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**Upland Development Programme in Southern
Mindanao
(UDP)**

Durian Market Report

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Durian Market Report

1 Introduction

The durian (*Durio zibethinus Murray*), a native of the rainforests of Malaysia and Indonesia, is a tall tree reaching as high as 40m in the jungle rainforest or in semi-orchard. Seed trees may take 8-10 years to fruit. Grafted durian grows to 15 - 20m tall and fruits in 5 to 6 years. The fruit is green to brown in colour, pendulous, round to oblong in shape and is completely covered with strong sharp thorns. It is a capsule which splits into five parts when ripe and each segment contains brown seeds covered with thick, firm, creamy, yellow pulp with a strong and very distinctive aroma.

Apart from being consumed fresh it can be processed into jams, pastilles, blends/flavourings for ice creams, cakes, rolls and tarts and is being processed into chips. The edible parts of the fruit is also frozen or chilled and packed into polystyrene trays.

Availability of durian is affected by short harvest seasons, typically only two to three months, although smaller harvests are also reported during other months of the year. Thai and Malaysian production is highest between June and July, although exports are also reported during other months (mostly immediately preceding or following this period). Peak harvest in Indonesia is from October to February, although the high season in South Sumatra lasts from June to September. Production in the Philippines is mainly August to November.

2 Production

Commercial production of durian is concentrated in Thailand, Malaysia, and Indonesia. The Philippines and other Southeast Asian nations also produce durian commercially, but at much smaller levels and mostly for domestic markets. Up to date figures are not available in all producing countries so exact production estimates are difficult to calculate. In addition various sources give conflicting data which further confuses the issue.

2.1. Philippines

It is estimated that between 1987 and the present time the area planted to Durian has increased from 2,000ha to 11,000ha. There are now some plantings in the Visayas and Luzon. The popularity of the fruit is also increasing and it is seen on hotel and restaurant menus more frequently.

The traditional or native varieties are now being supplanted by modern hybrids. The list of recommended hybrids is given below.

2.2. Malaysia

Formerly, 80% of durian production was in mixed orchards (dusuns). Durian was the dominant species but other fruits such as rambutan (*Nephellium lappaceum*), langsat (*Lansium* spp), and mangosteen (*Garcinia mangostana*) were also grown. Generally the standard of management of these orchards was low, the varieties grown were unimproved seedlings, the quality was poor and the yield very variable. Prices for these fruits was also generally very low. During the mid-seventies there was an increasing interest in developing commercial durian orchards and rehabilitating the dusuns. Commercial orchards varied in size from 2 - 100 ha.

One estimate of production in Malaysia gives production of 128,555 metric tons (MTs) in 1988. The same source estimates production in 1991 of 180,715 (MTs). By contrast the Malaysian government statistics give production of 426,381 MTs in 1992.

Estimates of area planted are 48,000ha in 1988 increasing to 68,000ha in '92. Using even conservative yield figures, and assuming that most of the 1988 planted area was in production in 1992, the figure of 426,381 would appear to be reasonable. It is estimated that the area planted increased to 83,000 ha in 1993 and to 106,000 in 1994.

It is likely that further during the following years as Malaysia was implementing a policy to expand tropical fruit production, and there is some anecdotal evidence that producers of other fruits are switching to higher value durian production. From 1986 to 1994 the total area under fruit production is estimated to have increased from 121,000ha to 263,000ha, with durian accounting for approx. 50% of this increase.

Production in 1999 could therefore be approaching 1,000,000 tons.

2.3. Thailand

Thai production was estimated to have expanded nearly 50 percent between 1989 and 1992, going from 486,644 MTs to 720,990 MTs. Production was also expected to increase during the following years. The total planted area in 1992 was estimated to be just over 100,000ha. this could indicate current production in excess of 1,000,000 tons.

2.4. Indonesia

Durian production in Indonesia has varied widely over the same period. Production decreased from 242,585 MTs in 1990 to 152,501 MTs in 1992, although preliminary 1993 figures showed an increase of more than 50 percent from 1992 levels. These

variations however may have more to do with the methods of collecting or reporting the information or other reasons such as seasonal climatic changes rather than changes in the production area.

3 Varieties

There are several hundred varieties of durian. These are mostly selections of favourite trees and are not the result of any scientific breeding programme.

