

STEM CHARACTERISTICS AND GROWTH OF PLANTED AND WILD ROTAN BATU (*CALAMUS SUBINERMIS*) IN SABAH

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CHIA, F.R. 1995. Stem characteristics and growth of planted and wild rotan batu (*Calamus subinermis*) in Sabah. Growth rates of rotan batu (*Calamus subinermis*) canes were observed at two sites in Sabah, Malaysia. The ones planted at Kolapis A had a mean annual increment of about 2.4 m at the age of 12 years; the mean stem diameter and mean internode length were 29 mm and 26.3 cm respectively. Wild canes on Berhala Island had a mean diameter of 22 mm and mean internode length of 26.5 cm. Length of the stem covered with dried leaf sheaths is positively related to total stem length.

Key words: *Calamus subinermis* - rattan - growth - internode - regression - Sabah

CHIA, F.R., 1993. Ciri-ciri batang dan pertumbuhan rotan batu liar (*Calamus subinermis*) yang ditanam di Sabah. Kadar pertumbuhan rotan batu (*Calamus subinermis*) telah diteliti di dua tapak di Sabah, Malaysia. Rotan batu yang ditanam di Kolapis A mempunyai min tambahan tahunan sebanyak lebih kurang 2.4 m pada umur 12 tahun, min diameter batang dan min panjang ruas masing-masing berukuran 29 mm dan 26.3 mm. Rotan liar di Pulau Berhala mempunyai min diameter sebanyak 22 mm dan min panjang ruas sebanyak 26.5 sm. Panjang batang yang diliputi dengan selaput daun kering berkait rapat dengan keseluruhan panjang batang.

Introduction

Rotan batu (*Calamus subinermis*), a rattan indigenous to Sabah produces large-diameter canes (18 - 30 mm). This is the locally preferred large-diameter cane, and is comparable in quality to *Calamus manan* (Dransfield *et al.* 1989). Due to the depletion of the rattan resource from natural forest and increasing demand for rotan batu, silvicultural information is urgently needed for proper management and sustainable production.

During the last two decades, many studies on growth and other silvicultural aspects of rattan have been carried out. Most of the available information obtained, however, is on rotan manau, sega and irit (e.g. Manokaran 1982, Nur Supardi & Wan Razali 1989, Shim 1989, Nur Supardi & Aminuddin 1990). Rotan batu has the potential for large scale cultivation but has not been planted extensively due to the lack of silvicultural information. Since growth, cane maturity and other stem characteristics such as internode length and cane diameter are of major interest to rattan growers, this study was carried out to provide some information on these aspects.

Materials and methods

Rotan batu canes were selected randomly from two sites in the Sandakan Residency of Sabah, Malaysia, viz. Berhala Island and Research Plot (RP) 446/D at Kolapis A. Kolapis A is situated 65 km west of Sandakan. The area is undulating and the soils are orthic Acrisols belonging to the Tanjung Lipat Family of the Kretam Association, a well drained sandy loam to sandy clay loam (Acres & Folland 1975). The rattans in RP446/D were planted at a spacing of 3 × 3 m under a lowland secondary forest. On Berhala Island, located about 2 km northeast of Sandakan, the rattans grew naturally under lowland Kerangas forest near the beach. The type of soil where the canes were sampled is Orthic Acrisol of the Kapilit Family of the Maliau Association, a sandy loam (Acres and Folland, 1975). The rattans in Kolapis A were 12 years old whilst in Berhala Island, the ages of the clumps were not known.

Measurements of stem diameter variation (from base to tip), total stem length, internode length, internode number and length of stem covered with dried leaf sheaths were made. The diameter was measured at the mid-region of the internode with a diameter tape. Each stem was cut into 3 m sticks and the diameter at the middle of each stick was recorded. The data collected were analyzed to compare the growth, cane maturity and other characteristics such as internode length and diameter of the canes from the two sites. Cane maturity was indicated by the presence of dried sheath.

Growth data from Kolapis A were analyzed but data from Berhala Island could not be estimated because the clump ages were not known. Canes from the two sites were compared for stem diameter and internode length using t-tests.

The relationship between total stem length and length of stem covered with dried sheath was tested with linear regression analysis; data from the two sites were pooled for the analysis.

