



**Australian Government**  
**Australian Centre for  
International Agricultural Research**

# Final report

*project*

## **The potential for mangosteen in eastern Indonesia**

SADI-ACIAR research report

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**Australia Indonesia Partnership**  
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## ACIAR's participation in the Australia–Indonesia Partnership

The Australia–Indonesia Partnership (AIP), comprising \$500 million in grants and \$500 million in highly concessional loans over five years, was announced in January 2005. The partnership supports Indonesia's reconstruction and development efforts, both in and beyond tsunami-affected areas. Assistance involves long-term sustained cooperation focused on economic and social development projects and Indonesia's programs of reform and democratisation.

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This initiative will improve incomes and productivity for farmers and agribusiness in response to market opportunities, through a process that is underpinned by improved adaptive research and development capacity.

ACIAR's role in the initiative is to strengthen province-based agricultural research and development capacity that is market and client-driven, and effectively transfers knowledge to end users. A key part of this approach is delivered through market-driven adaptive projects which are priorities for smallholders, farmer groups, agribusiness, government and other supporting agencies.

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# 1 Acknowledgments

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## 2 Executive summary

Of the 4 provinces involved in the Smallholder Agribusiness Development Initiative (SADI), NTB is the only province with significant production of mangosteen, although it remains a relatively small industry compared to other horticulture crops in the region, such as cashews and mangoes.

Mangosteen is the only export focussed fruit industry in Indonesia with up to 8 000 ton/yr exported from all of Indonesia, almost all going to China. This has been developed solely by private exporters. Mangosteen growers are in a very profitable supply chain with incomes significantly above the poverty level and the general Indonesian population.

Developing a capacity to research, develop and negotiate access protocols is urgent. Current exports to China are in the absence of a formal protocol and are at risk. Exports to Taiwan have ceased presumably because of the absence of an access protocol. Also included required is the capacity to manage chemical registration and MRL issues for access.

There are pre and post harvest quality issues (gummosis, skin marks, size distribution, keeping calyx green), that could improve the % of fruit sold to export.

An evaluation of other export opportunities should be conducted for other phyto and non phyto markets, in consultation with exporters. Indonesia has strong competitive advantages in export.

The lack of post harvest cooling in NTB for export mangosteens is a constraint impacting on export price.

There is a need to develop a long term national capability in access protocol arrangements. Mangosteen is the most urgent protocol to resolve and probably the easiest as a good model to develop capability.

### 3 Introduction

This report is part of ACIAR's contribution to the Smallholder Agribusiness Development Initiative (SADI) in eastern Indonesia. The concept arose from a series of priority setting workshops.

This scoping study operated from a supply chain approach, looking at ways income could be increased for smallholders as part of a supply chain. This analysis operated from the position of researching issues in profitable sustainable supply chains, rather than an identification of technical constraints. There are many technical constraints. The only ones that matter are those that support profitable and sustainable supply chains. A number of project concepts were developed, identifying research required to make the supply chains work to the benefit of smallholders.

Analysis of the current situation operated from an understanding of the technical, marketing and economic issues faced by the crop. It rapidly became apparent that for some situations, it was difficult to improve incomes in the existing supply chain, despite many researchable problems. Adoption of improved technologies in this supply chain is unlikely, as margins are low for all in the chain.

Developing a new supply chain at a higher price provides the market pull in terms of price for farmers and others to invest and adopt new technologies. Farmers will adopt new technologies where there is sufficient price pull. These benefits will spill over to existing supply chains e.g. if a farmer adopts new production systems to improve quality to meet high priced export markets, the portion of the crop sold into domestic markets also benefits from this technology.

The analysis also looks at the economic situation faced by a family farming enterprise, particularly in relation to the ability of the farm to generate sufficient revenue to maintain a standard of living similar to the rest of the population. It is a very high priority to generate economic wealth at least equal to the rest of the population and create an environment where incomes can rise along with the rise of incomes in Indonesia.

Successful implementation requires strong involvement by all members of the supply chain as active participants in the research. These initiatives will fail if researchers proceed in the absence of input from as many participants in the supply chain as possible.

The results of the analysis arose from visits to farmers, government and private sector players in the three provinces as well as in other areas of Indonesia, where similar crops are grown. A series of project development workshops were held to develop project concepts from the scoping mission. These included a wide range of participants.

### 4 Current production

Mangosteens are grown in the wetter areas around Mataram (Namarda, Lingsa) and central Lombok. There are no mangosteens in the dry areas of north Lombok and Sumbawa (Tables 1 & 2).

