

PLANTING *DURIO ZIBETHINUS* IN ABANDONED SHIFTING CULTIVATION AREAS: RESULTS THREE YEARS AFTER PLANTING

G. Ådjers*, J. Kuusipalo*, S. Nduka & A. Otsamo*

Enso Forest Development Ltd., Reforestation and Tropical Forest Management Project, c/o Balai Teknologi Reboisasi Banjarbaru, P.O. Box 65 (Jl. Sei Ulin 28 B), 70714 Banjarbaru, Indonesia

Received February 1995

ÅDJERS, G., KUUSIPALO, J., NDUKA, S. & OTSAMO, A. 1997. Planting *Durio zibethinus* in abandoned shifting cultivation areas: results three years after planting. Multipurpose tree species such as *Durio zibethinus* are easily accepted by farmers whose shifting cultivation areas are to be reforested. *Durio zibethinus* is valued for its fruits as well as its timber. Timber quality equals light red meranti (*Shorea* spp.), the most common utility timber in Southeast Asian dipterocarp forests. We planted abandoned shifting cultivation sites with *D. zibethinus* seedlings. Planting was done both in lines opened up in the secondary forest and in clearings where all secondary vegetation was removed. Vertical and horizontal tending was applied four times per year in lines and in the clearings. Survival and growth were monitored for three years and results computed using *t*-test. Survival after three years was better in the line planting treatment (83% vs. 54%) whereas height and diameter growth yielded no significant differences. The mean annual increments were about 60 cm in height and 0.6 cm in diameter, i.e. slower than meranti. These results indicate that *D. zibethinus* can be planted in open lines in the same way as meranti.

Key words: *Durio zibethinus*-growth-line planting-shifting cultivation-secondary forest - survival - tending

ÅDJERS, G., KUUSIPALO, J., NDUKA, S. & OTSAMO, A. 1997. Penanaman *Durio zibethinus* di kawasan pertanian pindah yang terbiar: keputusan tiga tahun selepas penanaman. Spesies pokok pelbagai-guna seperti *Durio zibethinus* mudah diterima oleh petani di kawasan pertanian pindah yang akan dijalankan perhutanan semula. Buah dan balak *D. zibethinus* sangat bernilai. Mutu balaknya sama dengan meranti merah muda (*Shorea* spp.), balak gunaan yang paling biasa ditemui di hutan dipterokap di Asia Tenggara. Kami menanam anak benih *D. zibethinus* di tapak pertanian pindah yang terbiar. Penanaman dilakukan di barisan yang terbuka di hutan sekunder dan di cerang yang dibuang kesemua tanaman sekunder. Kemandirian dan pertumbuhannya diawasi selama tiga tahun dan keputusannya dikira menggunakan ujian-*t*. Kemandirian selepas tiga tahun lebih baik bagi rawatan penanaman baris (83% lawan 54%) manakala ketinggian dan pertumbuhan diameter tidak menunjukkan perbezaan yang ketara. Purata pertambahan tahunan lebih kurang 60 cm tinggi dan 0.6 cm diameter, iaitu lebih perlahan daripada meranti. Keputusan ini menandakan *D. zibethinus* dapat ditanam di barisan terbuka, sama seperti meranti.

*Present address: c/o Enso Forest Development Ltd., Kuparintic 47, FIN-55100, Finland.

Introduction

Logging followed by shifting cultivation creates areas extremely difficult to reforest. In Indonesia alone there are about 11 million hectares under shifting cultivation (Thangam 1989). Some of these areas are covered by secondary forest species. Today secondary tree species have little economic value, but reintroducing valuable timber species is possible. Intensified promotion and planting of multi-purpose tree species is one way to reforest depleted areas with the help of the local population.

Species of the genus *Durio* (Bombacaceae) are examples of trees with a number of uses. The ripe fruits, or rather the white or yellowish arils, are eaten fresh. The value of the produced fruit can far surpass that of the timber. Seeds are up to 4 cm long and can be boiled or roasted and eaten as snack. Young shoots and unripe fruits can be cooked as greens. The rind of the fruit can be used as fuel, particularly for smoking fish. Several parts of the tree are used medicinally (Subhadrabandhu *et al.* 1992). *Durio zibethinus* yields timber equivalent to light red meranti (*Shorea* spp.). The wood is mainly used for veneer, plywood and light construction work, and also for making chests, cigar boxes, wooden slippers and inexpensive furniture.

Identification of *Durio* spp. is considered somewhat difficult. According to Whitmore *et al.* (1989), nineteen species of *Durio* spp. occur in Borneo. Kostermans (1953) identified eight species near Samarinda, East Kalimantan. In a 2-ha permanent plot in the vicinity of the trial site three species were identified, *D. acutifolius* (Mast.), *D. excelsus* (Korth.) and *D. oxleyanus* (Griff.).

