Zealand	309	8.70	312	9.20	282	8.84	0.97	5.70	27.03	42.63
6. Russia	132	4.26	151	5.11	144	4.93	14.39	20.11	-4.64	-3.49
7. So. Korea	112	3.93	106	4.40	46	1.96	-5.36	11.81	-56.60	-55.51
Total	10,680	366.11	12,446	432.47	10,577	365.94	16.54	18.12	-2.62	-3.07

Source: Department of Customs (2006).