

INDIGENOUS FRUITS OF SARAWAK

Kueh Hong Siong



FOREST DEPARTMENT SARAWAK



**INTERNATIONAL TROPICAL TIMBER
ORGANIZATION (ITTO)**

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ORGANIZATION (ITTO)

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International Tropical Timber Organization, Yokohama, Japan
Sarawak Forest Department, Malaysia

First Published December 2003

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Printed by
Lee Miing Press Sdn Bhd (541980-U)
Lot 143, Abell Road, 93100
Kuching, Sarawak, Malaysia.

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ACKNOWLEDGEMENTS

I take this opportunity to thank the Lanjak Entimau Wildlife Sanctuary Project Leader Dr Paul Chai P.K. for suggesting that an information leaflet be prepared for the indigenous fruits collected for planting in the ethnobotanic garden to be established in the Batang Ai area. The Director of Forests Datu Cheong Ek Choon's friendship and support for the project is greatly appreciated; the ITTO Coordinator Dr Penguang Manggil for giving me the opportunity to undertake the project.

The following were kind enough to provide me with a number of quality photographs which I have included in the book. Dr Paul Chai P.K. for photographs on *Pangium edule*, *Etilingera punicea*, *Hornstedtia havilandii*, *Nephelium melanomiscum* and *Baccaurea lanceolata*; Mr Voon Joon Hee on *Pangium edule*, *Sandoricum borneense*, *Pometia pinnata* and *Willughbeia* sp. Mr Voon Boon Hoe of Department of Agriculture who assisted in identification of some of the fruits and a photograph of *Durio dulcis*. Dr Paul Chai P.K. also assisted in botanical identification and proof reading of the manuscript.

Finally I am very grateful to Miss Chiang Moi Sien who painstakingly typed the manuscript through a number of drafts. She also did a great job scanning the large number of photographs included to illustrate the book. Her patience and dedication to work was outstanding.

Kueh Hong Siong

GLOSSARY

Local Word/Abbreviation	Meaning
Acar	Pickles of fruits or vegetables with salt, vinegar and spices
Atap fruit (or kalin)	Sweetmeat obtained by boiling the pulp of <i>Arenga pinnata</i> fruit in syrup
BANP	Batang Ai National Park
Belukar	Secondary forest
Dawa (Fijian)	<i>Pometia pinnata</i>
Durian otak udang galah	A variety of <i>Durio graveolens</i> with crimson aril
Durian simpor	A variety of <i>Durio graveolens</i> with bright yellow aril
Engkala bintang	A variety of <i>Litsea garciae</i> with small fruits
Engkala bulan	A variety of <i>Litsea garciae</i> with large fruits
Ipoh	Poison from <i>Antiaris toxicaria</i> used in blowpipe darts
ITTO	International Tropical Timber Organization
Jerami	Pickle made of ripe and unripe <i>Artocarpus champeden</i> pulp
Kapulasan merah (Indonesian)	A race of <i>Nephelium mutabile</i>
Kasam	Preserved meat with little salt to allow some fermentation
Kerangas	Stunted forest growing on poor podsols
Kelepak jantung	Leafy wrapped heart of banana plant
Keluak	Fermented <i>Pangium edule</i> seeds used as a delicacy for cooking dishes
KerANJI emplawak	A variety of <i>Dialium indum</i> with velvety, brown pods and fluffy, sour pulp

Keranji madu	A variety of <i>Dialium indum</i> with small pods and sweet pulp
Keranji masam	A variety of <i>Dialium indum</i> with small, black pods and fluffy, sour pulp
Keranji papan	A variety of <i>Dialium indum</i> with thumb-sized fruits and caramel-like sweet pulp
Kubal ai	A <i>Willughbeia</i> sp. with round fruits
Kubal arang, kubal tusu	<i>Willughbeia coriacea</i>
Kubul madu	<i>Willughbeia augustifolia</i> with round fruits
Kubul tabau	<i>Willughbeia sarawakensis</i>
Laksa	A spicy Malay dish of fine rice vermicelli, vegetable, prawn, meat and tofu served in a spicy soup
LEWS	Lanjak Entimau Wildlife Sanctuary
Manisan	Sweetmeat
Nira	Fresh juice obtained by tapping the male inflorescence of <i>Arenga pinnata</i>
Pansuh	Iban delicacy of meat or fish cooked in bamboo section
Pisang mas, pisang raja, pisang susu	Races of <i>Musa paradisiaca</i>
Rambutan lejang	A race of rambutan fruit which is partially freestone
Rojak	Fresh fruit salad mixed with prawn paste, ground peanut, lime and chilli
Rujak mricha	A Javanese preparation made of <i>Averrhoa bilimbi</i> fruit and pepper taken to induce perspiration
SAD	Sarawak Agriculture Department
Sambal belacan	Relish made of dried prawns, chilli and prawn paste
Sng boi (Hokkien)	Sour plum
Sunti	A pickle prepared from <i>Averrhoa bilimbi</i> fruits

Tamu	Local market place
Taup (Papua New Guinea)	<i>Pometia pinnata</i>
Tempoyak	Aril of <i>Durio zibethinus</i> preserved in salt
Tom yam	A hot and spicy Thai soup cooked with meat or seafood
Tuak (Sundanese)	Fresh juice obtained from male inflorescence of <i>Arenga pinnata</i>
Tuak tampoi	Liquor made by fermenting the pulp of <i>Baccaurea bracteata</i> or <i>B. macrocarpa</i>
Ubar (Sumatra)	<i>Eugenia</i> spp.
Ulam	Local salad
Umai	Local raw fish dish

INTRODUCTION

Malaysia's hot and humid climate is conducive for the cultivation of many species of fruits including heat tolerant temperate species (e.g. apple, persimmon) in the highlands. Some of the fruits grown here are indigenous to Malaysia with many related species still growing wild in the natural forests of the country especially in Sarawak. Indigenous species include the mangosteen, durian, rambutan, lansium, *cempedak*, pummelo, star fruit, *isau*, *dabai* and a number of banana species and varieties. In the past, many species of fruits, especially the non-seasonal ones have been introduced into Malaysia for cultivation. The papaya, pineapple, guava, *ciku*, soursop, mango and watermelon are all introduced species from South America, Africa and other parts of Asia. After long periods of cultivation even exotic species become naturalised and are often mistaken as indigenous.