Acceptable varieties of durian are those that meet the market quality criteria, including aril volume, texture, and flavour, and, for the grower, yield, spread of harvest, and shelf life. Durians are genetically diverse in terms of fruit size, shape, skin colour and thickness, aril volume, colour, aroma, texture, flavour, seed number and size, and peduncle length. The varieties showing the best production, fruit quality, and seasonal range in various countries are as follows:

In Malaysia improved local clones such as D2, D10, D16, D24 and introduced clones such as D100 and D123 were selected and used in new plantations. D24 was the predominant clone used. Fruits from these clones commanded much higher prices than the fruits from the dusuns. Clones are derived by selecting good trees and then multiplication is by vegetative propagation. There is a limit to how far a crop can be genetically improved by this type of selection. Along with the good points of the mother tree you also get the bad ones. In the case of D24 good fruit quality was associated with poor or irregular fruiting.

As part of a breeding programme conducted in Malaysia over a 20 year period, 500 F₁ hybrids were developed and tested. MDUR78, MDUR79 and MDUR88 were released in 1991 and 1992. Resistance to stem patch canker was higher in these hybrids than in D24, MDUR88 being the best. Amongst these hybrids peaks in fruiting occur in different years. For this reason single variety orchards are not recommended. In order to ensure regular supply of fruit and even out income from year to year 3 or more varieties should be planted.

Varieties commonly grown in the main producing countries are:

3.1. Malaysia

- D2 (Dato Nina), D10 (Durian Hijau), D16, D24, D98 (Katoi), D99 (Kop Kecil) D116 (Batu), D117 (Gombak), D123 (Rim 2/Chanee), and Hew 3; D145 Tuan Mek Hijau/Beserah D158 Kan Yau/Tangkai Panjang, D159 Mon Thong/Bantal Mas, D169 Tok Litok, MDUR78, MDUR79 and MDUR88

3.2. Thailand

- Gaanyao, Montong, Kob Picul, Chanee, Luang, Kradoom Tong, and Chompoosri;

3.3. Indonesia

- Sitokong, Bakul, Mas, Sitebel, Simanalagi, and Simadat.

3.4. Varieties recommended in the Philippines

A breeding programme in the Philippines has resulted in a number of cultivars of local origin.

The National Seed Industry Council (NISC) of the Department of Agriculture has recommended 10 cultivars for the Philippines.

Cultivar	Shape	Flesh colour	Weight Kg	Edible portion %	TSS Brix	Maturity days	Juvenility	Other Features	Origin
Chanee	Ovoid with broad obtuse tip	Golden yellow	2-4	32	25	110-115	3-4	Flesh is thick and sweet with mild aroma	Thailand
Mon Thong	Slightly elongated with pointed apex	Golden yellow	2-5	30	27	120-130	5	Flesh is thick and sweet with mild aroma	Thailand
Alcon fancy	Round	Canary yellow	0.5-1.5	34	26	90-100	4-5	Flesh glutinous, mild aroma, sweet with bitter taste	Local
Arancillo	Ovoid	Mimosa yellow	0.5-2	38	27	115-120	4-5	Flesh is firm, sweet and creamy with mild aroma	Local
Atabrine	Ellipsoidal	Maple yellow	2-3	25	24	100-110	7-8	Flesh very glutinous, sweet with slight bitter taste	Local
Duyaya	Oblong	Bright yellow	3-4	32	27	120-130	4-5	Flesh is sweet with mild aroma	Local
GD 69	Obovate	Yellow orange	2-2.5	45	27	110-115	3-5	Flesh is firm and thick with mild aroma	Local
Lacson uno	Obovate	Yellow	3-4	33	27	110-120	4-5	Flesh is sweet with mild aroma	Local
Mamer	Ellipsoidal	Barium yellow	2-3	25	23	100-110	7-8	Flesh is sweet and glutinous	Local
Oboza	Cylindrical		3-4	21	26	120-125		Moderate aroma	
Puyat	Cylindrical	Chrome yellow	2-4	40	26	110-125	3-4	Flesh is sweet, firm, soft & buttery with mild aroma	Local

4 Planting material

Commercial durian varieties are propagated vegetatively. This is done by either grafting or budding. Rootstocks used vary but there is increasing efforts being made

to identify rootstocks which are resistant to *Phytophthora palmivora*, a soil borne fungus which is the most serious pathogen of durian and the major cause of premature death in seedlings and trees. In Thailand cv Chaynee is used and there are good reports from Malaysia on the use of *Durio lowianus*.

