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NYATOH–ITS SUSTAINABILITY AS FURNITURE TIMBER

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ANI, S. & BARNETT, J. R. 1999. Nyatoh–Its sustainability as furniture timber. Nyatoh is a light hardwood and a popular timber in the furniture industry. This is because of its attractive physical appearance, particularly on the radial surface and its colour which is light red-brown to orange-brown. The lighter shade of the sapwood merges gradually with the deeper shades of the heartwood. Its air dry density varies from 400 to 1075 kg m^{-3} depending on species. Nyatoh is derived from several genera of Sapotaceae; the more common being *Madhuca, Palaquium* and *Payena.* Species from these genera such as *Madhuca utilis, Palaquium ridleyi* and *P. stellatum* which are very heavy may be excluded from the nyatoh group and referred to as bitis. Nyatoh may be found from lowland to upper hill forests at 1650 m altitude and in fresh water and peat swamp forests. Demand and supply of nyatoh as indicated by prices in the domestic and export markets have been volatile but trending upwards. The demand for nyatoh in the domestic market has even exceeded that of dark red and light red meranti from 1995 onwards, particularly for sawntimber. The demand for nyatoh in furniture manufacturing is expected to continue but its supply is decreasing as seen from the drop in exports. To ensure its sustainability, plantations of selected species of nyatoh should be established. This is important in reducing the variability of the group in terms of density, strength, seasoning, machining, wood-working, peeling and gluing properties.

Key words: Nyatoh - furniture - timber prices - domestic and export market - nyatoh plantation

ANI, S. & BARNETT, J. R. 1999. Nyatuh–Keberkekalannya sebagai kayu perabot. Nyatuh adalah kayu keras ringan dan terkenal dalam industri perabot. Ini disebabkan oleh bentuk fizikalnya yang menarik, terutamanya di permukaan radial dan warnanya daripada coklat-kemerahan cerah kepada coklat-keperangan. Kayu gubalnya yang lebih cerah bertukar perlahan-lahan kepada warna kayu teras yang lebih tua. Ketumpatan kering anginnya berubah daripada 400 kepada 1075 kg m^{-3} bergantung kepada spesies. Nyatuh didapati daripada beberapa genera Sapotaceae; kebiasaannya ialah *Madhuca, Palaquium* dan *Payena.* Spesies daripada genera ini seperti *Madhuca utilis, Palaquium ridleyi* dan *P. stellatum* yang tersangat berat boleh dikecualikan daripada kumpulan nyatuh dan dirujuk sebagai bitis. Nyatuh boleh ditemui daripada hutan pamah hinggalah ke hutan berbukit tinggi pada ketinggian 1650 m dan di kawasan air tawar serta hutan paya gambut. Permintaan dan bekalan

nyatuh seperti yang dilihat daripada harga pasaran domestik dan eksport tidak stabil tetapi menunjukkan trend yang meningkat. Mulai tahun 1995 dan seterusnya, permintaan bagi nyatuh dalam pasaran domestik telah melebihi permintaan terhadap dark red dan light red meranti, terutamanya bagi kayu bergergaji. Permintaan bagi nyatuh dalam pembuatan perabot dijangkakan akan berterusan tetapi bekalannya semakin berkurangan seperti yang dilihat daripada kejatuhan dalam eksport. Untuk mempastikan keberkekalannya, ladang hutan yang terdiri daripada spesies terpilih nyatuh perlulah diusahakan. Ini penting dalam mengurangkan kebolehubahan kumpulan ini dari segi ketumputan, kekuatan, pengeringan, pemesenan, pemprosesan, pengkulitan dan sifat-sifat perekatan.