Non-seasonal fruits which bear all year round have a greater commercial potential as compared to seasonal fruits which bear once or twice a year or once every few years. Most species of indigenous fruits are seasonal. The main season is in November to February with a minor season in June to August. Fruit species that fruit more than twice a year are considered as non-seasonal. In this category are *Parkia speciosa*, *Pithecellobium jiringa*, *Artocarpus camansi*, *Ficus obpyramidata*, *Musa acuminata* var. *microcarpa*, *Eugenia aquea*, *E. malaccensis*, *Averrhoa bilimbi*, *A. carambola*; the palm fruits *Areca catechu*, *Arenga pinnata*, *Eleiodoxa conferta*, *Salacca edulis*; *Citrus maxima*, *Lepisanthes alata* and the wild gingers *Etlingera elatior*, *E. punicea*, *Hornstedtia havilandii*, *H. scyphifera*, *Plagiostachys crocydocalyx* and *P. subaequalis*. For seasonal fruits, post harvest handling during transportation, downstream processing and export trade must be developed to facilitate commercialisation.

Malaysia is a net importer of fruits. It must exploit the comparative advantage of producing tropical fruits to increase production. The Eighth Malaysia Plan with strategies of the Third National Agricultural Policy will give special focus on fruit production. During the plan the production of fruits is estimated to increase by 7.6% where priority will be given to nine fruit species : mandarin orange, pineapple, jackfruit, papaya, carambola, mango, watermelon, guava and durian. The planted area for fruits is expected to increase by 5% per year to 378,600 ha in the year 2005.

The prospects for increased production are bright due to increased domestic fresh fruit demand, export demand for exotic tropical fruits and down stream processing. The consumption of local fruits per household in Malaysia is estimated to have increased from 24 kg in 1982 to 32 kg in 1985.

The fruit industry in Sarawak is considered a minor industry catering primarily for the domestic market. The Sarawak Agriculture Department (SAD) estimated that there are some 36,997 ha of fruits planted in 2000 of which three quarters (28,648 ha) are indigenous species. It is essentially a smallholders crop and cultivated on a subsistence level. In spite of efforts to intensify fruit cultivation in Sarawak through the Fruit Tree Subsidy Scheme, to date little headway has been made.

Among the major fruits cultivated are durian, rambutan, citrus, guava, carambola, pineapple, watermelon, rockmelon and indigenous fruits such as *dabai* and *isau* which are growing in popularity locally.

Citrus is the only fruit that can be considered as grown on a commercial scale especially in the Samarahan basin but was recently devastated by the citrus greening disease. Rehabilitation planting using disease free planting material has been successfully carried out.

The SAD is actively involved in revitalising the fruit industry. The focus is on intensification of fruit cultivation to augment smallholders' farm income through research, extension, subsidy and marketing. The research programme is towards the production and selection of quality planting materials and the development of new technology. In the 1980s domestication and commercialisation of indigenous fruits was given some priority by SAD. The International Tropical Timber Organization (ITTO) is making fruitful contribution by carrying out inventory work and encouraging communities in the buffer zone of the Lanjak Entimau Wildlife Sanctuary (LEWS) and Batang Ai National Park (BANP) to cultivate indigenous fruits to augment their nutrition and farm income. In the ITTO-Forest Department Project on Development of Lanjak Entimau Wildlife Sanctuary as a Totally Protected Area, Phase III, a field demonstration centre is to be established in the LEWS-BANP buffer zone to promote sustainable resource utilization through agroforestry activities. This will serve as a demonstration plot to equip the community with the necessary technology to embark on economic activities. To ensure proper transfer of technology a book on the Indigenous Fruits of Sarawak has been written for use by both the Forest Department staff and community members in particular and growers and consumers in general. Information on biodiversity richness, identification, cultivation and nutritional value will contribute towards popularising the indigenous fruits among both growers and consumers.

This publication on the Indigenous Fruits of Sarawak is to provide basic information on this plant group from the genetic resources and sustainable utilization viewpoints. In addition to dessert and snack fruits, such as *Dimocarpus longan*, *Canarium odontophyllum* and *Durio zibethinus*, vegetable fruits such as *Parkia speciosa* and seeds and nuts such as *Elateriospermum tapos* and *Castanopsis foxworthyi* are included. The emphasis, however is on those indigenous fruits with potential for domestication and commercialisation. Examples of such fruits are *Dimocarpus longan*, *Canarium odontophyllum* and *Parkia speciosa*.

The publication is arranged on plant family, genus and species in alphabetical order. The vernacular names in Malay or Iban are included for the benefit of local readers. Some species found only in Sarawak may have no Malay name. Only species native to Sarawak are included whereas introduced or naturalised species such as jackfruit (*Artocarpus heterophyllus*) and mango (*Mangifera indica*) introduced from India are omitted. *Morinda citrifolia* with its origin in the Moluccas is also omitted for the same reason. The publication covers ecology, botany, fruit quality (including nutrient content where available) and mode of propagation so that would be growers are able to plant them.

Uses other than the fruits such as timber and medicinal uses are included for some of the fruit species.

The information in this publication are researched from publications from S.E. Asia, particularly Peninsular Malaysia, Australia, Brunei and of course Sarawak. Observations were also made on the fruits collected for production of seedlings. Most of the fruits have commercial potential as they were collected from the *tamu* (local market place) throughout the state especially Song, Sarikei, Sibul, Serian, Bau and Kuching. Botanical names of fruits are given the greatest emphasis as vernacular names are many and varied and many give rise to confusion and misnomer.

Fruits are valued for their health giving properties. Conventionally they are claimed to be excellent sources of vitamins, minerals, fibre, easy to digest carbohydrates, fruit acids, pectins, phytohormones, enzymes, trace elements, anti-cancer compounds, proteins and anti-oxidants but the medicinal properties are less well documented.

The nutrient content where available have been included for most species. Those that have not been analysed should be included in future research programmes to form a more complete picture of their nutritional value.

Plates have been included to enhance the text as a picture is always worth a thousand words.

This publication is meant for a wide readership; to the layman, it will help to popularise indigenous fruits sold in the *tamu* when in season; to the student, it provides useful information to increase their knowledge; to the researcher, the database will form the starting point for the next step; to the entrepreneur, to assess the potential of indigenous fruits as a business venture; to the conservationist, the list of over eighty species of which sixty species occur in LEWS forms part of the gene pool for *in situ* and *ex situ* conservation of this biodiversity resource.

