PROPAGATION OF RATTANS IN THE WESTERN GHATS – A SPECIES TRIAL

(Final report of the project KFRI 337/2000. April 2000 - March 2005)

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KFRI

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PROJECT PROPOSAL

Project No. : KFRI 337/2000

Title : Propagation of rattans in the Western Ghats–A species trial

Investigator : Dr. C. Renuka

Objectives : To establish species trial plots at different localities with economically important species of rattans.

To monitor the growth performance of species planted for five years.

To monitor the growth performance of the species raised by Kerala Forest Development Corporation at various places.

Duration : April 2000 - March 2005

Funding Agency : Planning and Economic Affairs Dept., Govt.of Kerala

CONTENTS

Abstract

Species selection is very important when large scale plantations are planned or when some of the commercially important species from other regions are adopted and acclimatized for widening the resource base. Hence a species trial of rattans with four species from Karnataka and Goa part of the Western Ghats was conducted at two different elevations, at Kacchithodu at 300 m under Thrissur Forest Division and at Nelliampathy at 1000 m under Nemmara Forest Division. Species planted were *Calamus prasinus, C. nagbettai, C. stoloniferus* and *C. thwaitesii* (Goa Provenance). The former three species are reported from Karnataka region of the Western Ghats. Survival percentage and growth in height were monitored during the experimental period.

C. nagbetttai grew well at both elevations. Hence this species is recommended for raising large scale plantations at elevations up to 1000 m. It provides large diameter canes (about 3 cm in diameter) and is suitable for furniture frame work.

The Kerala Forest Development Corporation had planted three species, *C. thwaitesii* (Kerala Provenance), *C. pseudotenuis* and *C. rivalis* at four different altitudes, 650, 1000, 1150 and 1550 m. Survival percentage and growth in height were monitored here also. The survival of *C .pseudotenuis* was more than 90 percent in all the areas except at Nemmara where it declined drastically for all the species. The main reason for the decline in the survival percentage was the exposure of roots due to rodents' activity and soil erosion.

Acknowledgements

The author gratefully acknowledges the financial support from the Western Ghat Cell, Planning and Economic Affairs Department, Government of Kerala. The whole hearted support and encouragement given by Dr. J .K. Sharma, Director, KFRI and Dr. R. Gnanaharan, Research Coordinator is gratefully acknowledged. The author is extremely thankful to the officers of the Kerala Forest Development Corporation for their help in the field. Mrs. P. Rugmini, Scientist, Statistics, did the data analysis. The help given during the field work by Mr. K. Dinesan is much appreciated. Mr. James P. Thomas, Mr. V. B. Sreekumar helped in measurements and data entry. Thanks are also due to Mr. K.C. Chacko, Dr. K.K. Seethalakshmi and Dr. C. Mohanan for editorial scrutiny.

INTRODUCTION

World wide, millions of people trade in or use rattan for a variety of purposes. Almost all rattans are collected from the natural forests. In recent years, uncontrolled harvesting and deforestation have exhausted the desired species in many rattan producing countries in Asia. Plantations of rattans are needed in order to relieve pressure on overexploited natural forests and to ensure sustainable supplies of desirable species for the industry.

India is represented with four genera and 62 species of rattans out of which the Western Ghats harbour about 22 species (Renuka and Bhat, 2002) and Kerala State has 15 species (Anto *et al.*, 2001). During recent years, large-scale extraction of rattans coupled with deforestation for various programmes has caused alarming depletion of the natural population of rattans in Kerala and many of the species are on the verge of extinction. Local scarcity of material is evident from the fact that, small-scale industries in Kerala are getting their raw material supply from the north-eastern states and the Andamans. Conservation and mass multiplication are some of the measures needed to be undertaken urgently to maintain a sustainable resource base for this valuable group of plants. In addition to these, adopting and acclimatizing some of the commercially important species from other regions can widen the resource base. This can be achieved through multi locational species trials.

Rattans occur from almost sea level to 2000 m asl. While species like *Calamus pseudotenuis, C. brandisii,* and *C. gamblei* prefer high altitudes, ie., above 700 m asl, *C. thwaitesii, C. rivalis.* etc. have a wide range of distribution. At present not much data are available pertaining to the general growth performance of different species of rattans at different areas (Renuka and Rugmini, 1996). Now, as the Kerala Forest Department is planning for large-scale plantation of rattans, it is desirable to know which species is suitable for a particular area.

The Institute has supplied about 40000 seedlings of three rattan species, *C. pseudotenuis, C. rivalis and C. thwaitesii* to the Kerala Forest Development Corporation (KFDC). KFDC has raised trial plots of these species at four localities. Monitoring the growth of these plants also will be helpful to evaluate the performance of these species at different altitudes.

