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GROWTH PERFORMANCE OF *CALAMUS MANAN* GROWN ON DIFFERENT SITES IN PENINSULAR MALAYSIA

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ABSTRACT: *Calamus manan, the primer rattan in Peninsular Malaysia has been widely studied. Research on planting of rattan under rubber started since 1980's. C. manan has been planted in different sites and under different management regimes. The result indicated that the annual increment of height and diameter were significant when compared between sites.*

INTRODUCTION

Calamus manan (Rotan manau), the primer large diameter cane/rattan is found mainly in Peninsular Malaysia. It is the most sought after rattan in the furniture industry. Due to over harvesting of the species, the resource is getting scarce and collectors have to venture deep into the forest to harvest them. Steps have been taken to domesticate the species by planting them in large areas of rubber plantation. Government agencies and private sectors have started to plant in large-scale. To date more than 10000 ha have been planted with *C. manan* under rubber plantations (Abd. Halim and Aminuddin 1998)The performance of *C. manan* under forest condition have been widely studied (see Kong and Manokaran 1986, Aminuddin 1990). The planting of rattan under rubber have started since 1980's and the performance has been very encouraging (Aminuddin and Nur Supardi 1986, Salleh and Aminuddin 1994). This paper highlights the growth performance of *C. manan* grown under different management system in rubber plantations.

MATERIALS AND METHODS

Experimental Sites

This study was based on four field trials set up by Forest Research Institute Malaysia (FRIM) during 1985-1987. They were located at Ulu Seraja in Malacca, Kota in Seremban, Ulu Cheka in Pahang and Serting in Negeri Sembilan.

Ulu Seraja

Ulu Seraja is in the state of Malacca. The site located about 13 km from downtown Alor Gajah is located at 2° 25' N latitude and 102° 15' E longitude. Mean annual temperature of the area varies from 21 to 36°C, while the average annual precipitation is 2163.5mm. The rainfall is of bimodal distribution with two peak seasons in the months of May and June. The area can be described as flat, having 2 - 3% slope.

The trial plot was intercropped with rubber. The plantation was established in 1987. The plantation was 8 years old at the start of this study.

Kota

Kota is located near Seremban. The trial site is 30 km from Bahau, at 2°30' N and 101°30' E. The average annual temperature precipitation is 1739.1 mm, occurring heavily during the months of March and November. The area is generally undulating with slope gradient ranging from 1 to 20 percent. The soil classified as Bt Temiang series is moderately well-drained. The site was not well maintained. Movement in plots were difficult.

The trial plot was set up in 1985. The plantation belongs to a smallholder and the age of the plant was 10 years old at the start of this study.

Ulu Cheka

Ulu Cheka is located in Kampong Koi near Jerantut town in Pahang. It is situated 15km from the Jerantut town at 4° 34'N and 102° 15'E. The average annual temperature varies from 21 to 36° C. The mean annual precipitation is 1932.4 mm, occurring heavily during the months of October and December. The site is flat with 1 - 2% slope. The plot was fairly weeded, showing some ground cover.

The trial plot was also set up in 1987. The plantation belongs to a smallholder and the age of the plant was 8 years old at the start of this study.

Serting

Serting is in the state of Negeri Sembilan.. The site is located along the Kuala Lumpur-Karatong-Kuantan highway at 3°30' N and 102°30' E. The annual temperature varies from 20°C to 35° C. The annual precipitation is 90 mm, occurring heavily during the months of March and April. The area is generally flat with 2 - 3% slope. The trial plots was well maintained, and devoid of weeds.

The trial plot was established in 1986. The plantation belongs to Federal Land Development Agency (FELDA) and the age of the plant was 9 years old at the beginning of this study. Unfortunately, this site was harvested before the final measurement took place.

Experimental Designs

The experimental design used for each site was a randomized complete block design (RCBD) with 3 replications, 27 plots per replicate and 11 trees per plot. The exception was for Kota, which used only 2 replicates with 6 plots.

Growth Measurement and Data Analysis

Height was first measured by FRIM from the first year after planting up to three years after planting. Later when the present study took place, height and diameter were measured once again. Because of the differences in age at different sites, the final height and diameter measurements were used to calculate mean annual increments (MAI) for ease of comparison. Analysis of variance was used to determine the significant effect of site MAI of height and diameter. Height measurements measured from the beginning were non-linearly regressed to enable growth prediction be made for each site.

Growth Increments

Results of ANOVA showed that both mean annual increments of height and diameter were significantly ($p<0.01$) affected by the site of planting (Table 1).