Introduction

Nyatoh is a popular timber for furniture, interior trim, panelling, mouldings and skirtings, high class solid doors and cabinet work, strip and parquet flooring. It is also used for plywood, both rotary peeled and sliced. The radial surface of veneers gives a very attractive figure which is characteristic of the timber. The sapwood of nyatoh is generally lighter in colour and only moderately differentiated from the heartwood. Heartwood may show various shades of brown, light red-brown, red-brown, red or purple-red, yellow or orange-brown. The lighter shade of the sapwood merges gradually with the colour of the heartwood. Planed surfaces are not particularly lustrous but are attractive especially when a streaky figure is present. Nyatoh wood has a moderately fine to slightly coarse and even texture with straight to shallowly interlocked and sometimes wavy grain. It is hard to moderately hard to cut across the grain with an air-dry density of 400 to 1075 kg m^{-3}. Its working qualities vary depending on species; lighter species work easily producing smooth surfaces. It varies from durable to non-durable depending on species.

The nyatoh species in demand in the trade are mainly derived from the genera *Madhuca, Palaquium* and *Payena* and occasionally, *Diploknema.* In *Madhuca,* only the species *M. utilis* is not accepted as nyatoh. In *Palaquium,* two species *P. ridleyi* and *P. stellatum* have been excluded from the nyatoh group due to their high density. These two species and *M. utilis* are referred to as bitis.

Availability and distribution of nyatoh

Nyatoh belongs to the family Sapotaceae which consists of ill-defined 24 to 75 genera of 320 to 800 species throughout the tropics and sub-tropics (Ng 1972). In Peninsular Malaysia, 10 genera have been documented with 80 species, of which 71 are indigenous. However, only 57 species reach timber size of over 90 cm girth. The genera from which nyatoh timbers are derived and other related genera are given in Table 1.

The nyatoh family is found in primary forest to 1650 m altitude except in mangrove swamps and exposed peaks. In lowland, hill and upper hill forests to 1200 m, Sapotaceae are commonly found with other families such as Burseraceae, Dipterocarpaceae and Leguminosae which contain many big trees. They are also

common in fresh water swamp forests; in East Johore, *Palaquium xanthochymum* is found in almost pure stands. In peat swamps, the three main species are *Madhuca motleyana, Palaquium ridleyi* and *Planchonella maingayi.* In sheltered parts of some montane forests at elevations between 900 and 1650 m, *Palaquium regina - montium* is most commonly found as a big trees with a conspicuous coppery crown. Other species of Sapotaceae may be found less frequently, on limestones, along the coast and in the mountains. Table 2 shows the distribution of nyatoh in the natural forests of Peninsular Malaysia (Wyatt-Smith 1952).

Table 1. Nyatoh and its related genera

Genus	Vernacular name	No. of species
Chrysophyllum	Pepulut	1
Diplokinema	Nyatoh kekabu	1
Isonandra	-	1
Madhuca	Nyatoh/bitis	30
Manilkara	Sapodilla/ciku	2
Mimusops	Bunga tanjong	1
Palaquium	Nyatoh/bitis	22
Payena	Nyatoh	10
Pouteria (Planchonella)	Nyatoh/nyatoh kuning	2 (5)
Sarcosperma	-	2

Demand and supply of nyatoh in the domestic and export markets

Previously, nyatoh was marketed as meranti which it closely resembles in colour and was classed as a general utility timber with properties similar to mixed consignments of red meranti. It was considered inferior to dark red meranti and fetched a much lower price (Desch 1954).

At present nyatoh, as with dark red meranti (DRM), light red meranti (LRM) and red meranti (RM), is traded as a group of its own. The average prices of these groups of timbers vary from time to time and between each other depending on demand, availability and weather conditions.

Bitis and nyatoh kuning are less in demand and sold as mixed heavy hardwood and mixed light hardwood respectively. Their prices are much lower than nyatoh since they are not suitable for furniture manufacturing.