*Table 1: Mangosteen production and tree numbers in NTB from 2002 - 2005.*

	2005	2004	2003	2002
<b>Tree Numbers</b>	7,290	8,763	9,462	12,449
<b>Production (tons)</b>	314	288	201	93

Source: BPTP NTB

Table 2: Mangosteen production and tree numbers in all Kabupatens of NTB (2005)

Kabupaten	Tree Numbers	Production (tons)
West Lombok	3,748	165
Central Lombok	1,910	85
East Lombok	1,237	44
North Lombok	11	1
Dompu	0	0
Bima	50	3
West Sumbawa	0	0
Mataram City	334	16
Bima City	0	0
<b>Total</b>	<b>7,290</b>	<b>314</b>

Source: BPTP NTB

Farm size is small varying from 1 tree in a garden to over 100 trees. There is no accurate data of farm size distribution. It is variously estimated that there are around 300-500 farmers. There is an active farmers association with around 300 members and 60% actively participating in monthly meetings. The association also runs a small credit service with members paying Rp50 000 to join and a monthly fee of Rp2 500. Farmers can access these funds as free credit for up to 6 months. The association is keen to develop direct sales to an exporter.

In relative terms it is clear that mangosteens are not as important as other fruit crops including mango, citrus and banana. Mangosteens are planted in the wetter areas of NTB where farmers have a wide range of reasonably secure cropping options. They are not planted in the drier areas of north Lombok or Sumbawa as mangosteens are not adaptable to long periods of drought. In these dry areas they may however produce earlier if irrigation is available.

It is interesting that they are not planted in South Sulawesi which has suitable areas, including areas that could produce in June and July, out of season to the rest of Indonesia.

## 5 Current markets

It appears a large percentage of the crop from NTB is sold to two major export consolidators who then sell to a number of exporters in Bali and Surabaya. The consolidators buy the whole crop then grade for size and quality with smaller and marked fruit going to the domestic market. Farmers get a set price of around Rp4 000 /kg. When there were three exporters the price was higher at around Rp7 000 /kg. In the only Hero supermarket in Mataram, mangosteens were on sale for around Rp20 000 /kg. In the wet market the sale price was between Rp4 000 - 5 000/kg. There are some sales into drier areas of east Indonesia that do not grow mangosteen, such as Sumbawa and Kupang.

The export opportunities for mangosteen from Indonesia are due to:

- there is significant production that can be exported
- there is a long line of supply
- Indonesia is very price competitive
- the quality issues are probably easier to deal with
- there is not as much international competition
- Indonesia has a supply window advantage over other international suppliers.

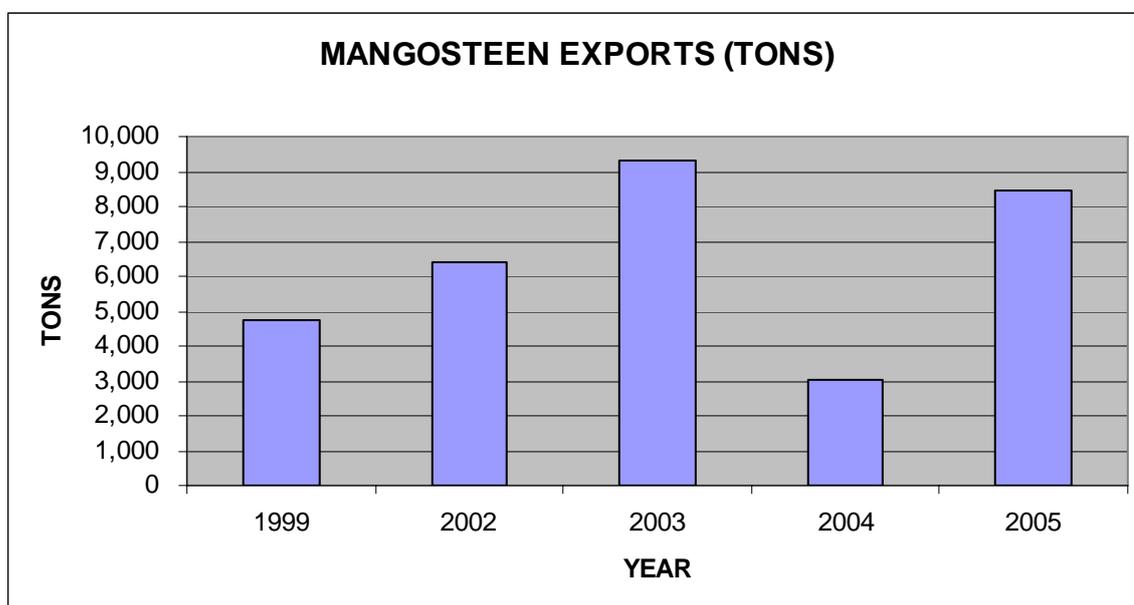
Mangosteens are exported via Bail and Surabaya based exporters. Some are Indonesians and some are Taiwanese. Fruit is shipped un-refrigerated from Mataram to Bayiwangi in East Java, then by cold container via Surabaya port to the export market. It was not clear exactly where fruit was going but growers believed Taiwan and Korea were the main markets. Discussions with large Korean tropical fruit importers confirmed there are no fresh imports but there are imports of Individual Quick Frozen (IQF) mangosteen from Indonesia but very small quantities and the quality is not as good as IQF mangosteens from Thailand. There is a Jakarta branch office of a Thai company that specialises in IQF mangosteen. The most likely outlet was mainland China for Indonesian IQF fruit.