Table 1
Results of Analysis of Variance on the Effect of Site on Growth of Rattan

a. Height Annual Increment

Source	DF	Sum of Squares	Mean of Squares	F-value
Sites	3	823538.44	274512.81	180.26**
Error	243	370066.23	1522.91	
Corrected Total	246	493604.67		

b. Diameter Annual Increment

Source	DF	Sum of Squares	Mean of Squares	F-value
Sites	2	96.45	48.22	11.90**
Error	163	660.64	4.05	
Corrected Total	165	757.08		

Note: **-Highly Significant ($p<0.01$).

The mean annual increment of height was highest at Ulu Cheka site and lowest at Serting (Figure 1). The low MAI at Serting could be reflection of the fact that MAI was calculated based on a three year old data only. However, the next lowest MAI was recorded at Kota.

The mean annual increment of diameter was highest at Ulu Seraja site and lowest at Kota (Figure 2).

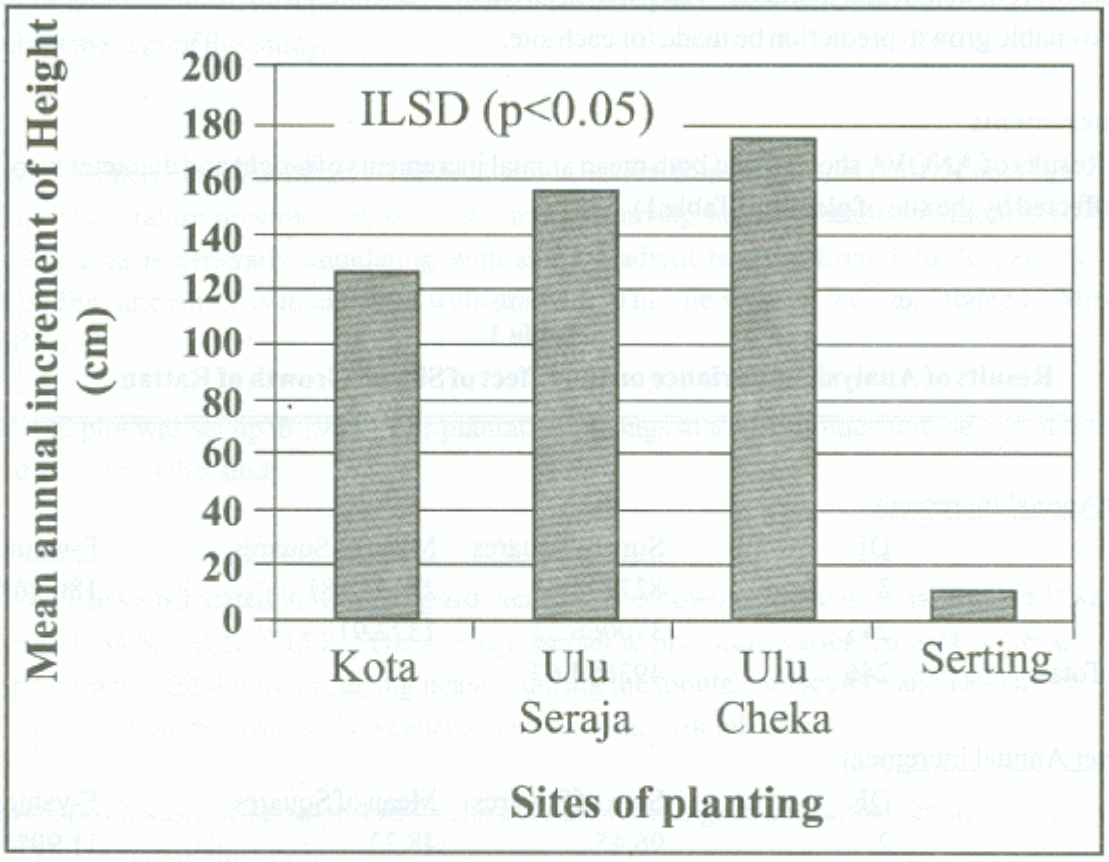

Figure 1: Growth performance of mean annual height increment atdifferent sites.

Growth Prediction

Using the measurement of actual height over time a non-linear regression equation was derived for each site. This can be used to predict the height growth performance. The relationships between height and age for the sites are shown in Figure 3.No regression analysis for Serting site due to insufficient data. From the first to five years of planting, the growth of rattan seemed to increase slowly. After five years onward the growth increased rapidly particularly between 6 and 8 years for Ulu Cheka and Ulu Seraja. It is obvious that to attain a height of for example 15m, it would take longer time at Kota than Ulu Cheka and Ulu Seraja.