The demand and supply of nyatoh on the market are reflected in the prices in the domestic and export markets (Maskayu 1990-1997 & Figures 1 to 3). Comparison was also made with other species of equal importance in the furniture industry such as DRM, LRM, RM and sepetir in the local market and with ramin and sepetir in the export market. Ramin is not widely supplied in the local market, only in the export trade. The demand for nyatoh is comparable to that of DRM, LRM, RM and sepetir.

Table 2. Distribution of nyatoh in Peninsular Malaysia

Botanical name	Vernacular name	Distribution
Madhuca motleyana	Nyatoh ketiau	Low lying, swampy land; Jh; Kd; Ns; Ph; Pk; Sl; Tr
M. hirtiflora	Nyatoh ketiau	Lowland forest; Jh; Pk
M. kingiana	Nyatoh ketiau	Lowland forest; Tr; Ph; Sl; Jh
M. penangiana	Nyatoh	Hills and mountains; Kd; Pk
M. penicilliata	Nyatoh	Lowland and hills; Kl; Tr; Pk; Sl; Ns
M. sericea	Nyatoh	Lowland forest; Pk; Ph; Ns; Ml
Palaquium regina-montium	Nyatoh gunong	Mountain forests; Pk; Sl; Ph
P. hexandrum	Nyatoh jambak	Lowland forests
P. xanthochymum	Nyatoh kabu	Low lying, swampy land; Jh; Pk; Tr; Ph; Sl
P. sukoei	Nyatoh mayang	Low lying land; Pk; Tr; Jh
P. microphyllum	Nyatoh pipit	Lowland forests; Kd; Pk; Sl; Ph; Ns; Jh
P. obovatum	Nyatoh putih	Lowland forests except in Ps & Pk
P. semaram	Nyatoh semaram	Lowland forests; Kl; Tr; Ph; East Jh
P. rostratum	Nyatoh sidang	Low lying land to high hills, common except in Ps
P. impressernervium	Nyatoh surin	Lowland and hills; Kd; Kl; Pk; Ns
P. gutta	Nyatoh taban merah	Lowland forests except Ps; Kd; Tr
P. oxleyanum	Nyatoh taban puteh	Lowland to hills; Pk; Sl; Ph
P. maingayi	Nyatoh tembaga	Lowland forests; common except in Ps; Pn; Tr
P. hispidum	Nyatoh tembaga kuning	Undulating forests except in Ps; Pn; Jh
P. clarkeanum	Nyatoh	Lowland forests except in Ps; Pn; Ml
P. herveyi	Nyatoh	Undulating forest; Kd; Kl; Pk; Sl; Ph; Ns; Ml
Payena maingayi	Nyatoh durian	Lowland forests except in Ps & Kl
P. lanceolata	Nyatoh ekor	Lowlands and hills; Lk; Ps; Kd; Kl
P. obscura	Nyatoh sundek	Lowland forests; hills; Kd; Pk; Sl; Ph; Jh
P. dasyphylla	Nyatoh	Lowland to high hills; Kl; Pk; Ph; Ns
P. lucida	Nyatoh	Lowland forests except Ps
Planchonella maingayi	Nyatoh nangka	Lowland forests; peat swamps to hillsides
P. firma	Nyatoh nangka	Mountain forests; Kd; Ph; Jh
P. glabra	Nyatoh nangka	Mountain forests; Ph
Pouteria malaccensis	Nyatoh nangka kuning	Lowland forests; ridges; frequent
P. paucinervia	Nyatoh nangka	Low lying, seasonal swamps; Jh; Tr

Note: Jh=Johore; Kd=Kedah; Kl=Kelantan; Ml=Melaka; Ns=Negri Sembilan; Ph=Pahang; Pk=Perak; Pn=Penang; Ps=Perlis; Sl=Selangor.

Average domestic prices of nyatoh logs and sawn timbers (1991-1997)

Log prices are based on a standard size of 45 cm or more and for sawn timber on general market specification (GMS) size (25-50 × 150 mm). These prices are quoted in Malaysian ringgit (M$) per m^3 delivered to mills.