Jakarta based exporters are selling to southern China. Their sales to Taiwan have stopped, though the reason is unclear. It is difficult to determine the destination of exports from available export statistics.

Export to these centres is likely to contravene importing country quarantine laws. Illegal imports into China are common practice in China, with customs officials easily bribed. Quarantine is more regulated in Taiwan and especially Korea. The risk is that these imports could be stopped very abruptly in the absence of a quarantine protocol. This has happened in China (Australian mangoes) and Taiwan (Australian stone fruit). China has recently imposed quarantine restrictions on the large Thai exports of mangosteen. An immediate cessation of the trade would cause significant disruption. There is an increased risk due to the large numbers of live ants and spiders (including eggs) observed under the calyx of mangosteen.

Indonesian exports of mangosteen are significant around 6,000-8,000 tons per year. This is the only significant fruit export (Figure 1).

Figure 1: Mangosteen exports from Indonesia.



Source: Foreign Trade Statistics, Statistics Indonesia. [www.bps.go.id](http://www.bps.go.id)

Export fruit are packed in 8 kg plastic crates, surrounded by paper and graded for class and size. In Lombok there is no cool chain until well after packing. For Lombok exports, the cool chain starts in Bayiwangi, in East Java, which may be up to 4 or 5 days after picking. This could be a significant issue in keeping life adequate for sea freight journeys of 12-14 days, especially in keeping the calyx green on arrival.

In discussions with Jakarta based exporters, sourcing from West Java and Sumatra, it appeared prices paid to farmers were higher (Rp5 000-15 000/kg). In this supply chain,

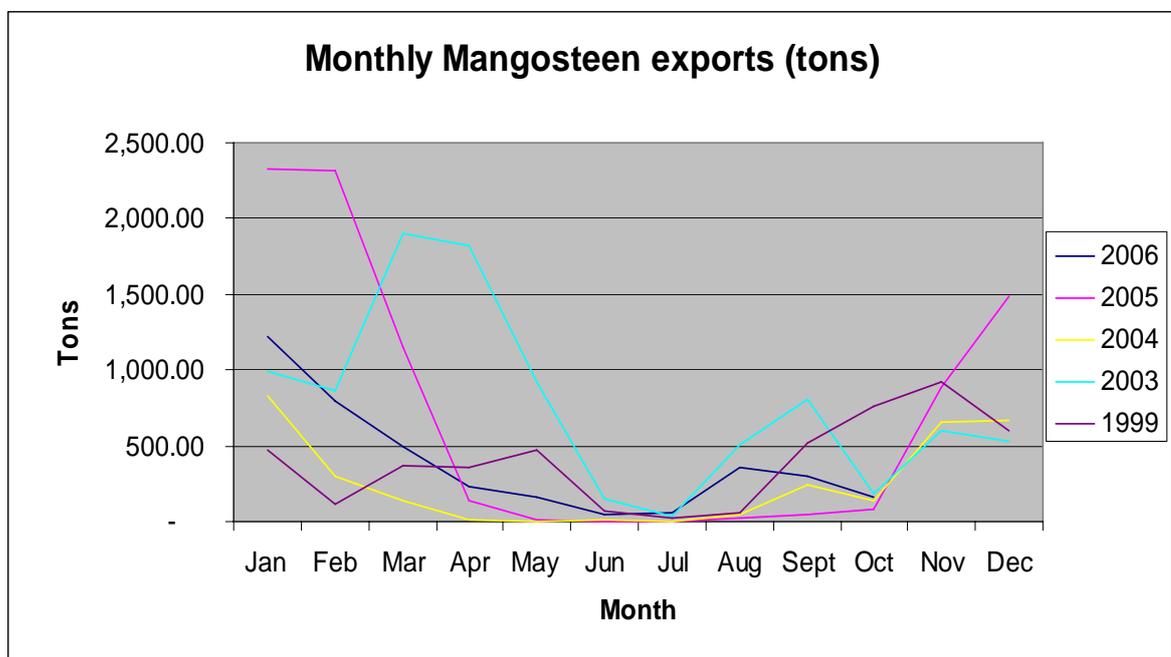
the cool chain starts at the farm with cool trucks and cool storage at the packing shed. The exporter emphasised the need to maintain the calyx green on arrival or price is discounted. This may be an issue worthy of further investigation. The sea freight journey from Surabaya is 12-14 days. Added to the time taken to collect, pack, and ship to Bayiwangi in the absence of cool storage may be causing problems, especially with the calyx drying.