This publication is a precursor of a more complete and elaborate book which should be written given more time and opportunity.

ANACARDIACEAE

Dracontomelum dao Merr. and Rolfe *Sengkuang dao* (Malay, Iban)

Dracontomelum is a small genus of trees of the family Anacardiaceae found in south-eastern Asia, Malaysia and the Pacific. The pulp round the seeds of the fruits of several species is edible as in *D. edulis* and *D. dao* which are eaten in the Philippine Islands and as in *D. vitiense* which is eaten in Fiji. The fruits of *D. dupperreanum* are reported to be eaten in Indo-China.

Some species have medicinal uses and the timber of most species are inferior. That of *D. dao* is a little used in the Philippine Islands.



The terminal inflorescences of *Dracontomelum dao* are large, much branched and yellow in colour

D. dao is a medium-sized tree of 40 m height found in the lowlands to 200 m by streams. The bole is buttressed to 4 m high. Bark grey-brown, smooth to scaly. Leaves clustered towards ends of twigs, each with 5-9 pairs of subopposite or alternate leaflets. Leaflets elliptic, oblong or ovate, 5-22 x 2.5-8 cm. The terminal inflorescences are large (50 cm long) much branched, hairy and yellow in colour. The immature fruits are green in colour ripening to a brown purple colour. Each bunch carries many fruits. Each globose fruit is the size of a large grape. On removal of the skin, a juicy white pulp is revealed. It tastes sweet but has no flavour. The pulp is thick but the fibres are attached to the seed and cannot be removed cleanly.

The fruit is not sold in the *tamu* and does not seem to have the potential for domestication and commercialisation.

It is propagated from seeds.



The pulp is thick but the fibres are attached to the seed and cannot be removed cleanly

***Mangifera caesia* Jack**
***Binjai* (Malay), *Lanyat* (Iban)**

Mangifera is a genus of trees of south-eastern Asia and Malaysia. The species differ in slight points in flowers and fruit, but in the foliage all are very similar. On the whole they tend to be poisonous, but by cultivation the nature of the fruits of several seems to have been so changed that they are edible but those of only one, namely *M. indica*, are excellent. The tissues contain resin-canals and resin-spaces, and the turpentine flavour of the inferior mango fruits comes from the substances in them. Resin-canals occur in the bark, in particular, and are accompanied by tannin sacs.

In nature *M. caesia* is found in lowland forests by streams and swampy areas. It is grown in villages throughout Malaysia especially in Sarawak. The mature *binjai* tree is large with a height of 30 m or more. The straight columnar trunk is devoid of lower branches and thus exceedingly difficult to climb to harvest the fruits. The crown consists of many branches each with a tuft of thick leathery leaves. Leaves are 10-20 cm long and 4-6 cm wide with prominent midribs and veins. The young leaves may be eaten. At flowering the crown is covered with numerous inflorescences with small pink coloured flowers.



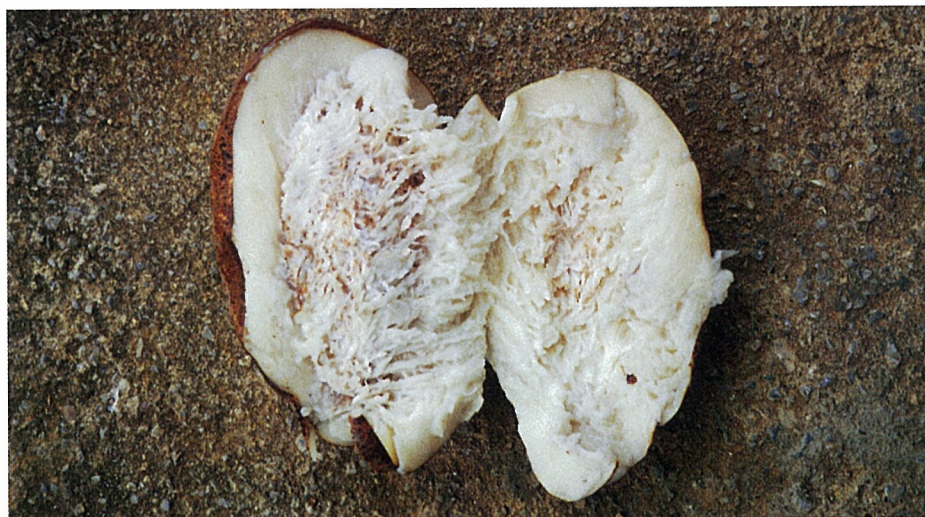
The inflorescences of *Mangifera caesia* are typically pink coloured

Mature fruits weigh from 0.5- 1.0 kg with a longish or round shape. The colour may be brownish in which case the skin is scurfy and coarse or it may be greenish yellow with smooth skin. The flesh is always white, smooth or fibrous, sour or sweet but always with a characteristic strong fragrance and taste. The seed is purple in colour. The ripe fruit is consumed fresh or with *sambal belacan*. The young fruits and seeds are also eaten.

It is propagated from seeds.



The brown scurfy variety of *Mangifera caesia*



The flesh is white and fibrous

Nutrient composition of *Mangifera caesia*

Nutrient composition per 100 g edible portion

Composition					Minerals						Vitamins						
Energy (Kcal)	Moisture (%)	Protein (g)	Fat (g)	CHO (g)	Fibre (g)	Ash (g)	Ca (mg)	P (mg)	Fe (mg)	Na (mg)	K (mg)	Carotene (ug)	RE (ug)	B1 (mg)	B2 (mg)	Niacin (mg)	C (mg)
64	81.2	1.0	0.2	14.6	2.4	0.6	7	17	0.3	1	120	0	0	0.05	0.16	1.2	74.1

*ppm

Mangifera foetida Lour.

Macang (Malay), *Bacang* (Iban)

M. foetida is found in Indonesia and Malaysia growing in lowland and hill forests to 1,000 m. The horse mango locally known as *bacang* is a considerable tree cultivated and encouraged in a semi-wild state throughout Sarawak. Medium-sized tree to 20 m tall, 35 cm diameter. Bark grey-brown, fissured and scaly. Leaves spirally arranged, elliptic, oblong, 12-28 x 6-10 cm. Inflorescences pyramidal to 30 cm long, peduncles brick-red. Flowers fragrant. Fruits subglobose, slightly oblique, to 14 x 10 cm, greenish grey, with strong turpentine odour, pulp yellow. The fruits when immature are quite inedible, but are much eaten when ripe, in which state they are still green; their texture is coarse, their smell objectionable, but the flesh is rather sweet. They are chiefly used in curries and are pickled by salting. Sometimes they are made into sweetmeats.