Three year old planting material or Large Planting Material (LPM) is recommended. Durian can be difficult to establish and the survival rate of LPM is much higher than with one year old seedlings.

5 Per capita consumption

As there are no reliable figures for production in the Philippines it is not possible to estimate per capita consumption. At any rate it must be considerably less than 1kg. In 1995 per capita consumption was estimated at 0.5 kilogram(CRC Factbook, May 1995; PCARRD, June 1995). Given the estimated production area at that time this estimate would appear to be on the high side although other estimates go as high 0.8kg.

Per capita consumption in Singapore is said to be the highest in the world at over 13kgs. If production estimates for Thailand and Malaysia are reasonably reliable then per capita consumption in those countries are underestimated by a considerable factor. Thailand, a nation of 60 million inhabitants is estimated to produce over one million tons annually, 95% of which is estimated to be consumed domestically. That would indicate a per capita consumption of 17kgs.

Malaysian per capita consumption would be even higher given the level of production and the population. Even if estimates of production were overestimated by a factor of 2, per capita consumption would still be 25kgs. Indications are that consumption in Singapore and Taipei would be higher if product was available over a longer period. Indeed it is a feature of most markets now that consumers expect availability where possible throughout the year. Consumption in China appears to be very low.

6 Market

The main market for durian is in Asia. Thailand and Malaysia and Indonesia, the main producers, are also the main consumers of the fruit. The main export markets are Singapore, Hong Kong and Taiwan. Lesser amounts are exported to North America and Europe, where it is consumed by members of the Asian population there. It is generally unknown to the non-Asian population.

6.1. Export Markets

As most official national trade statistics do not provide details on imports of durian separately world trade is estimated using export statistics of these three countries. About 95% of exports are in fresh form, the remainder is mostly frozen. Over 99% of Malaysian exports go to Singapore.

Total exports from the three countries are probably less than 100,000 tons with Singapore accounting for over 65% of this figure and Hong Kong approx. 20% with lesser amounts to Taipei and Brunei, together with cross exports between Thailand and Malaysia.

Asia

Singapore, Hong Kong, and Taiwan are the main importers of durian worldwide. These three countries account for 90 percent of total exports from Malaysia, Thailand, and Indonesia. When shipments among the three durian-exporting countries — Malaysia, Thailand, and Indonesia — are added to their combined exports to Singapore, Hong Kong, and Taiwan, nearly 99 percent of world trade in fresh durian is accounted for.

Singapore. Singapore is the largest import market for durian, accounting for 65 percent total exports of the top three supplying countries. Malaysia supplies most of total domestic demand. Singapore buys the vast majority of Malaysia's and Indonesia's durian exports, as well as significant quantities from Thailand. Singapore is one of the few importing countries that reports durian in its official trade statistics. The majority of fresh durian entered during the periods February-March and June-August. Thai supply entered exclusively during the period May-July, primarily in June.

Hong Kong. Hong Kong is the second-largest import market for fresh durian in the world, accounting for 20 percent of the exports from the top three supplying countries. Almost all of Hong Kong's import demand is met by Thailand. Most remaining supply entered from Malaysia.

Taiwan. Taiwan is the third most important Asian market. It imports mostly from Thailand but includes small amounts from Indonesia and Malaysia.

North America

United States. The United States imports more durian, fresh and frozen, than any other non-Asian country. Frozen durian accounts for more than 80 percent. Thailand supplied almost all of U.S. demand, although small amounts entered from Malaysia.

Canada. As with most non-Asian countries, demand in Canada is mainly limited to the Asian immigrant population. There has been very little cross-over appeal. Canada is the largest non-Asian market for fresh durian. Canadian imports are probably around 1,000 tons 45 percent fresh and 55 percent frozen. Thailand supplied the vast majority of Canada's import demand, although small quantities also entered from Malaysia.

Europe

The European market for durian is small, probably less than 200 tons. France is the largest European importer of fresh and frozen durian, followed by the Netherlands.

Domestic market

Consumption of durian in the Philippines is supply led. Durian is a popular fruit and is relatively expensive. The fact that consumers in Davao are prepared to pay P60 per kilo or more for durian and that only 30% of the gross weight may be consumable is an indication of its popularity. All produce coming on the market clears without any problems. There are continual reports of unavailability of product.