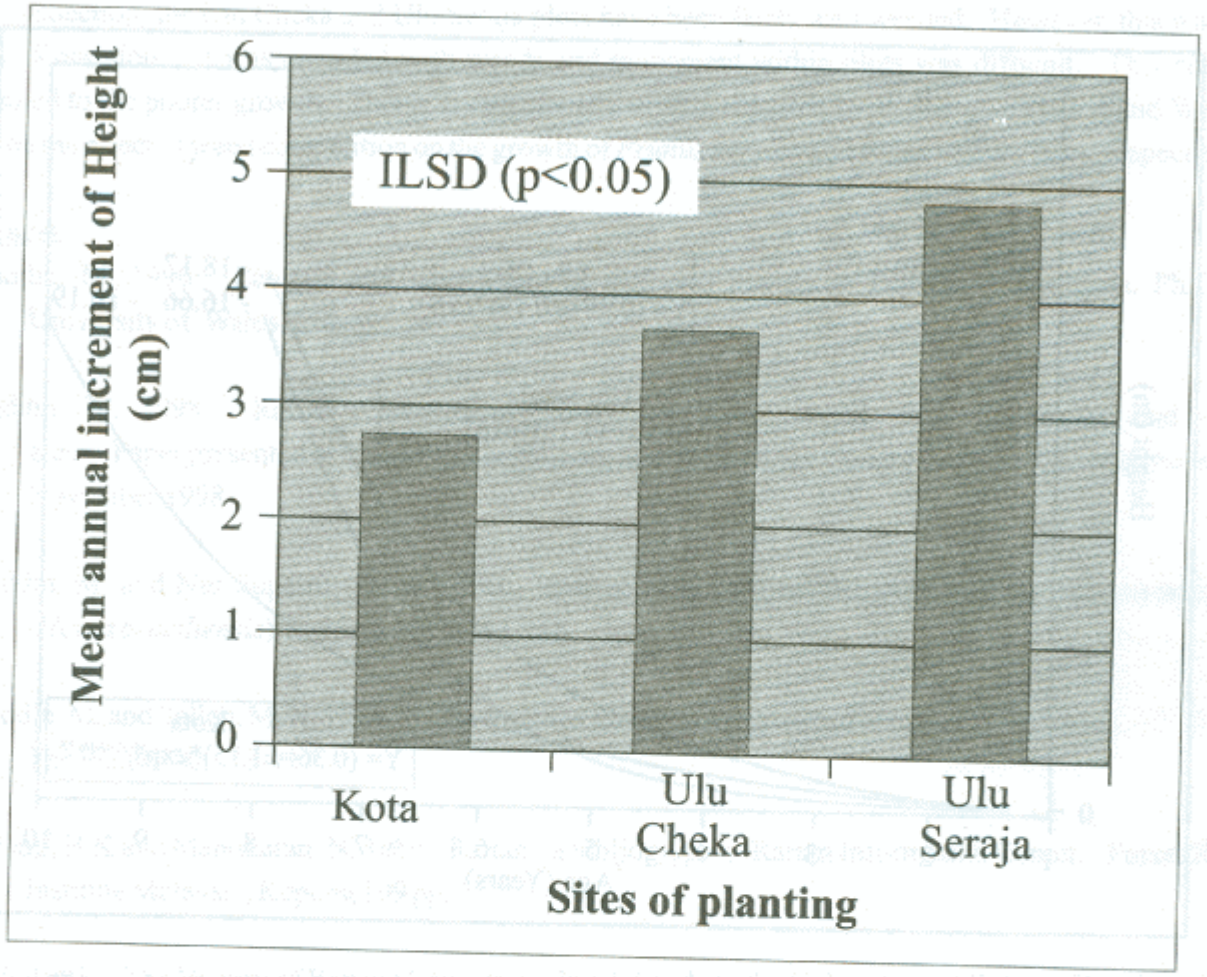

Figure 2: Growth performance of mean diameter annual increment at different sites.

Discussion

Site condition is extremely important for plantation development because the rattan species planted must be able to adapt and grow well. In the last decade, many trials have been conducted to grow rattan under rubber plantations. Rattan prefers, moist, deep soils with texture ranging from sandy loam, loam, silty clay loam, to clay loam (Tan, 1992). *C. manan* is generally considered as a shade tolerant plant occurring on well drained soils in valleys with high humidity. The site suitable for the best growth of *C. manan* has yet to be determined.