Export prices in China are variable but around US\$15/8kg (Rp16 875/kg CIF). There are other markets that will pay much higher prices for mangosteen e.g. Australia imports Thai mangosteen at around \$A5-8/kg CIF wholesale Sydney markets (Rp35 000 – 55 000/kg). Thailand exports to Europe, Australia, and Japan. It is likely there are much better market options for mangosteen if the Indonesian government had the capability to successfully research and develop access protocols.

Sales may be worthwhile in Europe (Netherlands, Germany). There is no requirement for quarantine access protocols. Airfreight from Jakarta to Europe is around US\$3/kg. Identifying the economics of further export options in terms of prices, costs and access issues is well worth further evaluation.

Indonesia has real competitive advantages for mangosteen export. They are only grown in any significant quantity in Malaysia, Indonesia and Thailand. The Indonesian season, Nov-Dec, is opposite to Malaysia and Thailand, June-July. Current mangosteen exports from Indonesia are over a long season of 8 months (September – April) (Figure 2). Indonesia has a large existing production base at cheap prices. Mangosteen quarantine issues are not difficult to resolve and the fruit has a reasonable post harvest life for sea freight.

Figure 2: Monthly mangosteen exports from Indonesia



Source: Foreign Trade Statistics, Statistics Indonesia. [www.bps.go.id](http://www.bps.go.id)

Accessing Australia is worth considering as the precedent has been set with Thai mangosteens into Australia. The protocol requires methyl bromide fumigation. This may reduce quality and post harvest life. Wastage of Thai mangosteen imports into Australia is very high. They retail in many major chains at around \$A2/piece. Indonesia has a major advantage in time of supply but also the shipping time to Australia is much less. It is possible to ship to Darwin from Surabaya in 3 days on a weekly service with a further 3-

4 days to Sydney by backload road freight rates. This is around half the current shipping time from Thailand. The other issue is to negotiate fumigation treatment on arrival rather than departure, as is done for many dry goods from Indonesia (furniture) and fresh pineapples from Philippines. This would significantly improve post harvest life

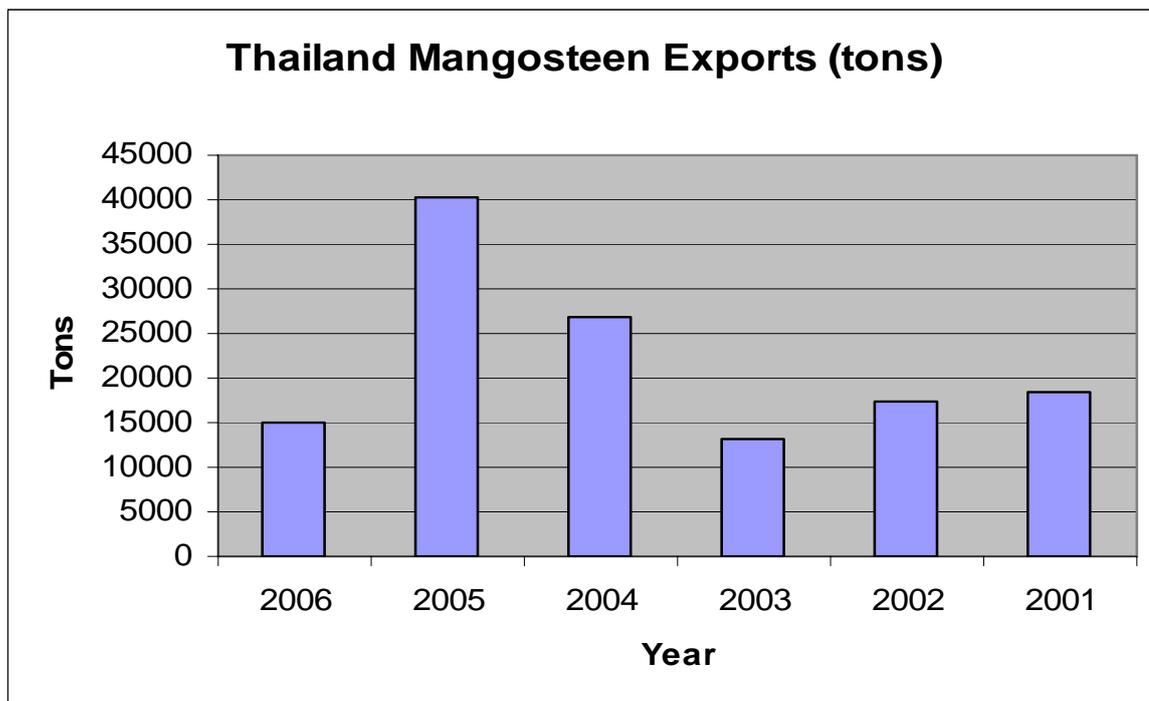
Access into Japan may require Vapour Heat Treatment (VHT) for fruit fly. It is unclear if there is a feasible market into USA and Canada.