This study was taken up with the following objectives:

1. To establish species trial plots at different altitudes with economically important species of rattans

2. To monitor the growth performance of species planted

3. To monitor the growth performance of the species planted by Kerala Forest Development Corporation at various places.

MATERIALS AND METHODS

Seeds of four commercially important species of rattans, not common to Kerala, were collected from the Western Ghat regions of Karnataka and Goa. Species selected were *Calamus prasinus* Lakshmana & Renuka, *C. nagbettai* Fernandez & Dey, *C. thwaitesii* Becc. & Hook. f. (Goa provinence) and *C. stoloniferus* Renuka. Of these, *C. prasinus, C. nagbettai,* and *C. stoloniferus* were from Karnataka region of the Western Ghats. The populations of *C. thwaitesii* seen on the northern parts of the Western Ghats are different from that of southern parts. Hence *C. thwaitesii* from Goa was included in the experiment to assess the performance of this population in Kerala.

Seedlings were raised in the nursery at the KFRI Field Research Centre, Veluppadam. One-year-old seedlings of these four species were planted. Planting sites were selected at 300 m asl at Kacchithodu (Thrissur Forest Division) and at 1000 m asl at Nelliampathy. (Nemmara Forest Division). The planting was done in the evergreen forests after the pre- monsoon showers. The species were planted in a randomised complete block design with equal replications in a block. Five replications were given for each species. Within each plot there were 25 plants (5 x 5) with a spacing of 2 m. Observations on survival and height were taken annually. Arithmetic means of height of 25 plants within each plot were computed. The data on mean height and survival percentages were subjected to analysis of variance. The data on height were transformed to logarithmic values and survival percentages to angular values before they were subjected to analysis of variance. The analysis of variance was followed by comparison of means by the Duncan's Multiple Range Test (Gomez and Gomez, 1984).

A total of 40000 one– year-old seedlings of three species, viz., *C .rivalis* Thw. ex. Trim., *C. thwaitesii* Becc. & Hook. f. and *C. pseudotenuis* Becc. & Hook. f. were supplied to the Kerala Forest Development Corporation under this project. The same species were planted at four different altitudes, 650 m asl, 1000 m asl, 1150 m asl and 1550 m asl at Kuttakkuzhy, Nemmara, Mankulam and Kadalar respectively. The planting was done in the evergreen forests after the pre-monsoon showers. Based on the total area planted, 20 plots were marked at Kuttakkuzhi, 28 at Kadalar, nine at Mankulam and 10 at Nemmara for monitoring the survival and growth in height (Maps 1-5). Each plot was having 25 plants of each species planted.

RESULTS AND DISCUSSION

Species trial

The survival percentage and growth in height of the different *Calamus* species planted were monitored in the two species trial plots. At Kacchithodu data for three years only were available because a part of the experimental plot was destroyed due to wild fire.

Survival

Kacchithodu

The mean survival percentage of plants is presented in Table 1 and Figure 1. At Kacchithodu *C. nagbettai* showed 69 per cent survival followed by *C. thwaitesii* with 56 per cent. *C. stoloniferus* and *C. prasinus* were having 42 and 50 per cent survival respectively.

Table 1. Mean survival (%) at two altitudes at consecutive years after planting

Year	Place	*C. thwaitesii*	*C. nagbettai*	*C. stoloniferus*	*C. prasinus*
2001	K	100	100	100	100
	N	100	100	100	100
2002	K	66	82	58	54
	N	73	77	73	73
2003	K	56	69	42	50
	N	54	65	60	57
2004	N	54	65	59	57

K- Kacchithodu, N- Nelliampathy

The analysis of variance on survival percentage is reported in Table 2. The effects due to species, period and the interaction between species and period turned out significant which indicates that the effect of species varies with the change in period ie., age.

Table 2. Analysis of variance of data on survival (%) at Kacchithodu in angular values

Sources	Degrees of freedom	Mean sum of squares	F value
Species	3	339.86	15.90**
Replication	4	17.05	0.80
Error(1)	12	21.37	
Period	2	7707.90	1031.20**
Species x period	6	98.78	13.21**
Residual	32	7.47	

** - significant at P= 0.01

Nelliampathy

At Nelliampathy the survival almost stabilized after the third year. *C. nagbettai* was having 65 per cent survival followed by *C. thwaitesii* with 54 per cent. *C. stoloniferus* and *C. prasinus* showed 59 and 57 per cent survival respectively (Table 1; Fig. 1).