It is propagated from seeds.



A mature *Mangifera foetida* tree



The immature fruits of *Mangifera foetida* are quite inedible



The flesh of ripe *Mangifera foetida* fruit is sweet but fibrous

Nutrient composition of *Mangifera foetida*

Nutrient composition per 100 g edible portion

Composition		Minerals										Vitamins					
Energy (Kcal)	Moisture (%)	Protein (g)	Fat (g)	CHO (g)	Fibre (g)	Ash (g)	Ca (mg)	P (mg)	Fe (mg)	Na (mg)	K (mg)	* Carotene (ug)	* RE (ug)	B1 (mg)	B2 (mg)	Niacin (mg)	C (mg)
81	77	1.1	0.1	19.0	2.0	0.8	36	23	0.3	8	324	301	50	0.06	0.07	0.6	65.7

*ppm

Mangifera odorata Griff.

Kuini (Malay, Iban)

A considerable tree, regarded by some as a variety of *M. foetida*, on account of the similarity of the foliage. The young fruit is inedible like that of *M. foetida*. Towards ripeness, as the fruit becomes edible, it develops a distinctive flavour, and it is distinguished by that and by its yellow colour; moreover, there are also small differences in the flowers.



A *Mangifera odorata* tree in flower

The ripe fruits smell of turpentine and are juicy and sweet, but on the whole they are rather poor eating as the flesh is run through by coarse fibre and is odorous rather than aromatic. However, the tree is cultivated for them throughout the whole of Malaysia, because, owing to climate, a superior mango cannot be grown satisfactorily in so many places. The Malays use them in curries, and make pickles of them with salt.

It is propagated from seeds but can be vegetatively propagated by budding on its own rootstock.



Mangifera odorata has white and red inflorescences



Unlike *Mangifera indica*, the *kuini* fruits freely and heavily



The yellow flesh of *Mangifera odorata* is usually sweet and fibrous

***Mangifera pajang* Kosterm.
Embang (Malay), Mawang (Iban)**

The brown mango is a majestic tree with a round crown of tough leathery dark green leaves. It is a native of Sarawak and is widely cultivated. In nature it grows in lowland forest to 500 m. Over 40 m tall, it often towers over other fruit trees of average height. Bark dark brown, smooth to shallowly fissured. Leaves usually spirally arranged, sometimes in pseudowhorls, elliptic to oblong or obovate, 15-28 x 5.5-12.5 cm. Young leaves have a pinkish brown hue and is popularly eaten as *ulam*. When the tree is in bloom, the crown is covered with red inflorescences which attract insects to pollinate them. Inflorescences terminal or appearing in the axils of upper leaves, to 30 cm long. Flowers dark purple.



Mangifera pajang is a majestic tree with a crown of tough leathery dark green leaves



Mangifera pajang when in bloom has a crown covered with red inflorescences which attract insects to pollinate the flowers



Ripe brown mango fruits



The attractive yellow colour of the *Mangifera pajang* pulp which is usually fibrous

The resultant brown globular fruits range in size from 0.5 to almost 3 kg. The rind is thick contributing to the fruits good keeping quality. It can be cut and peeled off and eaten as *ulam* with *sambal belacan*. The ripe fruits may be yellow or white fleshed, sweet or sour, fine textured or fibrous, small or large seeded with a strong fragrance and is juicy. Sweet, less fibrous varieties are eaten as dessert while sour fibrous fruits are eaten as *ulam*. Unripe fruits are also used in *ulam*. *M. pajang* has great potential for domestication and commercialisation. Selection of quality fruits that are sweet and not fibrous and vegetative propagation to reduce the juvenile period will popularise the fruit.

It is usually propagated from seeds but the Sarawak Department of Agriculture is experimenting on vegetative propagation of brown mango.

***Mangifera quadrifida* Jack**
***Asam kumbang* (Malay)**

The *asam kumbang* tree is found growing usually in alluvial forests of flood plains and riverine areas in Sarawak. Trees are medium to large averaging 40 m in height. It has a dense crown with spirally arranged leaves producing seasonally, abundant inflorescences with small whitish flowers. The immature green fruits ripen to reddish purple colour. Mature fruits are oval in shape and small, measuring 5-10 cm in diameter. The flesh is light yellow in colour and is juicy, fibrous and sour. The green fruits are eaten as *ulam* or pickled. It is propagated from seeds.



Ripe *Mangifera quadrifida* fruits are reddish purple in colour but may be masked by sooty mould

***Mangifera torquenda* Kosterm.**
***Lamantan* (Malay), *Kemantan* (Iban)**

It is a medium-sized tree with coarse leaves found in the lowland and hill forests of Sarawak. Tree to 36 m high, 60 cm diameter. Bark greyish, shallowly fissured to scaly. Leaves spirally arranged, oblong or elliptic, 12.5-23(-32), x 4-8(-11) cm. Inflorescences pseudoterminal. Flowers sweet scented, pale yellow. The fruit is round about 8 cm in diameter. The immature green fruit turns yellowish when ripe. The flesh is pale yellow in colour. Most varieties are fibrous and sour but some may be less fibrous and sweeter. It has a mild fragrance. Green and ripe fruits are used for *ulam* or pickles. Sweet preserves and cordials can also be made from the fruits.

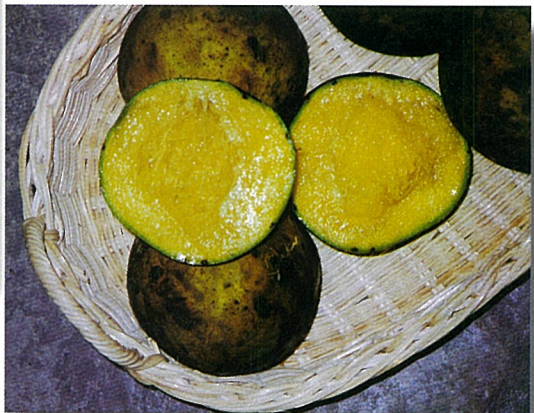
It is propagated from seeds.