Given the popularity of the fruit in the Philippines there is little doubt that consumption would increase if it were more widely available. There is also scope for reducing prices thus making the product more affordable for a larger potential market.

Given an average yield of 10tons per ha and a per capita consumption of 2kg it would require the produce of 15,000 ha to satisfy the Philippine market. Every 1kg increase in per capita consumption would require an additional 7,000ha.

7 Market outlook

In addition to the domestic market there are opportunities to supply product to all the other traditional markets in Asia. The production season in the Philippines complements the production seasons in the major producing countries. Philippine produce could supply the market in Singapore, Hong Kong and Taiwan during these periods when the main exporters are not in the market. In addition both Malaysia and Thailand import product during their off-seasons.

Durian does not appear to be well known in China. There is no reason to believe that Chinese people would not develop a taste for durian given its popularity in other Asian countries and its reputed "medicinal" properties. Even a very modest increase in consumption in China would require a significant production area.

While it is sometimes dangerous to follow a trend it is not always the case. Trends can give a good indication of how consumption patterns develop. Production and consumption of durian has increased rapidly in Thailand and Malaysia. While there is always a danger of produce from these countries, and especially from Malaysia, coming on to the market in the Philippines the production seasons are different. Cryogenic techniques do offer the possibility of extending the marketing season but that also has a cost and requires a refrigerated chain extending right to consumer level. The market in the Philippines is likely to expand and I do not foresee any oversupply problems in the foreseeable future. The Philippines is a long way from producing export surpluses but there is a window of opportunity to come into export markets between the Thai and Malaysian seasons. Durian could be the crop of the future for many Philippine farmers.

8 Quality and Postharvest Handling of Durian

As with many other fruits quality problems that manifest themselves after fruit is harvested are often caused by factors in the cultural phase of the crop. These can include:

- physiological disorders
- rots caused by fungi
- distorted and misshapen fruit as a result of insect damage

8.1. Physiological disorders

There are a number of physiological disorders which affect Durian.

Uneven Fruit Ripening (UFR): this is a common disorder of durian and losses can be as high as 50%. Low levels of leaf Calcium are strongly associated with the disorder. UFR affected fruits are characterised by the formation of hardened leathery aril during ripening. The affected portion remains unripe, whitish in colour, odourless and tasteless. Normally the disorder does not affect all fruit units.

Wet Core: sometimes known as water core this disorder affects the core and the flesh. Affected areas are over moist and very soft. Losses in 1998 were estimated as high as 60%. Wet core is strongly associated with low levels of leaf potassium. Wet core is also associated with high rainfall. Maximum incidence (80%) was observed

when rainfall reached 345 mm/week. Minimal incidence was seen when rainfall was less than 100mm/week.

Tip Burn: in this disorder the end part of the flesh turns dark brown. It is more likely to occur when there is rapid growth in the flesh and there is inadequate fertility and water. Young bearing trees, large early maturing fruits and unhealthy trees are more susceptible.

Fruit end rot: brown spots, 0.5 - 1.0cm diameter, occur on the base of the fruit 4-6 weeks before harvesting. The spot becomes more visible after a week and then the fruit starts to split. The cause of this disorder is not known but it is suspected of being physiological. It is common on Oboza and Soriano varieties.

8.2. Nutrition:

Apart from affecting yield, crop nutrition influences a number of quality characteristics of durian, including:

- Brix
- Physiological disorders
- Number of fruits and average fruit size

As soil nutrient levels increase up to the optimum levels,

- total yield increases
- total number of fruits per tree increases
- average fruit size decreases

Uneven Fruit Ripening is more common in fruits weighing over 3kg and with more than ten pulp units. Incidence of Wet Core is also positively correlated with larger fruits. As outlined above Ca and K leaf levels also affect incidence of these conditions.

Misshapen fruits can result from insect damage especially when the fruit is young and has still some way to go before it reaches full size. Sucking insects such as various aphid species can cause considerable losses.

Although post harvest handling operations for durians are relatively simple, the fruits ripen quickly after harvest, and high post harvest losses are possible. Harvesting at the proper stage of maturity, preventing mechanical damage, cooling, and maintaining correct temperature can allow a storage and shelf life of five to seven days. If fruits

are picked from the tree rather than waiting for it to fall to the ground the storage life is much longer.