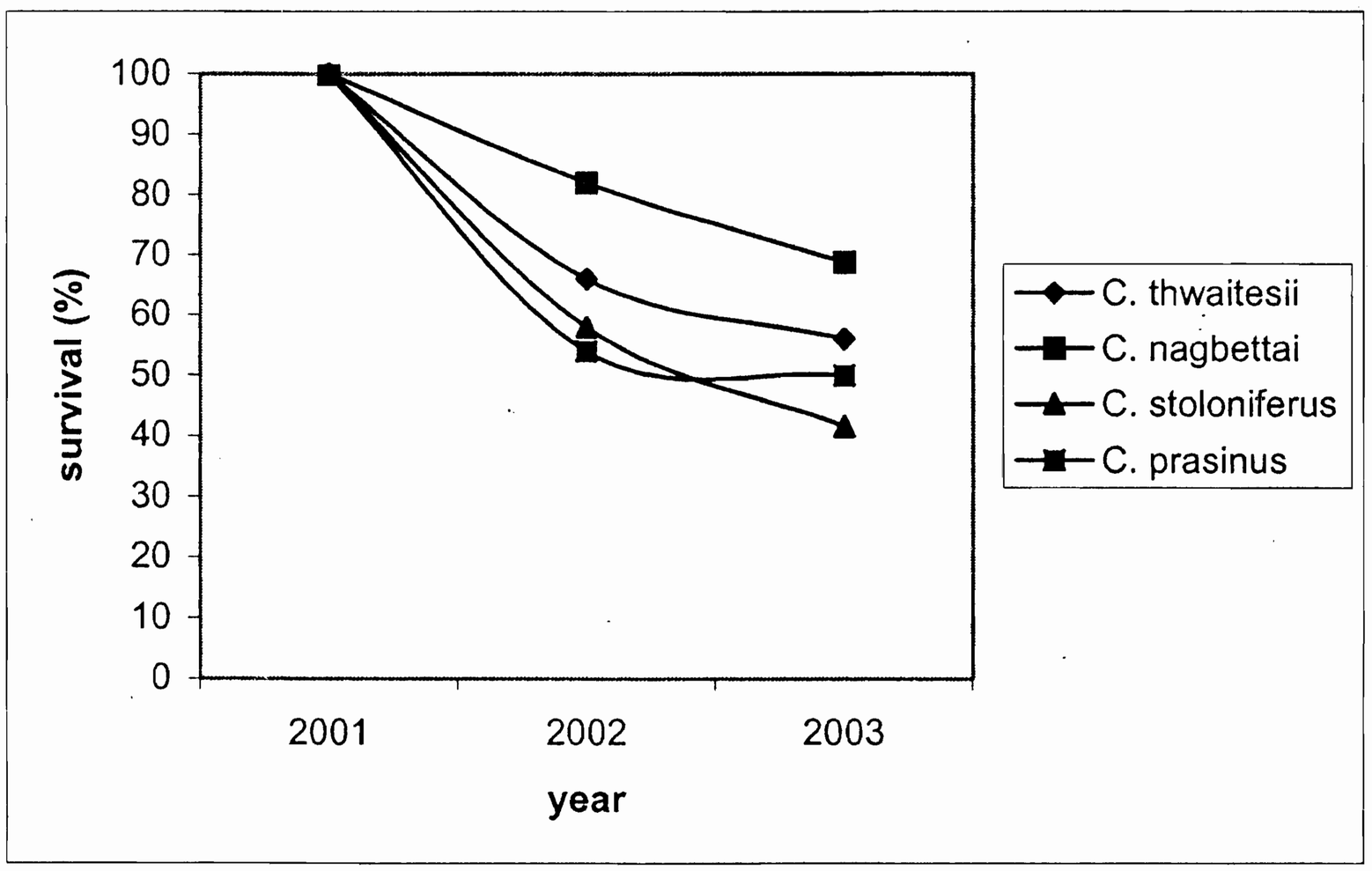
The analysis of variance on survival percentage is reported in Table 3. The effects due to period turned out significant whereas the effects due to species and the interaction between species and period were non significant. This indicates that the effect of species does not vary with the change in period, ie., age.