Mangifera torquenda is a medium-sized tree with coarse leaves



Green fruits of *Mangifera torquenda* are sour and used for *ulam* or pickles



Ripe fruits of *Mangifera torquenda* are sour and fibrous but some may be less fibrous and sweeter

***Pentaspadon motleyi* Hook.f.**
***Pelajau* (Malay), *Empelanjau* (Iban)**

Pentaspadon is a very small genus of trees found in Malaysia and New Guinea growing naturally in lowland forests to 300 m. This tree grows along river banks and is medium- sized to 30 m tall with an ornamental canopy with striking inflorescences in full bloom. The bole has spreading buttresses. Bark grey brown, smooth to scaly. Leaves each with 4-5 pairs of subopposite leaflets and a terminal leaflet, elliptic-oblong or ovate, 4.5-13 x 3-5.5 cm. Inflorescences to 30 cm long. Flowers white. Fruits ovoid, sharply pointed, green with brown spots when fresh, 2.5-4 x 1.8-2.5 cm. Fruits are carried in bunches which on maturity drop into the river. The floating fruits are collected from the rivers. The fibrous husk covering the small kernel is removed to obtain the white kernel which is fried or boiled with other vegetables. It has a delicious nutty taste. Snacks made by frying *pelajau* with salt or sugar have been found to be delicious.

It is propagated from seeds.



***A Pentaspadon motleyi* tree heavy with fruits**



Immature fruits of *Pentaspadon motleyi*



The white kernel of *Pentaspadon motleyi* is covered by a fibrous husk

APOCYNACEAE

Willughbeia spp.

Gerit-gerit (Malay), *Kubal* (Iban)

A small genus of woody climbers found from India to Malaysia. In Malaya it was used as a source of rubber but a few species yield edible fruits e.g. *W. coriacea*, *W. dulcis* and *W. edulis*. This plant is a woody creeper which scrambles over forest trees growing in lowland forests. It prefers soils high in organic matter. There are many species bearing round fruit except *kubal tusu* (*W. coriacea*) and *kubal tabau* (*W. sarawakensis*) which bear pear shaped fruits.



Willughbeia spp. are large woody vines that scramble over trees for support

Kubal tusu fruit has an attractive peach colour. The pericarp contains a latex and the soft aril is orange in colour, fibrous and adheres to the seeds. It is sour and bland without any aroma.

Kubal tabau bears white flowers in groups. The immature fruits are green and brown in colour maturing into large pear-shaped brown fruits weighing 1 kg or more. The species with round fruits include *kubal ai*, *kubal arang* (*W. coriacea*) and *kubal madu* (*W. augustifolia*). The fruit sizes range from small to medium, fruit colour from bright orange to brown and taste from sour to sweet. The best species is *kubal madu*.



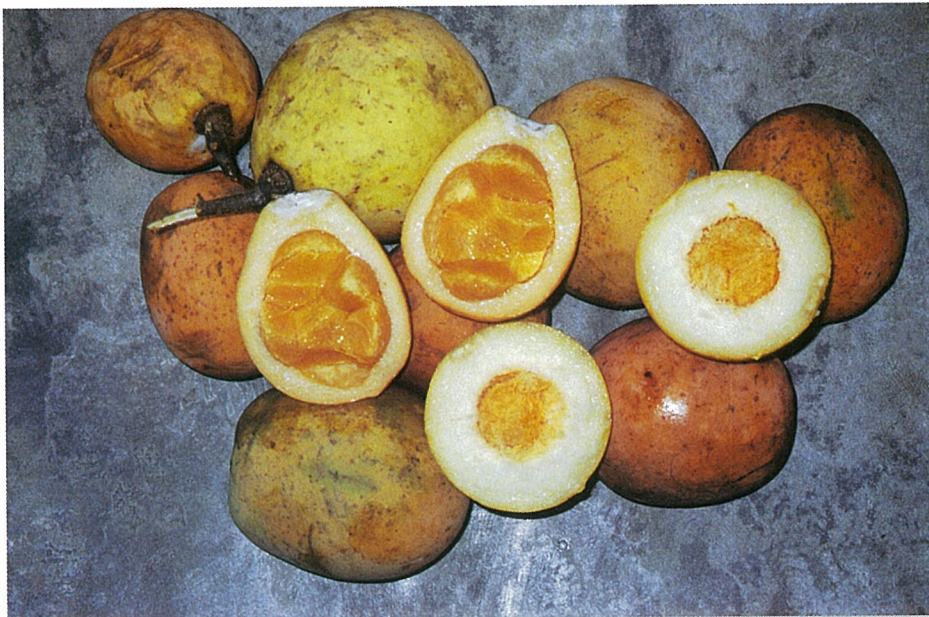
Kubal tabau bears white flowers in groups



Immature *kubal tabau* fruits are green and brown in colour ripening to brown colour



Ripe *kubal madu* fruits are attractive orange in colour.



Kubal tusu is pear shaped while *kubal madu* is round but the aril of both is orange in colour

Kubal madu bears a spherical fruit about the size of a tennis ball which ripens to a golden orange colour. The pericarp contains a latex. The aril which contains small dark seeds is soft, juicy, golden orange in colour, fibrous and subacid to sweet in taste. It has a pleasant almond fragrance. This fruit appears in the *tamu* when in season. Its unique taste and flavour makes it a potential fruit for domestication and commercialisation but first varietal selection and vegetative propagation methods need to be studied. It is propagated from seeds.

BOMBACACEAE

In the family Bombacaceae, the genus *Durio* consists of 27 species at least seven of which produce edible fruits. Natural distribution is Peninsular Malaysia (11), Sumatra (7) and Burma (1). Due to the large number of endemic species (14) Borneo is considered the centre of distribution of *Durio*. Sarawak with 16 species has the richest gene pool in the region (Table 1).