8.3. Quality Criteria

Quality criteria for durians vary among consumer groups, based on the fruits' ripeness. Some consumers prefer fully ripe fruits with no splitting, whereas others prefer less ripe fruits with relatively firm texture and a milder aroma. In all cases, the seeds must separate easily from the pulp; the best varieties have small seeds and large arils (pulp).

Many people prefer the native varieties

8.4. Varieties

Acceptable varieties of durian are those that meet the market quality criteria, including aril volume, texture, and flavour, and, for the grower, yield, spread of harvest, and shelf life.

8.5. Harvest Maturity

The growth of the durian fruit follows a sigmoid curve; growth is very fast until the 13th week after pollination, after which it slows until the 16th week (112 days), when the fruit reaches maturity and falls from the tree. The actual number of days will vary between varieties and different locations. Local knowledge and experience should be used to determine the number of days more accurately.

The fruit normally ripens two to three days after it falls. If fruit is allowed to fall from the tree it usually splits open in 2 days. Fruit harvested from the tree is cut 15 weeks after anthesis + 3 days (105 days, again depending on variety and local conditions). The skin of the durian shows little colour change during ripening; as a result, ripeness is judged by changes in the fruit's smell or the hollow sound produced when its spines are tapped.

8.6. Harvesting

Durian trees that are asexually propagated normally bear fruit 5 to 7 years after planting, whereas seedling trees may take 8 to 10 years. Trees may produce as few as 10 fruits or as many as 500 in a season. Fruits should be detached from the tree with the peduncle intact before they reach full maturity, but at a stage late enough to ensure normal ripening without loss of flavour. Fruits harvested in this way may have a shelf life of up to seven days.

Durian fruits are also collected daily from the ground after they naturally abscise from the tree. In most cases, the fallen fruits sustain damage, which speeds up deterioration and forces rapid marketing, as fermentation begins as soon as the fruits drop from the tree. Unbroken durians may remain edible for two to three days.

8.7. Packhouse Operations

For grading and packing durians, simple operations are sufficient. These include trimming the stem, classifying to remove damaged or split fruits, cleaning or brushing, packing, precooling (sometimes), storing, and transporting.

Durian fruits are not normally size-graded once they meet the minimum size requirement. Packing varies depending on the fruits' origin, but most durians are packed in single layers in telescopic cartons with the pedicel pointing up. Fruits should not be forced into the carton, because force may cause mechanical damage. Carton net weights range from 18.2 to 22.7 kilograms with between three and five fruits per carton.

Postharvest fungicide treatment with fosetyl aluminium at 4 grams per liter of water for two minutes is reported to control *Phytophthora palmivora*; however, exporting- and importing-country regulations for pesticide use should be consulted before the treatment's use. Wrapping the peduncle with banana leaf or paper reportedly extends shelf life. This practice also protects fruit in transit. Studies indicate that waxes can be used to increase storage life by reducing water loss, delaying splitting, and slowing the ripening process. Gibberellic acid treatments may also reduce ripening rates.

8.8. Packaging

Packaging requirements and practices vary depending on the particular market. Bamboo baskets, wooden boxes and two-piece telescopic cartons are used.

The main Asian markets prefer fruits packed in 40 to 50 kg bamboo baskets. North American and European markets prefer 10-15kg cartons. 25kg capacity wooden crates are used to transport fruit from Davao to Metro Manila.

Bamboo baskets are not suitable for stacking directly on top of each other. If baskets are to be transported more than one layer deep then a secure platform should be provided to prevent one basket resting on the one below.

It is common practice to line crates with banana leaves or paper to prevent damage in transit. If fruit are to be kept in cold storage to prevent ripening air flow through the

fruit should not be impeded. Narrow, vertical ventilation is preferred, because round vent holes will become blocked by the fruits.

Packages should have all the labelling information required by the importing country, which may include the following:

- Country of origin;
- Product/variety;
- Net weight/count; and
- Exporter name/importer name.

8.9. Cooling and Storage

Durians can be stored for up to three weeks at temperatures of 15°C. However, some reports state that 4°C to 5°C can also be used for two to three weeks (but if 15°C will do why go to the extra expense of cooling to 4 or 5). Ethylene treatment or presence can increase the ripening rate and advance splitting. Reports also indicate ripening can be stimulated in durians harvested at between 70 percent and 80 percent maturity by dipping the fruits in an ethephon solution before they are transported to market (but why fruit should be harvested at this stage?).