Results and discussion

The five parameters measured, viz. total stem length, lengths of the stem covered with dried and green leaf sheaths, mean cane diameter and mean internode length are presented in Tables 1 and 2.

Growth performance

Mean stem length of the canes collected at Kolapis A was 28.9 m at the age of 12 years (Table 1). The mean annual increment of these canes ranged from 1.8 to 3.6 m y⁻¹ and the average was 2.4 m y⁻¹. This indicates that the growth rate of the rotan batu stems is comparable with that of rotan manau which had a mean annual increment of about 2.5 m at the age of 12 years in Kolapis A (Chia, unpublished data). Rahim and Phillipps (1989) reported that rotan batu grew slowly until age 5 and rapidly from ages 5 to 7. Thus, rotan batu is a "late starter", with a long "establishment phase" as defined by Tomlinson (1990).

Table 1. Growth parameters of rotan batu canes from Kolapis A (RP 446/D)

Parameter	Minimum	Maximum	Mean	Std dev	c.v.
Total stem length (m)	22.0	42.6	28.9	6.3	21.8
Length of stem covered with dried sheath(m)	14.0	28.6	17.7	4.5	25.4
Length of stem covered with green sheath(m)	8.0	16.0	11.2	2.7	24.1
Mean stem diameter(cm)*	2.1	3.5	2.9	0.2	6.9
Mean internode length(cm)**	19.4	37.0	26.3	5.3	20.1

Table 2. Growth parameters of rotan batu canes from Berhala Island

Parameter	Minimum	Maximum	Mean	Std dev	c.v.
Total stem length(m)	21.6	41.8	32.3	8.2	25.4
Length of stem covered with dried sheath(m)	11.6	36.8	24.0	9.8	40.8
Length of the stem covered with green sheath(m)	4.0	13.0	9.0	3.1	34.4
Mean stem diameter(cm)*	1.8	2.6	2.2	0.2	9.1
Mean internode length(cm)**	18.2	32.1	26.5	6.1	23.0

* mean diameter of a 3 m stick

** mean internode length for the collected canes

The mean total stem length of rotan at Berhala Island was 32.3 m (Table 2). The ranges of total stem length for the canes sampled from Berhala Island and Kolapis A were 21.6 to 41.8 m and 22.0 to 42.6 m respectively. Thus the stems collected for this study were of similar length for the two sites. A high coefficient of variation of the parameters measured in Berhala Island indicates that higher variation in these parameters could be due to the difference in stem age.

Variation in stem diameter

The mean stem diameter of canes ranged from 2.1 to 3.5 cm in Kolapis A and 1.8 to 2.6 cm in Berhala Island (Figure 1), ($t = 5.1727$, $p < 0.001$). This difference may be due to the less fertile and shallower soil in Berhala Island. Another possible cause of the difference is the seed source; the seed origin of the rotan batu trial plot in Kolapis A was Banggi Island. For the first 24 m, mean diameter of the cane increased rather constantly; thereafter it levelled off (Figure 1).

Variation in internode length

Internode length increased linearly from the third to the tenth internode and fluctuated about a mean value thereafter (Figures 2 & 3). This trend is similar to that reported by Nur Supardi and Wan Razali (1989) for rotan manau where the

internode length increased linearly from the first to the tenth internode. The internode length was reduced for those internodes bearing inflorescences. This was also reported by Shim (1989) for rotan irit. For the cane from Kolapis A, the drastic drop in internode length from internode 24 (Figure 2) may be due to that part of the stem which had reached the top of forest canopy and did not need to produce long internodes to compete for sunlight. There was no difference in internode length between the canes from the two sites ($t=0.0492$, $p < 0.9614$) and the internode length was not correlated to the internode diameter ($p < 0.6932$).