Table 1 : *Durio* species indigenous to Sarawak

	Species	Vernacular name
1	<i>D. acutifolius</i> Kost.	Durian maias
2	<i>D. affinis</i> Becc.	-
3	<i>D. carinatus</i> Mast	Durian paya
4	<i>D. crassipes</i> Kost. et Soeg.	-
5	<i>D. dulcis</i> Becc.	Tutong
6	<i>D. excelsus</i> (Korth.) Bakh.	-
7	<i>D. grandiflorus</i> (Mast.) Kost. et Soeg.	Sukang
8	<i>D. graveolens</i> Becc.	Durian kuning
9	<i>D. griffithii</i> (Mast.) Bakh.	-
10	<i>D. kutejensis</i> Becc.	Nyekak
11	<i>D. lanceolatus</i> Mast.	-
12	<i>D. lissocarpus</i> Mast.	-
13	<i>macrophyllus</i> Ridley (syn. <i>D. testudinarum</i> Becc.)	Durian kura
14	<i>D. oblongus</i> Mast.	-
15	<i>D. oxleyanus</i> Griff.	Isu
16	<i>D. zibethinus</i> Murr.	Durian

Source : Ashton (1988)

The seven species that bear edible fruits are ranked in the following order of importance :

- | | |
|---|------------------------------------|
| 1. <i>Durio zibethinus</i> Murr. | - Durian |
| 2. <i>Durio kutejensis</i> Becc. | - Nyekak |
| 3. <i>Durio graveolens</i> Becc. | - Durian kuning |
| 4. <i>Durio oxleyanus</i> Griff. | - Isu |
| 5. <i>Durio dulcis</i> Becc. | - Tutong |
| 6. <i>Durio testudinarum</i> Becc. | - Durian kura-kura |
| 7. <i>Durio grandiflorus</i> (Mast.) Kost. et Soeg. | - Sukang (rarely found in Sarawak) |

In Sarawak the name durian refers to *Durio zibethinus*. The other six species are generally referred to as wild durians and are not well known outside the localities where they are found either growing wild or partly domesticated. Apart from these six wild species, several possible natural hybrids or new species that produce fruits with very good eating qualities have been encountered.

The vernacular names selected for the wild durians are based on the name that is most commonly recognised for that particular species. Due to the many ethnic groups in Sarawak, vernacular names can be very confusing.

***Durio dulcis* Becc.**

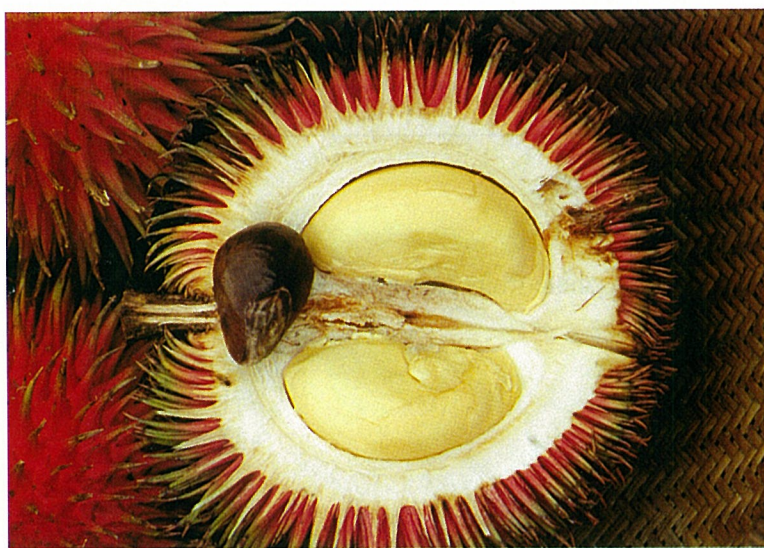
***Durian merah* (Malay), *Rian tutong* (Iban)**

Found mostly in the primary forests, *Durio dulcis* is found throughout Borneo and is scattered in the mixed dipterocarp forest usually below 800 m altitude. It grows into a large tree reaching 40 m height. It has large buttresses up to 4 m high. The leaves are similar to those of durian, with an upper glossy surface and with light coppery scales on the lower surface.

The inflorescences are held in clusters on older branches. Petals are pink. Fruits are globose, medium sized (400-1,000 g) and dark red in colour with dense slender, long spines with darker tips. These spines are hard and stiff, making the fruit difficult to handle. The shell is thick (1.0 cm).

The aril is thick, yellow, very soft, fine and creamy in texture. It is very sweet and highly fragrant. However its taste has also been described as delicious, by those who find the smell agreeable. Seeds are dark glossy brown. The ripe fruits open along the sutures but difficult to open fruits need to be cut open. It ranks fifth in the preference list and has not been domesticated.

It is propagated from seeds.



The fruit of *Durio dulcis* is dark red in colour like a huge rambutan

Durio graveolens* Becc.**Durian kuning* (Malay), *Rian isa* (Iban)**

Durio graveolens trees are found growing on hill soils, alluvial flats and coastal peats in Sarawak. The tree is large, has a columnar trunk, and a crown often reaching 40 m. The young shoots have a typical bronze colouration. The mature tree bears white flowers.

D. graveolens fruits have greenish yellow to deep yellow skins. They are globose and covered with long sharp spines. Each fruit weighs 200-600g. There are stark differences in aril colour, texture, fragrance and taste in *D. graveolens*. The colour range can be from bright yellow (*simpur*) to crimson (*otak udang galah*) and intermediates orange and purple. The flesh varies in thickness, is dry, sweet, cheesy and fragrant. The seeds are large, ellipsoidal and glossy brown in colour. It is popular in Northern Sarawak and Brunei where varieties with good mild flavour and moderate to thick pulp are cultivated.

D. graveolens is a very nutritious fruit being high in energy, protein, potassium and Vitamin C. It ranks third after *D. zibethinus* and *D. kutejensis* in terms of potential for commercialisation.

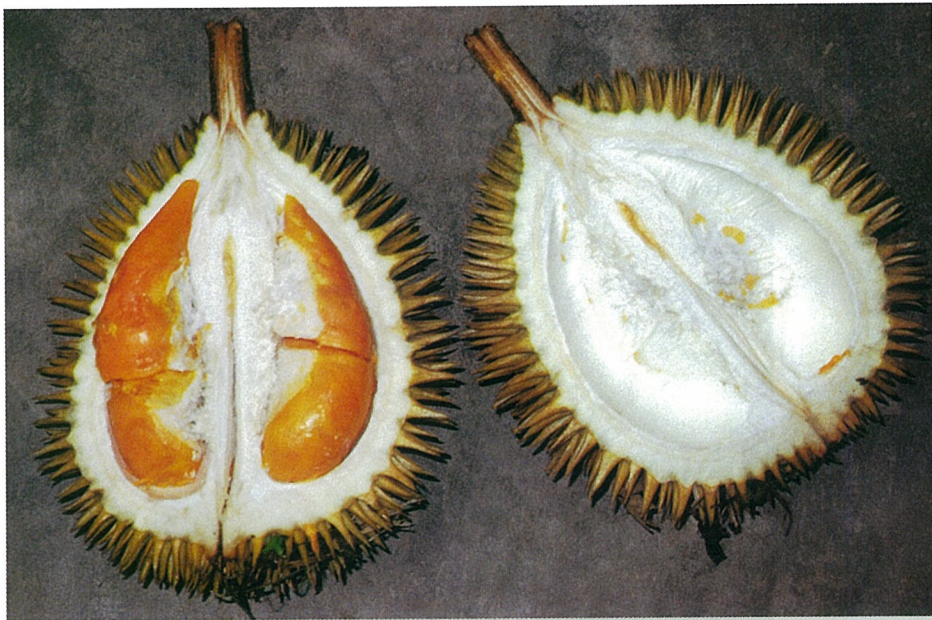
It is propagated from seeds but the Sarawak Department of Agriculture has done budding successfully.