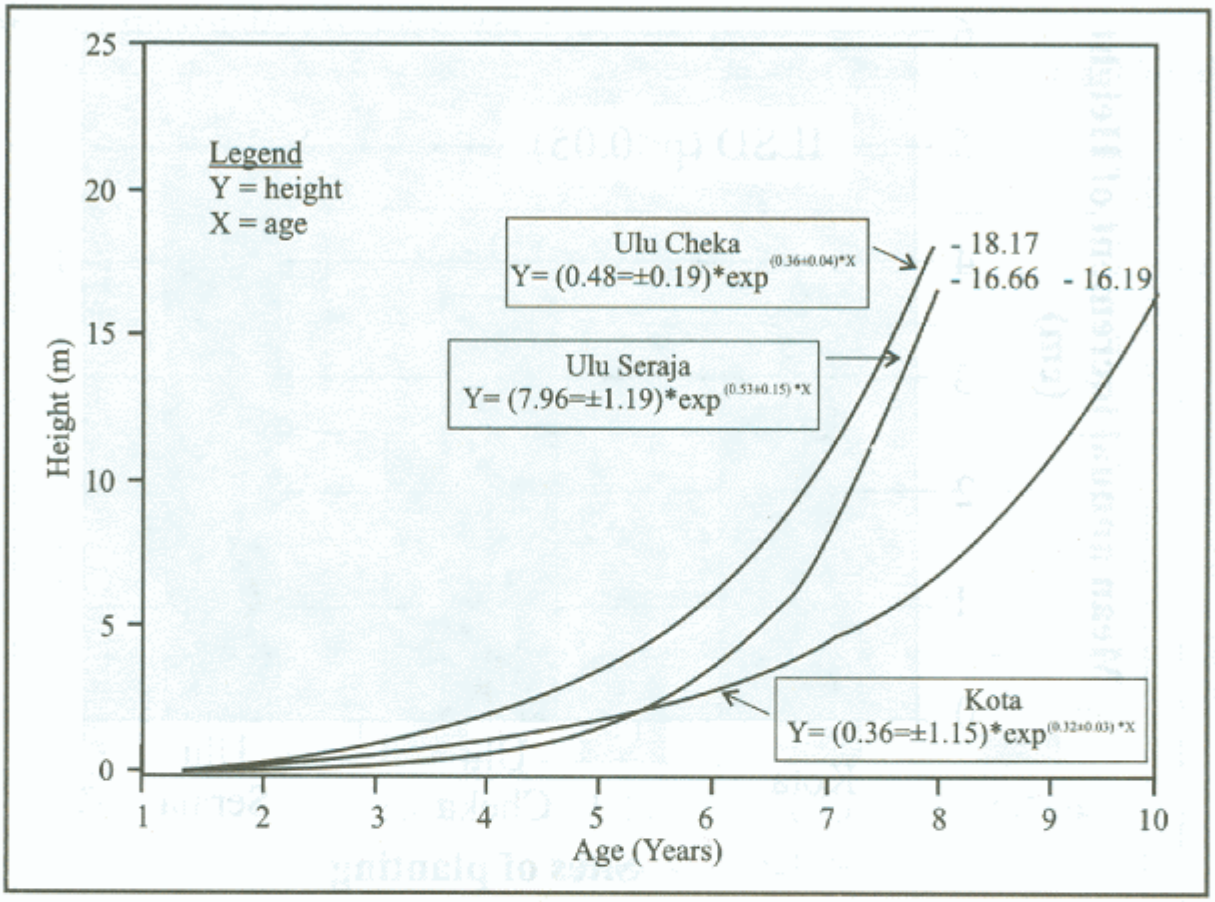

Figure 3 : Relationship between height and age of rattan at Ulu Cheka, Ulu Seraja and Kota

The results of the present day study showed that *C. manan* planted at Ulu Cheka grew better in terms of height compared to the other sites. The poorest growth was at Kota. The soil of Ulu Cheka is of Ulu Dong series, developed from schist/shale, have clay texture and is drained. While at Kota, the soil is of Bt Temiang series, developed from granite, moderately well drained and occurs under hilly topography. There is no significant difference in fertility status among the planting sites. But, it is generally believed that soils developed from schist are less fertile compared to those developed from granite. However, in this study the soil at Ulu Cheka, developed from schist/shale, promoted higher than the soil developed from granite.

Another factor that may account for the growth difference is management practice such as weed control. In this connection, the Ulu Cheka and Ulu Seraja plots have been fairly well weeded. However, this was not the case of Kota plots. It was crowded with weeds and movement within plots was difficult. This could have contributed to the poorer growth. This is in agreement with that reported by Weller et.al.(1985) and Wood et al. (1992) on the effect of weed competition on the growth of *Prunus persica* and *Pinus radiata* trees, respectively.

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