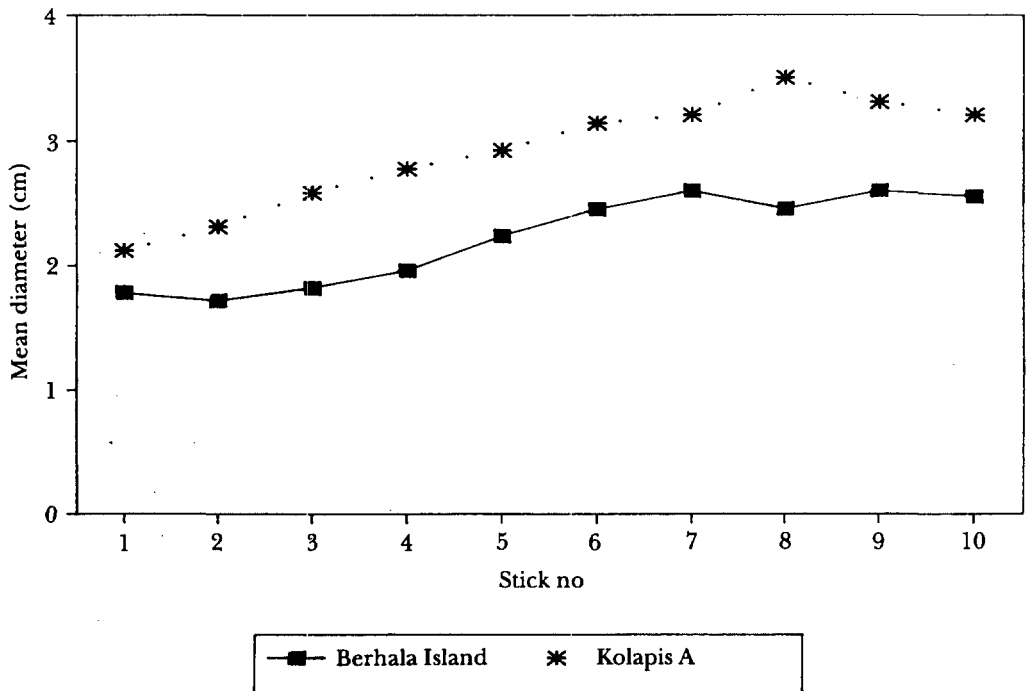


Figure 1. Mean diameter of 3 m long rotan batu

Stem maturity

Cane maturity was indicated by the exposure of the lowest portion because of loosening of the leaf sheath (Sharma & Choudhary 1987) and stem that was covered with dried leaf sheath. The length of stem covered by dried leaf sheaths was positively correlated to total stem length.

$$\text{Length of stem covered with dried sheath} = -1.4375 + 0.6623 \text{ total stem length}$$

$$r^2 = 0.8501, p = 0.001$$

This equation indicates that the length of the stem covered with dried sheath increases with the total stem length. This relationship was also reported by Nur Supardi and Wan Razali (1989), and Nur Supardi and Aminuddin (1990) for rotan manau.