Durio zibethinus (Murray) is the most common species for human consumption. This species occurs naturally wild in Sumatra and Borneo (Whitmore *et al.* 1989). *D. zibethinus* is a large buttressed tree. It grows up to 40 m tall and occurs to altitude of 1000 m. It is found in all of Southeast Asia, and it flowers seasonally and bears fruit every year at the end of the dry season. It has a large, recalcitrant and thin-skinned seed which is easily germinated and maintained at the nursery (Singh & Rao 1963). High quality seedlings for fruit production are vegetatively propagated.

Small scale cultivation of *Durio* spp. has been going on for hundreds of years (Chin & Young 1987). As a forestry species it has been planted in Selangor, Malaysia, and is considered a potential plantation species (Appanah & Weinland 1993). In Sarawak *Durio* spp. together with other species was considered in reforestation and rehabilitation of lands subjected to shifting cultivation (Butt & Sia 1982, Petch 1986). Although planting of *D. zibethinus* was already recommended by Endert (1930), there is little information on establishment and tending techniques.

The aim of this study was to test the survival and early growth of *D. zibethinus* using two site preparation methods in a secondary forest.

Material and methods

The Kintap trial area is located in South Kalimantan (03°42'S, 115°09'E). The topography is undulating and the altitude around 100 m above sea level. The average annual rainfall was 3725 mm during 1992-1993. Usually there is a dry spell only in July-October, with monthly rainfall less than 100 mm. The soil in the area is of the red-yellow podzolic/lateritic type. The original forest was of mixed dipterocarp forest type typical of moist tropical lowland areas of the region. The trial site was logged in 1979 and subsequently subjected to shifting cultivation until 1987. *Durio zibethinus* seedlings were planted in December 1991 when the rainy season had already started. At that time the site was already covered with a secondary forest. The most frequent tree families were Euphorbiaceae, Moraceae, Lauraceae, Verbenaceae and Anacardiaceae.

At the nursery seeds were sown directly into plastic tube containers (250 cm³) and placed under a shading net (50% solar transmission). The seedlings were removed from the shaded to the open area at the age of 3 months and planted at the age of 6 months, when their height was about 40 cm.

The seedlings were planted by two methods, (1) in opened lines and (2) in a completely slashed area. The sites for the two treatments were adjacent to each other. The area (including buffer) was 40 × 90 m for each treatment. In line-planting the distance between lines was 10 m and the seedlings were planted at a 2-m spacing along the line. In a completely slashed area the same spacing was used. There were 80 seedlings in each treatment.

At the time of establishment the height of the surrounding pioneer trees was about 3 m. The plantation was maintained four times a year; trees and branches closing the planting line were removed (horizontal tending) and competing herbs and ferns were slashed in the 2-m wide planting line (vertical tending). After the pioneer trees started to grow and disturb the seedlings in the slashed area maintenance was done as in the open line treatment.

Survival, height and diameter 10 cm above ground (D_{10}) were measured every sixth month for two years and after that once a year. Diameter breast height (DBH) was measured only at the end of the third year. Height and diameters of the two populations under different establishment methods were tested by *t*-test.

Results

Survival rates seemed to be higher in the line planting area. Mortality was highest at the beginning of the trial and did not increase after two years (Figure 1).

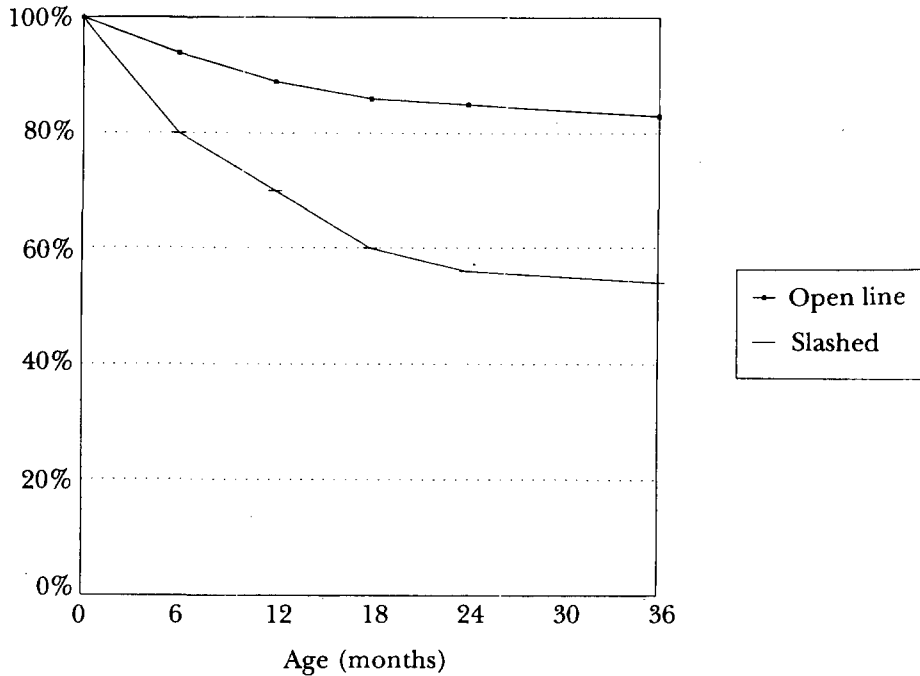


Figure 1. Survival of *Durio zibethinus* 6-36 months after planting in lines and a slashed area in South Kalimantan, Indonesia

No statistically significant differences in height and diameter of the two treatments were observed (Table 1).