It is unclear how much production from NTB is being exported but one exporter indicated that they were packing 3 ton of fruit every 2 or 3 days. At this rate it will take 6 days to accumulate sufficient fruit to fill a 40 foot sea freight container.

There are also reports that one of the large tobacco companies in central Lombok is involved with mangosteen exports. Tobacco companies provide farmers with credit. They also provide a high level of support for farmers, with extension staff visiting them at least 3 times per week. These companies are interested in closer links to their farmers to ensure they are financially stable, reducing the risk of credit default. Hence their interest in other crops the farmer may grow.

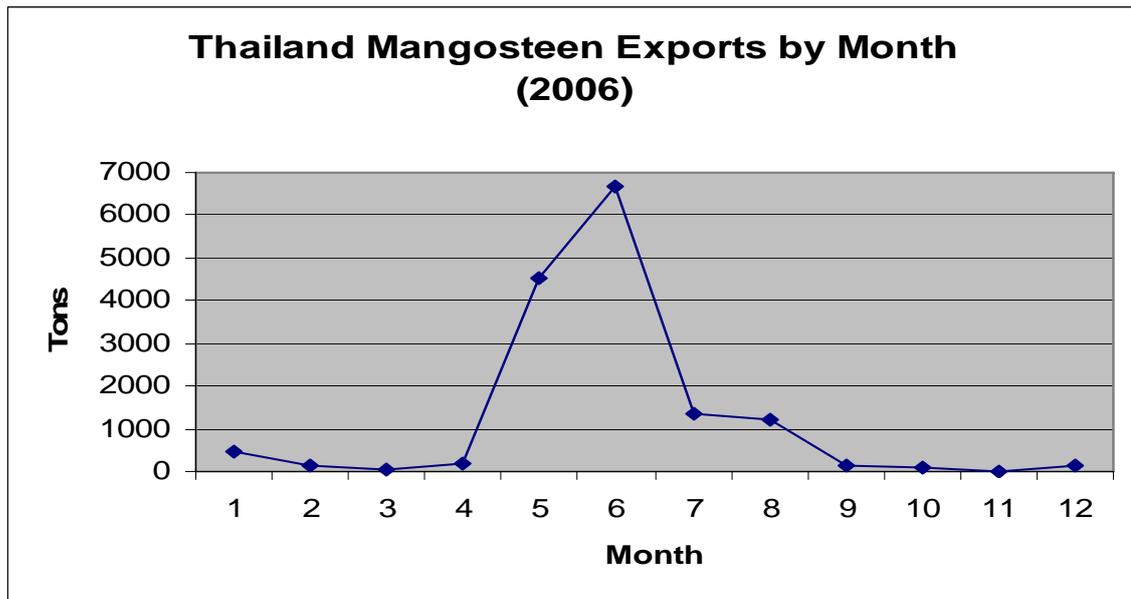
It is relevant to look at Thailand exports (Figure 3) of mangosteens that occur primarily over the months of May – August (Figure 4). Thailand exports some 15 000 – 40 000 ton of mangosteens. China accounts for around 80% of total exports (Figure 5). Taiwan was a major market until 2004 when exports virtually stopped from a level of around 5 000 ton only 2 years earlier. This also reflects the comments of Indonesian exporters that Taiwan has ceased to be a market over the last few years, possibly reflecting a quarantine or residue issue. Indonesia is emerging as a market for Thai mangosteens with around 1 000 ton imported in 2004 increasing to around 2 500 ton in 2005 but virtually ceasing to 2006. Vietnam is also an increasing market for Thai mangosteens. Significant quantities are also sold to Laos and Myanmar.