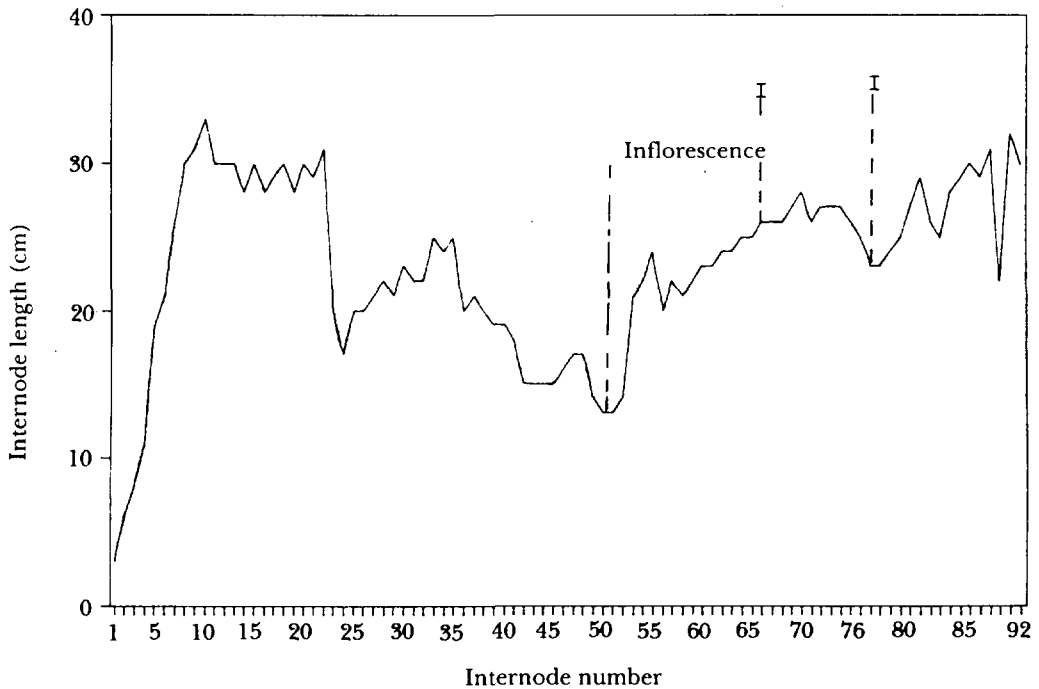


Figure 2. Trend of variation in internode length of rotan batu at Kolapis A

The average ratio of mature cane or stem covered with dried leaf sheath to immature cane or stem covered with green leaf sheath is about 2:1 (Tables 1 & 2). In this study, the portion of the stems covered with green sheath could not be brought down from the tree canopy, because these stems grew among others that were being intensively monitored in a separate phenological study. Thus the proportion of utilizable cane in this portion of the stems could not be investigated.

Conclusion

The growth performance of rotan batu at Kolapis A sampled for this study was good with a mean annual increment in stem length of about 2.4 m. On the basis of its favourable growth rate, clustering behaviour, and heavy market demand, this species is recommended for large scale planting.

The relationship between total stem length and the length of the stem covered with dried sheath established in this study provides a basis for estimating the growth and yield of the species.

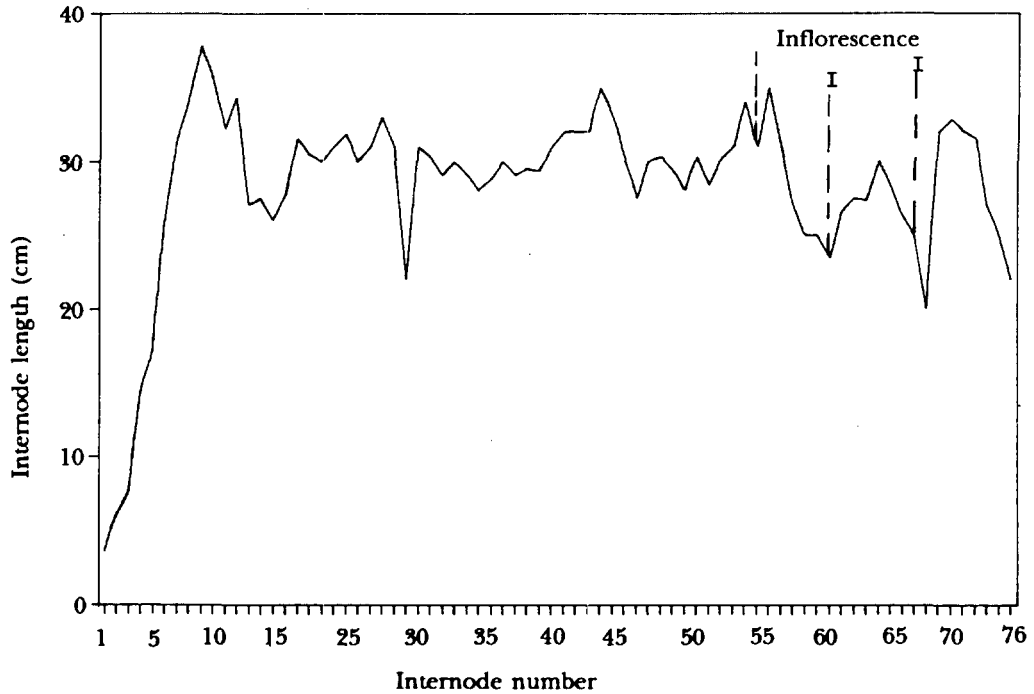


Figure 3. Trend of variation in internode length of rotan batu at Berhala Island

Investigation into the extent of genetic and environmental factors that cause the difference in stem diameter of the canes from the two sites could be fruitful.

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