In general, from Figure 1, the prices of logs followed a similar trend, increasing from 1991 to 1994, decreasing in 1995 and picking up again in 1997. The average domestic prices of nyatoh logs over the seven-year period showed a steadier increase than other species and were highest in 1997 at almost M$ 700 m^{-3}. Sepetir, another popular timber in the furniture industry, showed an almost similar trend to nyatoh but at a lower price level. In 1993 and 1994, log prices were dominated by DRM and LRM at M$560 to M$650 m^{-3}, nyatoh being under M$500.

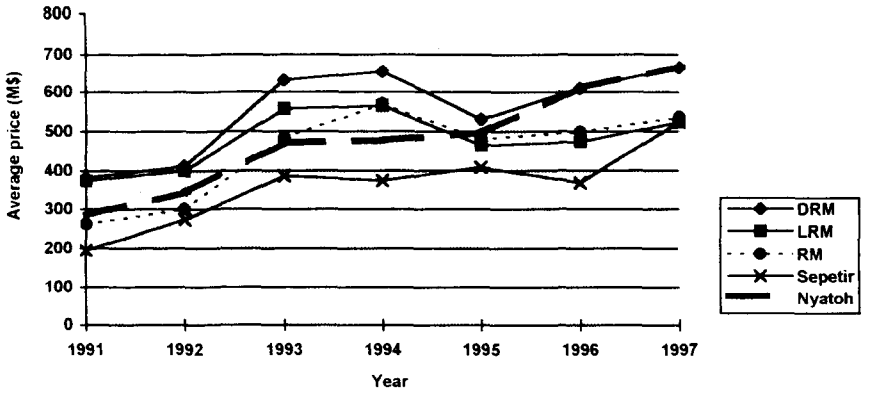

Figure 1. Average domestic prices of nyatoh logs and other species

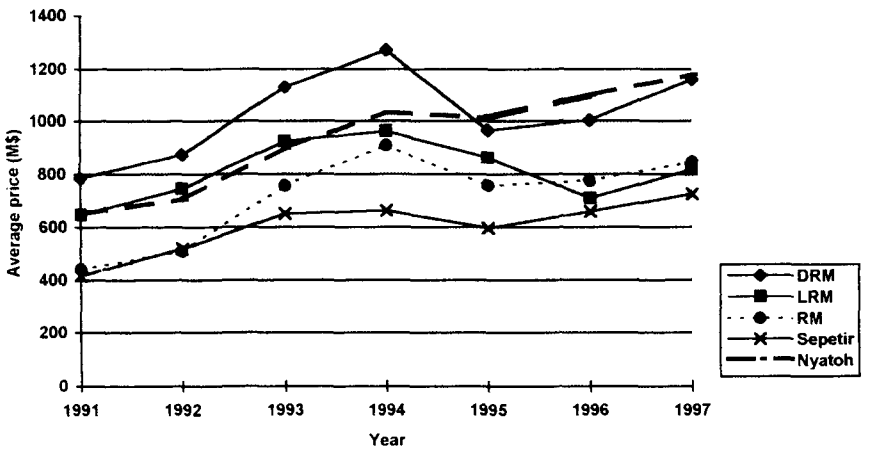

Figure 2. Average domestic prices of nyatoh sawntimber and other species

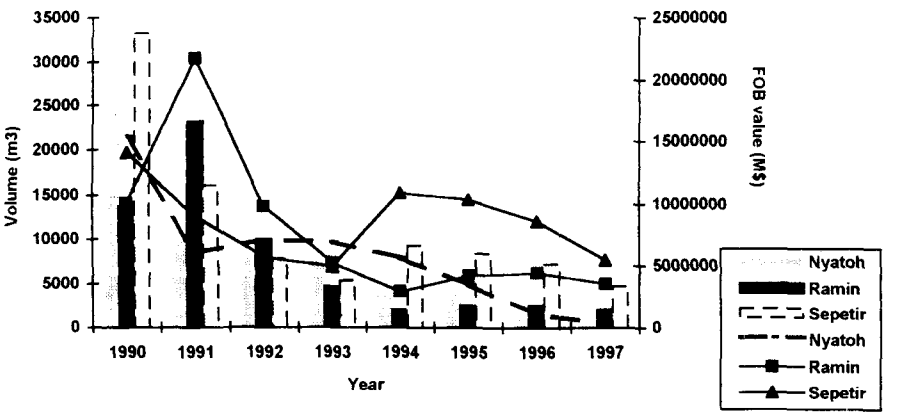

Figure 3. Export of nyatoh compared to ramin and sepetir

For nyatoh sawntimber (Figure 2), average domestic prices have shown a steady increase since 1991 and from 1995, its prices have even exceeded those of DRM which is another popular timber for general utility furniture. By 1997, the average domestic price of nyatoh sawn timber reached just under M$1200 m^{-3} in contrast to DRM which has fallen in price from its peak of more than M$1200 m^{-3} in 1994, although recovering in a similar price to nyatoh in 1997. LRM, RM and sepetir all sold for lower prices than nyatoh or DRM after 1993.

There was a basic similarity in the trend of average domestic prices of sawn timber for all species in Figure 2 to log prices in Figure 1 over the seven-year period.

The trend in market prices suggests that the demand for nyatoh has exceeded that for each of the merantis in the domestic market from 1995 onwards.

Export volume and earning from nyatoh sawntimber (1990-1997)

Figure 3 shows the export volume (m^3) and earnings (M$) of nyatoh, sepetir and ramin sawn timbers by Peninsular Malaysia over an eight-year period. The highest volume of nyatoh was in 1990 (> 32 000 m^3) with free-on-board (FOB) value of over M$ 15 million. Since then the volume exported has decreased drastically to less than 300 m^3 in 1997.