Figure 3: Thailand mangosteen exports



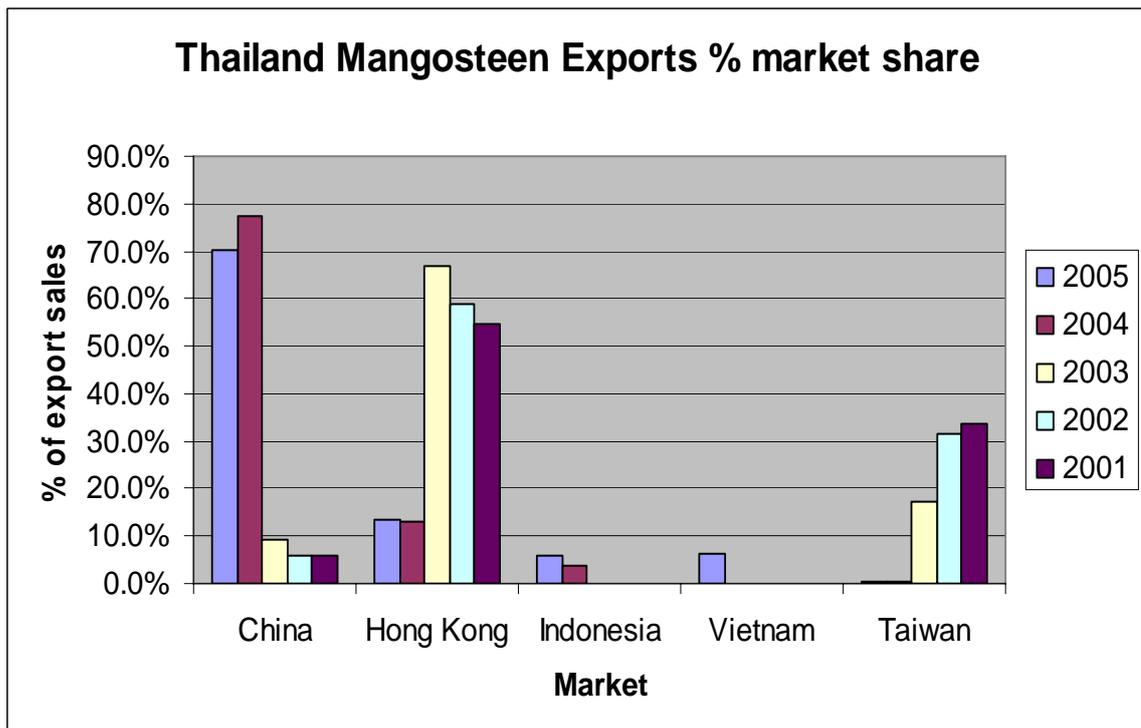
Source: Thailand Customs Export Statistics [www.customs.go.th](http://www.customs.go.th)

Figure 4: Thailand mangosteen exports by month (2006)



Source: Thailand Customs Export Statistics [www.customs.go.th](http://www.customs.go.th)

Figure 5: Thailand mangosteen exports by major importers.



Source: Thailand Customs Export Statistics [www.customs.go.th](http://www.customs.go.th)

Very little is exported to EEC countries (possibly reflecting air freight cost), none to Canada, and only small quantities to Australia (228 ton in 2005 and 74 ton in 2006) and to Japan (319 ton in 2005 and 169 ton 2004). Discussions with the major Australian importers indicate there is a future for the crop in Australia at a wholesale CIF price of A\$6-A\$8/kg (Rp40 000 – 55 000/kg) for airfreight mangosteens. There were initial problems with quality and the quarantine protocol with mites and soil found on imports. The current protocol requires methyl bromide fumigation. Importers do not believe the quality problems are caused by fumigation but issues on farm.

The other market that Thailand has been selling into has been the Arab states though the volume is relatively small at around 100 ton per year. Interestingly there are virtually no sales of Thai mangosteens into Malaysia. There may be opportunities to sell into the developing supermarket outlets, of which many have stores in Indonesia.

## 6 Season and climate

The areas around Mataram and central Lombok have higher rainfall than other area of NTB with some rainfall during the dry season. Mangosteens are mainly in the lower elevations. Trees flower in July – August and are harvested from December to March. The harvest periods for the various areas of Indonesia is shown in Table 3. There is no seasonal advantage for NTB production in relation to other areas of Indonesia.

Table 3: Mangosteen harvest seasons in Indonesia

West Sumatra	Medan	Central Java	East Java, Bali, NTB	West Java
August - November	September - December	November – February	December - March	February – May

Soils are excellent, with a good cation balance (Table 4).

## 7 Production technology

There appears to be very little use of ‘normal’ management systems including:

- irrigation
- nutrition
- canopy management
- pest control
- manipulation of flowering.

In part, this is because:

- soils have excellent levels of natural nutrition (Table 4)
- farm size is too small to utilise better technology and too small to have sufficient capital to invest in better production or post harvest technology e.g. spraying, cool rooms, packing lines
- smallholders use mangosteen opportunistically rather than committed to the crop. Almost all have another source of on-farm or off-farm income. All farmers will grow other crops.

Table 4: Soil analysis at Batu Mekar in NTB

	% N	% P	% K	% Na	% Ca	% Mg
1	1.2	0.11	0.64	0.06	1.10	0.23
2	1.2	0.16	0.86	0.08	0.96	0.23
3	1.2	0.04	0.60	0.06	1.19	0.23
4	1.1	0.05	0.57	0.07	1.31	0.21

Some farmers may use nutrition either organic or inorganic (1 kg/tree). Nitrogen and potassium are the 2 main elements used. There appears to be no use of calcium, potassium, zinc or boron, recognised as key elements in tree crop production. BPTP NTB

has done a 2 year fertiliser trial indicating that yield was increased due to increased fruit numbers not larger fruit size.