8.10. Transportation

Because of durians' high perishability, exports over very long distances are made by air. Transport from the packing facility to the airport should be in cool trucks if the fruits have been cooled. In all cases, trucks should be covered to prevent contact with wind, rain, and sun. Given that durian can be stored at 15°C for three weeks it should be possible to use sea transport for voyages of up to seventeen or eighteen days.

Because durians emit a notable odour to which most airlines would object, the fruits are shipped in aircraft containers rather than aircraft pallets. Heat build-up inside the containers can occur, especially if they are left exposed to the sun while awaiting loading in the airport. This is obviously detrimental to the fruits; attempts should be made to ensure that the aircraft containers are held in shady or cool locations until loading.

8.11. Potential Post-harvest Problems

Phytophthora infection produces brown patches that turn black under wet conditions and form a whitish bloom from the cottony mycelia. The rot can extend internally from the durian skin toward the seeds. The fungus can attack the fruits while they are attached to the tree or after they have fallen to the ground. Pre-harvest sprays may help control the fungus, but because of difficulties with application, additional

measures—removing debris from around the trees and planting plants nearby that are known to repel vectors such as crawling insects and snails—are advisable.

Other fungi can infect the fallen fruits as secondary infections through the bruised skin after the fruits hit the ground. Infection rates are high in fruits that are left on the ground uncollected for several days, particularly if the ground is wet. Diseases that can befall the fruits include *Rhizopus*, *Mucor*, and *Lasiodiplodia*, which produce soft rots and necrosis that can spread to the arils. Others diseases that do not cause softening and are superficial include *Phyllosticta*, *Colletotrichum*, and *Curvulari*. Another, *Fusarium*, produces water-soaked, soft, and pulpy lesions. One can control these diseases by collecting fruits frequently, brushing off debris such as leaves and soil, or constructing catching nets. Fungicide treatments for these diseases normally are ineffective because the diseases are secondary and infect the fruits through damaged areas.

The most effective control measure is to pick the fruit from the tree before it falls.

9 Note on cultural practices

The sections above have outlined the importance of good pest and disease control on fruit quality and the importance of hand harvesting if the fruit is not to be consumed immediately. Other practices such as artificial pollination of flowers and fruit thinning are important to achieve optimum yields. Tying up or propping of branches may also be required to prevent branches from breaking when heavily laden with fruit.

To achieve good pest and disease control it is necessary to be able to monitor the foliage, stems and fruit regularly. When chemicals (insecticides, fungicides or foliar feeds) must be applied it is necessary to be able to achieve good canopy cover. To achieve this the top of the canopy should be reasonably accessible from the ground. Grafted durian can reach a height of 25metres or more. This makes the various cultural practices very difficult if not impossible to achieve. With correct pruning the canopy height can be limited to +/- six metres.

In Thailand growers use paclobutrazol to dwarf trees. Two grams of the active ingredient per tree is applied as a soil drench at the start of the rainy season starting at the fourth year. The rate may be increased at a later stage.

10 Note on grading standards

There are moves to develop national grading standards for durian. One has to question the necessity of this. On export markets, the market usually sets the standard and

national quality standards are not always relevant. For the domestic market unnecessary grading standards impose an extra cost on producers and are difficult to enforce.

11 Conclusion

Durian fruit grows well in Mindanao at a range of altitudes. Given Southern Mindanao's latitude it is likely that it can be grown successfully at altitudes much higher than the traditionally accepted 700 metres. There may be some varietal influence on this also.

Consumption in the Philippines is only a small fraction of that in Malaysia, Thailand and Singapore. Given the fruits popularity here there is considerable scope for expansion. There is also scope for export to countries in the region. There is also a demand for product for processing. It is increasingly used in the manufacture of confectionaries and ice cream. This is a method of spreading demand over the year as the production season is relatively short. Cryogenic techniques are also being developed to extend the marketing season.

The strong outer shell of the fruit makes it easier to transport than some other products such as mango without causing damage. This makes it particularly suitable for UDP areas.

Large Planting Material should be used to ensure better survival after planting. While this adds to the cost it does shorten the period the crop is in the field before production starts. Seedlings could be grown on for two years in small nurseries at the homestead before planting. This would reduce the cost of planting material.

Well drained soils should be chosen which do not waterlog even temporarily, in order to minimise the risk from soil borne fungus diseases.

Cultural methods here need to be improved.