Similar trends in export volumes and earnings over the years have been experienced by all three species in Figure 3 and may be indicative of depleting timber supply. However, the determination of the Malaysian government to increase exports of value-added products, particularly furniture, with less emphasis on exports of sawn timber, may have contributed to the decrease in export volumes, i.e. the increase in downstream processing in the domestic market may have reduced the supply of sawn timber for export. As can be seen from the increasing prices of nyatoh logs and sawn timber (Figures 1 & 2) over other species in the domestic market, the possibility of nyatoh being seriously depleted should not be discounted. Figures 1 to 3 indicate that popular species for furniture such as nyatoh, sepetir and ramin are becoming increasingly scarce and measures need to be taken to overcome this.

Establishment of nyatoh plantations

There are many reasons for establishing forest plantations. In the case of nyatoh, the number of species marketed under this name in the trade means there are wide variations in properties such as density, strength, seasoning, machining, woodworking, peeling and gluing (Wong 1981). The variability in such properties has created a major problem for the industry. The market has a preference for wood that is uniform and homogeneous in properties although this is biologically impossible to achieve. The quality of nyatoh timber depends on the species available. This results in inconsistencies in the timber prices and in species groupings, and it is often difficult for traders to ensure a continuous supply of better quality nyatoh. There are various sources for these timbers e.g. fresh water swamp forest, peat swamp or higher elevation montane forest. Species from lowland forests

and easily accessible areas are increasingly difficult to find, as many have been cleared and converted into agricultural lands. Sawmillers generally prefer logs from drier lowland areas; those from wetter areas were claimed to suffer from excessive shrinkage, end and longitudinal cracks after less than two weeks of storage in the log yard. The sawn timber was also claimed to be of poorer quality.

The furniture industry would like to see only certain species of nyatoh readily available. Random sampling in the market indicated a preference for nyatoh timbers to be used for furniture in the density range 550–800 kg m^{-3} at 15% moisture content, a certain colour shade and easy working properties. Nineteen species of nyatoh from natural forests had the above density range (Ani 1996). From these 19 species, some were undesirable because of silica or crystal inclusions in the wood cells which affected the working and machining properties.