Based on discussions with farmers and government staff it appears the average production is around 100kg/tree for mature trees, up to 150kg in years of good production (1 in 5 years) and as low as 70kg in poor years. Trees are planted around 8m x 8m, 150 trees/ha. Trees are often planted around the edge of house compounds, businesses, offices and schools.

The only input that a farmer makes after planting and looking after the tree until it reaches production, is harvesting. Some farmers may use some fertiliser either organic or inorganic applied once per year.

The capital input in planting the tree and maintaining until production is not insignificant. It appears farmers are still making new plantings of mangosteen, reflecting the positive outlook for the crop.

There was an indication that mangosteens planted around rice bunds flower and crop a lot earlier. Similarly single trees in house gardens flower earlier. Both these early flowering responses could be due to irrigation, an issue that may be worth exploring. The current harvest season is December - February similar to most other areas of Indonesia. Earlier harvests attract higher prices and have advantages for extending the export season. Paclobutrazol is not suitable for use on mangosteen.

There is little knowledge of the causes of skin marks that reduce quality or the yellow sap that occurs in the flesh (getak, or gumbosis). The gumbosis problem has many proposed causes, none of which have any research base. There was some evidence of some research done in Java that it is related to an insect sting that then allows the entry of *Fusarium oxysporum*. Published research in Thailand indicates it is related to water stress or over watering/excessive rainfall. Skin marks that reduce the proportion acceptable for export are thought to be related to shade from coconuts. It is more likely that an insect from coconuts is causing the problem.

Ants and spiders are an issue under the calyx. At one export packing shed fruit were being dipped in a solution before packing though it was not clear if this was washing water or had other chemicals added.

There has been some research in Lombok grafting mangosteen. This significantly reduces the time taken to first fruiting from 9 years to 2-3 years. However experience elsewhere shows he plants have problems with the rootstock taking over, plagiotropic growth, and slow growth rate reducing yield. Australia tried this many years ago but abandoned the concept.

## 8 Economics of current production

Mangosteen farmers are relatively well off. A one hectare mangosteen orchard of around 150 trees producing an average of 100kg/tree sold at a price of Rp4 000/kg gives a gross income of Rp60 million (Table 5). The only cost incurred is harvesting, usually done by the farmer and his family and a small amount of fertiliser (150 kg) at less than Rp1 million.

Table 5: Approximate income comparisons

Mangosteen 1 ha	Rambutan 1 ha	Mango 1 ha	Middle level public servant	Rice farmer per crop/ha	Poverty level
50 million	30 million	12 million	24 million	7 million	8 million

Clearly mangosteen farmers are in a relatively good economic position, though they have had to wait over 10 years to achieve this level of income. The rice farmer probably crops his land at twice with rice and once with a field crop, increasing his income per year to around Rp20 million.

This is based on mangosteen growers receiving a market price for export of around Rp4,000/kg. Developing further supply chains will increase this price even further. In Sumatra the price paid for mangosteens in an export supply chain is between Rp10,000 and 15,000/kg.

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## 9 Future prospects

The current mangosteen market situation is good, based on a developing export market. Looking at Thailand exports, there are opportunities to follow their markets and increase export volumes significantly. New plantings are continuing though the area is restricted to around Mataram and central Lombok. The long time to fruiting deters many from planting but for those who do, the returns are good for mature trees.

Indonesian mangosteens have performed well as a crop for export because the crop has less post harvest constraints. World production is limited to Indonesia, Malaysia, and Thailand. Thailand has developed significant exports for mangosteen into a range of markets including Japan and Australia. Indonesia has significant export advantages including:

- long supply line of at 6-8 months
- counter seasonal to Malaysia and Thailand
- close to the developing market
- high production available at a cheap price.

The question is – is it worth investing development funds in a crop for which there is a good return. The key issues are:

- current export is occurring without formal access protocols and is at risk especially the high number of ants and spiders under the calyx
- the mangosteen model is a model that can be used as a model for research in a profitable sustainable supply chain for other fruit crops
- there are other market opportunities for mangosteen that could be developed if there were suitable access protocols
- mangosteen offers the opportunity to build capacity for dis-infestation research and negotiating access protocols.

One issue is that exports from Lombok are at lower prices than prices quoted to farmers in Sumatra and West Java by exporters in Jakarta. This may be due to the markets sold to, or it may reflect the poorer post harvest life of mangosteens from Lombok, which results in the calyx drying, reducing landed price. Similarly Jakarta based exporters indicate that they had variable outturn which may reflect the level of post harvest management. The major successful Jakarta exporter emphasised the importance of maintaining the calyx green at arrival in the markets. He also emphasised the importance of having staff based in importing markets, such as China to managing the supply chain. Some Jakarta exporters are no longer exporting presumably because of supply chain problems.