Table 1. Mean heights and diameters at 0.1 m (D_{10}) and 1.3 m (DBH) 6-36 months after planting *Durio zibethinus* in open lines and in a slashed area in South Kalimantan, Indonesia

Variable	Treatment	Age (months)					
		0	6	12	18	24	36
Height (cm)	Lines	37	59	86	122	144	217 (95)
	Slashed	41	57	86	109	139	232 (120)
D_{10} (cm)	Lines	0.4	0.6	1.1	1.3	1.6	2.1 (0.8)
	Slashed	0.4	0.6	0.9	1.2	1.6	2.3 (0.9)
DBH (cm)	Lines	-	-	-	-	-	1.1 (0.7)
	Slashed	-	-	-	-	-	1.3 (0.8)

*Figure in parentheses denote standard deviations at 36 months.

Discussion

In the totally slashed area the more extreme environmental conditions probably affected survival. No differences in growth were detected between the two methods. It seems that after the establishment phase, *Durio zibethinus* saplings can tolerate high light intensities without loss in growth, which makes the species flexible, for example for various agroforestry systems.

According to these tentative results, abandoned shifting cultivation areas with a cover of pioneer trees appear to be suitable for planting *Durio* spp. Establishment techniques for *D. zibethinus* and *Shorea* seem to be similar. The growth of *D. zibethinus* during the first three years was slower compared to *Shorea* spp. in the same area (Ådjers *et al.* 1995). Local multipurpose tree species can better cater to the needs of the local people and should be preferred to exotic species whenever possible. The encouraging results presented here raise the question of the suitability of other *Durio* spp. for planting. Species trials are recommended.

Acknowledgements

This trial was carried out under the auspices of the Reforestation and Tropical Forest Management Project (ATA-267) financed by the Finnish International Development Agency (FINNIDA) and implemented by Enso Forest Development Ltd. in cooperation with the Reforestation Technology Centre (Balai Teknologi Reboisasi, BTR) of the Ministry of Forestry, Indonesia.

References

- ÅDJERS, G., HADENGGANAN, S., KUUSIPALO, J., NURYANTO, K. & VESA, L. 1995. Enrichment planting of dipterocarps in logged-over secondary forests: effect of width, direction and maintenance method of planting line on selected *Shorea* species. *Forest Ecology and Management* 73 : 259 - 270.
- APPANAH, S. & WEINLAND, G. 1993. *Planting Quality Timber Trees in Peninsular Malaysia - A Review*. Malayan Forest Records No. 38. Forest Research Institute Malaysia, Kepong, Kuala Lumpur. 221 pp.
- BUTT, G. & SIA, P.C. 1982. *Guide to Site-species Matching in Sarawak. 1. Selected Exotic and Native Plantation Species*. Soils Research Unit, Forest Department, Kuching, Sarawak. 61 pp.
- CHIN, H.F. & YOUNG, H.S. 1987. *Malaysian Fruits in Color*. Tropical Press, Kuala Lumpur. 126 pp.
- ENDERT, F.H. 1930. Report of a tour to the Yanlappa forest reserve on 9 July 1930. Forest Research Institute. Unpublished report. 10 pp.
- KOSTERMANS, A.J.G.H. 1953. Some notes on *Durio* spp. found in the forests near Samarinda, E. Borneo. *Rimba Indonesia* (in Javanese) 2(4): 164 - 169.
- PETCH, B. 1986. *Alternatives to Shifting Cultivation: the Sabal Agroforestry Project*. Research Section, Forest Department, Kuching, Sarawak. 34+23 pp.
- SINGH, H. & RAO, A.N. 1963. Seed germination and seedling morphology in *Durio zibethinus*. *Malayan Forester* 26(2) : 98 - 103.
- SUBHADRABANDHU, S., SCHNEEMAN, J.M.P. & VERHEIJ, E.W.M. 1992. *Durio zibethinus* (Murray). Pp. 157 - 161 in Verheij, E.W.M. & Coronel, R.E. (Eds.) *Plant Resources of Southeast Asia. No. 2. Edible Fruits and Nuts*. PROSEA Foundation, Bogor, Indonesia and Pudoc-DLO, Wageningen, the Netherlands.

- THANGAM, E.S. 1989. *Enterprises Appropriate for Shifting Cultivators*. Indonesia, UTF/INS/065: Forestry Studies, Field Document No. II-4. Ministry of Forestry, Government of Indonesia and FAO. Jakarta, December 1989. 103 pp.
- WHITMORE, T.C., TANTRA, I.G.M. & SUTISNA, U. 1989. (Eds.). *Tree Flora of Indonesia - Checklist for Kalimantan. Part 1*. Agency for Forestry Research and Development, Forest Research and Development Centre, Bogor, Indonesia. 620 pp.