Immature *Durio graveolens* tree



Mature tree of *Durio graveolens* bears white flowers



The aril colour of this *Durio graveolens* fruit is orange. It may range from bright yellow (*simpor*) to crimson (*otak udang galah*)

Nutrient composition of *Durio graveolens*

Nutrient composition per 100 g edible portion

Composition							Minerals								
Energy (Kcal)	Moisture (%)	Protein (g)	Fat (g)	CHO (g)	Fibre (g)	Ash (g)	P (mg)	K (mg)	Ca (mg)	Mg (mg)	* Fe (ug)	* Mn (ug)	* Cu (ug)	* Zn (ug)	Vit C (mg)
152	66.7	2.6	6.2	21.5	2.0	1.0	43	529	10	27	6	4	7.0	5.9	10.4

*ppm

Durio kutejensis Becc.

Durian pulu (Malay), *Rian nyekak* (Iban)

Durio kutejensis is mainly found growing wild in mixed dipterocarp forests of the Bintulu and Miri Divisions of Sarawak. Elsewhere only scattered trees are found in both primary and secondary forests.

The tree is medium-sized with low branching habit growing to a height of 20-25 m. The bole is short and buttressed. Leaves are large, long, elliptical, measuring 20-33 cm long and 6-12 cm wide. The upper surface is shiny dark green while the lower surface is golden coloured. It takes 6-8 years to begin bearing. The flower clusters are bright crimson in colour. The petals and stamens usually persist in the fruit stalk giving it a hairy appearance.



Immature *rian nyekak* trees with low branching habit

The fruit of *rian nyekak* is round or ovoid, covered with short and blunt spines. Fruits are small to medium, weighing 0.5-1.5 kg. It is light brown in colour when immature ripening to a golden yellow colour. It is easy to open. The aril is golden yellow in colour, fine textured, sweet with a mild fragrance. The mild fragrance may appeal to people who have their first introduction to durian. Small lobed fruits have smaller seeds and thicker aril.

The seeds are glossy brown, ellipsoidal and up to 4 cm long. The fruit seems to be resistant to fruit borers but the plant cannot tolerate water-logged soil conditions.

A mature tree may carry up to 500 fruits per season. In the *tamu* it is sold at around RM2.00 per fruit. The *rian nyekak* always flowers and ripens about a month after durian. This is an advantage as it does not have to compete with the more established and ever popular durian in the market.

The *rian nyekak* has great potential for development into a commercial fruit because of the quality of its aril. Some parameters such as extremely fine texture can perhaps be bred into the durian. Nutritionally it is rich in carbohydrates, proteins and potassium. It also contains a fair amount of Vitamin C. It is popular in Sarawak and is commonly planted near rural homes and villages and even more so in Brunei Darrussalam where it is well sought after. Unlike the durian it does not cause flatulence.

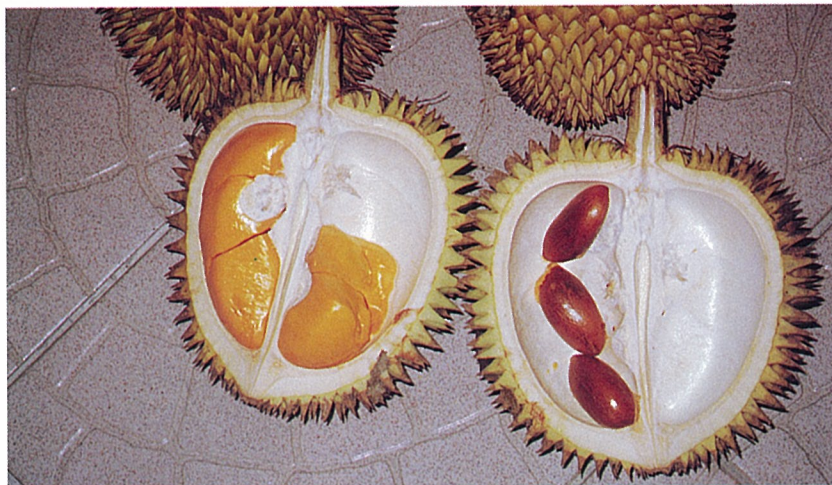
Propagation is from seeds but the Sarawak Department of Agriculture has carried out budding successfully.



***Durio kutejensis* fruits with persistent petals and stamens**



The *Durio kutejensis* flower has a bright crimson corolla which attracts insects, bats and birds to pollinate them



The golden yellow aril is fine textured, sweet, with a mild fragrance and nutritious

Nutrient composition of *Durio kutejensis*

Nutrient composition per 100 g edible portion

Composition							Minerals								
Energy (Kcal)	Moisture (%)	Protein (g)	Fat (g)	CHO (g)	Fibre (g)	Ash (g)	P (mg)	K (mg)	Ca (mg)	Mg (mg)	* Fe (ug)	* Mn (ug)	* Cu (ug)	* Zn (ug)	Vit C (mg)
149	61.5	2.6	1.7	30.9	1.9	1.5	25	362	19	19	7	5	3.2	7.3	15.9

*ppm

Durio oxleyanus Griff.

Durian burung (Malay), *Rian isu* (Iban)

Durio oxleyanus is a tall tree found growing in lowland forests of Peninsular Malaysia and Borneo. It has not been brought into cultivation. Trees are 40 m tall with large columnar trunk. The leaves are similar to *D. zibethinus*. Flowers are small, creamy white and slightly fragrant. The globular fruits are exceedingly homogeneous. Each fruit is small to medium-sized (15-20 cm diameter). The skin colour is greyish green or yellow with large, long and rigid curved spines. It is easily opened and has only four locules. The pulp is attractive corn yellow or orange, very sweet with a glutinous smooth texture and a distinct smoky fragrance. Generally the pulp is thin but some varieties have moderately thick aril. The seeds are large and glossy brown.