The supply chain issues need to be clarified, especially keeping the calyx green until arrival. Lombok mangosteens are collected in Lombok then shipped to Baiwangi in East

Java, then by cold container to Surabaya for exporter. It may take the exporter 2-3 days to get a shipment together and pack it, followed by a 1 day sea journey to Bayiwangi, a total of 3-5 days without cool storage. Clearly there are some cool storage issues that need to be investigated and may require some investment.

The key initial issue is to ensure that the access into existing markets is formalised. This could provide a model for government to start to build the capacity to develop formal access protocols. This may not be difficult for mangosteens as the quarantine issues are probably simpler as mangosteens are not grown in the target markets. This should include China, Korea and Taiwan.

In some countries there is a very high market price and developing demand for mangosteens. The mangosteen farmer group in Lombok is keen to see an expansion of the number of exporters. They indicated when there were 3 exporters in Lombok (now 2), prices to farmers were much higher.

Some analysis of Thailand exports should be conducted as to their economic feasibility for Indonesia. Thailand sells primarily in June – September, complementing Indonesia supply in October to April. There may also be linkages that could be developed with Thai exporters. Anecdotal evidence indicates that there are Thai and Taiwanese importers buying mangosteens in Sumatra, Lombok and West Java, particularly when prices in China are high.

It would be worth looking at the economics of exporting mangosteens into countries other than China. There are no quarantine access issues into Europe or Canada, though Europe does require Eurepgap certification. Exporters did not see that as a significant constraint. Probably a bigger constraint is air freight cost to Europe, as mangosteens will not survive sea freight times to Europe (2-3 weeks). Air freight rates into Europe are around US\$3/kg. It still may be worth exporting to Europe depending on sale prices in Europe.

There may be other markets that could be developed requiring some analysis e.g. the Arab States and supply out of season into supermarkets Singapore, Malaysia and Thailand. There may also be opportunities to look at supply to Indonesian supermarkets. However their pricing may be driven, at least in part, by the low prices in the wet markets. It was interesting to note that the Mataram Hero supermarket was selling mangosteen for Rp20 000/kg in the season.

The next step is to look at other export market opportunities, with more difficult access issues e.g. Australia, Japan and USA. This requires more detailed economic and marketing analysis and quarantine dis-infestation research. In Australia, Thailand mangosteens wholesale at A\$5-8/kg (Rp35 000 – 55 000/kg). Air freight prices into Australia from Jakarta and Denpasar are around US\$1.50-2/kg (Rp13 500 - 18 000). Mangosteens could be easily sea freighted to Australia at much less rates and for quite quick journeys, particularly through Perth or Darwin (approx 7 days).

The current Thai protocol into Australia is easy to replicate for Indonesia using methyl bromide fumigation. It would benefit the post harvest life of mangosteen if this could be done on arrival as is done for furniture imports from Indonesia and has been agreed to for Philippine pineapples into Australia.

Similarly Thailand sells mangosteens into Japan for prices around Rp50 000/kg. Air freight into Japan from Denpasar and Jakarta is around US\$1.50-2.00/kg (R 13 500 -18 000).

Some relevant production research issues include the development of ways to increase the percentage of fruit suitable for export from the current 30% with hopefully a price

benefit to the farmer. This may be hard to realise in the current supply chain where the farmer sells the whole crop to the exporter at one price. If exporters started a program of benchmarking suppliers for quality and size they may see the benefit of paying more to some and less to others. This could be part of an initial research effort to identify the causes of defects done in association with exporters. A benchmark program for suppliers to exporters is the basis for developing traceability, an essential part of future food safety programs including Eurepgap. Exporters will be aware that some growers are better than others, and may well be responsive to this concept leading them into the concept of different prices for different quality.

Developing a grade standard and a grade standard poster (already done in Australia) could be a first start. This needs to be developed with both farmers and traders and should even include input from exporters. Involving the whole chain in developing standards educates the chain in the defects and their causes. One issue in many chains is that the trade does not understand the causes of defects and takes a conservative position to minimise risk e.g. they may think this is a rot etc but it poses no risk.

This leads to the development of research strategies to reduce skin marks. The first step is to identify the causes of defects. This is a difficult detective task. Many of the marks may be occurring due to mites early during fruit development. Farmers mentioned that mangosteens grown near coconuts have more skin marks. Achieving a larger percentage of larger fruit for export may be a function of nutrition especially potassium, and or irrigation.

The issue of the yellow sap in the flesh occurs with mangosteens everywhere but has never been the subject of any intensive research. It is a significant issue but has never been researched successfully.

There may be some benefit in central Lombok of using the existing, large extension infrastructure in place for tobacco farmers who also grow mangosteens. Tobacco farmers often get credit from the companies and sometimes default. Companies are interested in ensuring their farmers are in a good economic situation including that they are profitable from other crops as well.