The existing trial plantations of nyatoh around the FRIM campus are mainly of *Palaquium* spp. plus some *Madhuca utilis* or bitis (Selvaraj & Muhammad 1980). The species planted are *P. maingayi, P. rostratum, P. hispidum, P. stellatum* and *P. gutta* totalling 4 ha, and *Madhuca utilis* 5 ha (Table 3).

Table 3. Plantation trials of Sapotaceae around FRIM campus

Species	Area (ha)	No. of seedlings	Spacing (m)	Year established
P. gutta	2.8	3941	2.4 × 2.4	1928 & 1936
			1.8 × 1.8	
			0.9 × 3.4	
			1.5 × 3.4	
			1.8 × 3.7	
P. maingayi	1.2	40	2.4 × 2.4	1937
P. rostratum	0.6	217	2.4 × 2.4	1927
M. utilis	11.862	5392	0.9 × 12.0	1928, 1929 & 1931
			1.8 × 4.6	
			1.5 × 3.4	
			1.8 × 1.8	
			0.6 × 3.4	
			1.2 × 3.4	
			1.8 × 3.7	
Sapotaceae	7.6	14	-	1938

Establishing extensive nyatoh plantations may help to alleviate the projected timber shortage from the natural forest. In 1995 production was down to 31.6 million m^3 from 40.1 million m^3 in 1990. In Peninsular Malaysia alone, production decreased from 12.8 million m^3 in 1990 to 9 million m^3 in 1995; however, timber utilisation is expected to increase. Demand for timber in 2010 is projected to be 26 million m^3, while only about 13.7 million m^3 will be met from native forests. Thus, plantations will be essential.

In establishing forest plantations to compensate for future shortages, indigenous trees such as nyatoh should not be disregarded, even though they are generally believed to be slow-growers. An indication of the growth increments (Ng 1974) of some of the species of nyatoh and bitis is given in Table 4.

Table 4. Maximum girth (cm) of timbers attained at 40 years

Botanical name	Vernacular name	1	2	3
Palaquium rostratum	Nyatoh sidang	(180)	-	580
Madhuca utilis	Bitis	147.5	(137.5)	860
Palaquium impressernervium	Nyatoh surin	(140)	-	800
Palaquium gutta	Taban merah	(120)	112.5	600
Mimusops elengi	Mengkula	(45)	-	870

1=arboretum tree, 2= FRI sample plot trees, 3= density kg m^{-3} ( )= extrapolated values for trees 30 years or older but under 40 years.

Conclusion and recommendations

Nyatoh species as with many Malaysian species are identified in the market by timber group and not by botanical name. Nyatoh in the forest can be identified quite easily to species level, but once felled and extracted loses its botanical identity, unlike monospecific timbers such as kempas or chengal.

The presence of mixed species of nyatoh in the trade creates some uncertainties with respect to properties such as density, strength, seasoning, machining, wood working, peeling and gluing. To reduce such problems, certain species having similar properties could be selected and established in plantations.

The supply of nyatoh timber with attractive physical appearance and good working properties for high class furniture manufacturing is becoming increasingly scarce and the timber is highly priced in both local and export markets.

There is as yet no nyatoh plantation established, either on a small or commercial size scale by any individual or private entrepreneurs. Nyatoh species planted in the campus of the Forest Research Institute Malaysia (FRIM) such as *P. maingayi, P. rostratum, P. hispidum, P. stellatum* and *P. gutta* have not been scientifically studied with respect to their wood structure, physical, chemical and mechanical properties, growth performance and responce to silvicultural treatments such as planting distance, thinning and fertiliser application. Because of the demand for the wood of the nyatoh group and the high prices which can be realised, a plantation programme based on this timber should be considered.

Acknowledgements

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