Found only in scattered locations, the fruits do appear in the *tamu* together with *D. zibethinus* priced at RM1-3 per fruit. Selection for good quality fruits with moderately thick pulp will popularise the fruit and facilitate its domestication and commercialisation.

It is propagated from seeds.



The immature fruit of *Durio oxleyanus* is green in colour with long curved spines



The pulp of *Durio oxleyanus* is attractive corn yellow or orange

Durio testudinarum* Becc.**Durian kura-kura* (Malay), *Rian kura-kura* (Iban)**

The *durian kura-kura* tree is rare, only sometimes found in lowland forests in Sarawak. It is a medium-sized tree with straight columnar trunk. The leaves are elliptical with upper glabrous surface. A distinct characteristic of this durian is that fruits are borne cauliflorously on the trunk to about 1.5 m above the ground. The fruiting cushions give the trunk a knobby appearance. Young trees 5 - 6 years old have been known to produce fruits. Flowers are produced in large numbers and are white in colour. The young fruits are brown in colour ripening to a yellowish brown colour. The spines are short and stubby. The pale yellow aril is dry, soft, smooth, sweetish with a strong onion fragrant taste that may not be agreeable to most people. It has no commercial value at the moment but has potential for crossing with *D. zibethinus* and as a rootstock to dwarf the plant.

It is propagated from seeds.



Immature *Durio testudinarum* tree



The large white flowers of *Durio testudinarum* are borne cauliflorously on the lower 1.5 m of the trunk



The young fruits are brown in colour ripening to a yellowish brown colour

Durio zibethinus* Murr.**Durian* (Malay), *Rian amat* (Iban)**

The most widely cultivated species is *Durio zibethinus* commonly referred to as durian of commerce. The durian regarded by many as the “King of Fruits” is found extensively in Indonesia, Malaysia and Thailand but lesser in the Philippines. Even though it is not universally accepted because of its strong taste and overpowering aroma, people who have developed a taste for it are able to appreciate it whole heartedly. It has been domesticated and commercialised especially in Thailand where an export trade has been established.

Durian in prime environment grows some 20-45 m tall but grafted clones seldom exceed 20m. Cultivars usually assume a Christmas tree habit but seedlings tend toward a tall branchless trunk with an irregular and dense crown. Flowers arise in stalked pendulous bunches with up to 25 individual flowers some 50-70 mm long on the main and smaller lateral branches. Durian flowers open from 3 p.m. to late evening. Before midnight most pollen is shed and all flower parts excepting the pistil fall to the ground. Moths and nectarivorous bats are probably the most important pollinating agents.



Vegetatively propagated durian trees usually assume a Christmas tree habit



Flowers arise in stalked pendulous bunches with up to 25 individual flowers



The durian fruit is stalked, pendulous, round to oblong or irregular shaped

The fruit is stalked, pendulous, round to oblong, commonly 200 mm long by 175 mm thick, but may be up to 400 mm long. The rind is tough and covered with thick sharp pointed coarse spines. The fruit is actually a capsule and splits when ripe into 3-4 segments of irregular width, each of which contains from 1-7 seeds. Varieties that are difficult to open along the sutures need to be cut open. Each seed is embedded in a rich pulp. The pulp is the edible portion and varies in colour, texture, thickness, taste, aroma etc. between cultivars. Seeds are large, 40-70 mm long by about 25 mm thick. The rind of the fruit is extremely tough and has evolved so as to withstand impact without major damage from a fall of as much as 40 m. The fruit is attractive to a great variety of animals including amongst many, the orangutan, elephant, tiger and even

the domestic cat. Generally, the pulp that is soft, sweet, aromatic, fine textured is preferred even though a degree of bitterness is liked by some. The ripe fruit is eaten fresh, preserved in salt (*tempoyak*), made into durian cake, used as a flavouring in ice cream, cakes, sweets, soft drinks, etc. The flowers and unripe fruits are eaten as vegetable. It is an extremely nutritious fruit with high values for energy, protein, calcium, phosphorus, iron and vitamins A, B and C.

Nutrient composition of *Durio zibethinus*

Nutrient composition per 100 g edible portion																	
Composition						Minerals						Vitamins					
Energy (Kcal)	Moisture (%)	Protein (g)	Fat (g)	CHO (g)	Fibre (g)	Ash (g)	Ca (mg)	P (mg)	Fe (mg)	Na (mg)	K (mg)	Carotene (ug)	RE (ug)	B1 (mg)	B2 (mg)	Niacin (mg)	C (mg)
153	64.1	2.7	3.4	27.9	0.9	1.0	40	44	1.9	40	70	150	25	0.10	0.13	0	23.3

*ppm

Historically the better production sites have developed in areas of rainfall well distributed throughout the year and with mean yearly totals exceeding 3,000 mm. Established durians cannot withstand more than 3 months drought without suffering irreversible damage. The durian grows best in a rich deep well-drained sandy clay or clay loam. Heavy clay soils with poor drainage should be avoided since the root system is very sensitive to standing water, and such conditions are conducive to proliferation of the most devastating durian disease, *Phytophthora palmivora*.

Durian progeny are very heterozygous in all attributes. Malaysia, Singapore and Thailand have selection programmes backed by government agencies which have covered hundreds of cultivars and resulted in recommendations. Clones generally commence bearing in the fourth to sixth year after field planting whereas seedlings take from 7-10 years.

Good orchards in Malaysia and Thailand commonly produce 10-18 tonnes per hectare per annum in the tenth to fifteenth year from planting. There is a slight tendency for biennial bearing even in areas where there are two crops per year.

Asexual propagation of durian is not difficult and a large number of methods are used in Malaysia, Indonesia and the Philippines. The modified forkert bud graft, wedge, whip and approach grafts are most common.

Following planting in Thailand, trees are provided with temporary shade for the first year.

The aril can be preserved for flavouring by spray or drum drying, but is very hygroscopic in the state and must be stored in airtight containers. The distinctive aroma of durian is attributed to thiols, thioethers and esters and the compounds responsible for the objectionable smell are hydrogen sulphide and diethyldisulphide.

Ripe durian is a high energy and nutritious fruit and although it is confined to a niche market today, research and market promotion will increase its popularity worldwide. It has been domesticated and fully commercialised.