Table 3. Analysis of variance of data on survival (%) at Nelliampathy in angular values

Sources	Degrees of freedom	Mean sum of squares	F value
Species	3	29.87	0.59
Replication	4	11.84	0.24
Error(1)	12	50.23	
Period	2	6142.44	395.17**
Species x period	6	12.62	0.81
Residual	32	15.54	

** - significant at P= 0.01

Kacchithodu



Nelliampathy

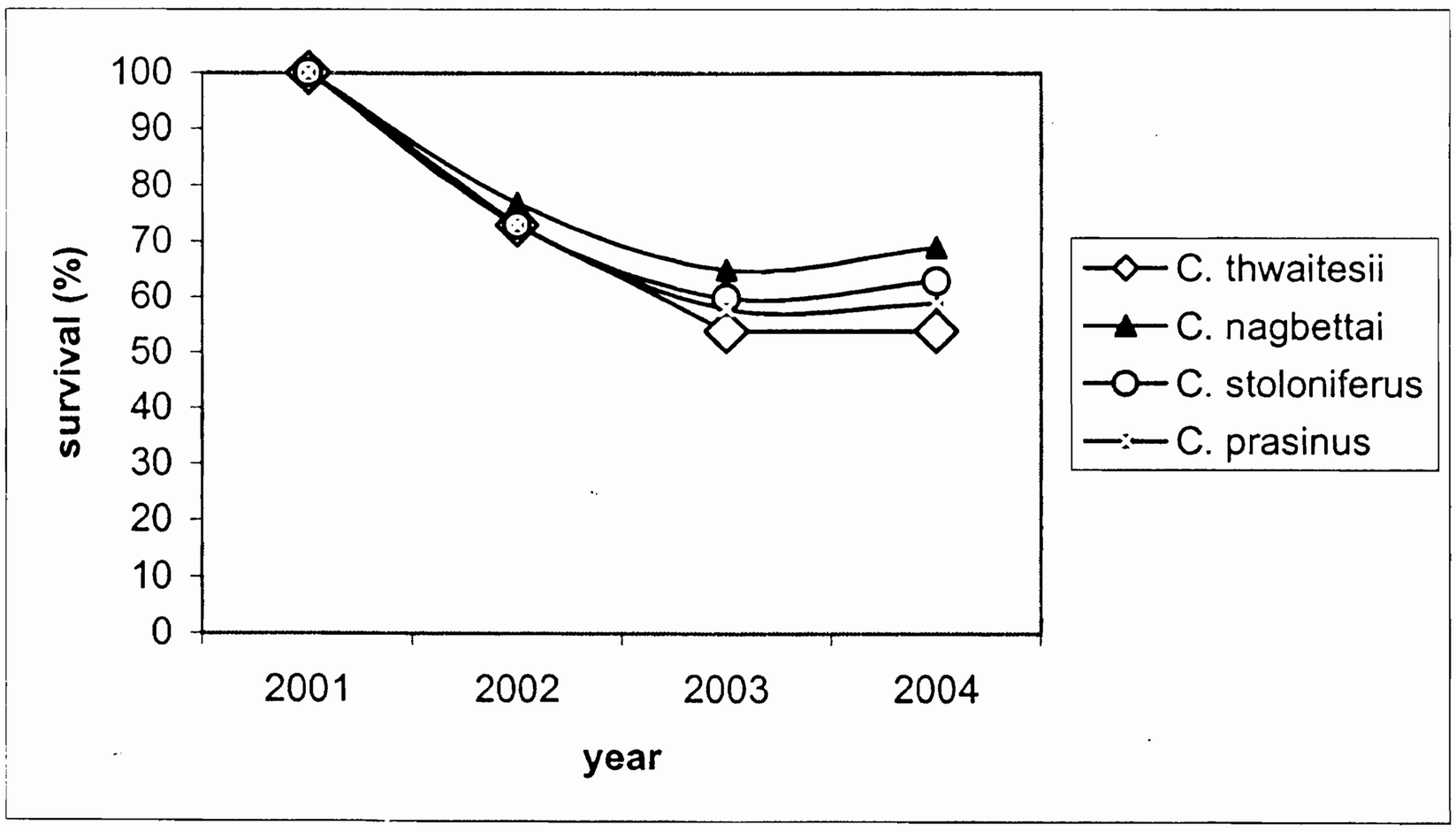


Fig. 1 Survival (%) of the four species at consecutive years after planting

Of the four species planted *C. nagbettai* is having more survival percentage in both the locations. It shows about 69 per cent survival at Kachithodu and 65 per cent at Nelliampathy (Table 3).

Height

Kacchithodu

The mean annual height is given in Table 4. *C. nagbettai* attained 53 cm followed by *C. prasinus* with 41 cm. *C. thwaitesii* had 28 cm while *C. stoloniferus*, 27 cm.

The analysis of variance on mean height is reported in Table 5. The effects due to species, period and interactions between species and period turned out highly significant, indicating that the effect of species varies with the change in period.

Table 4. Mean height at two altitudes at consecutive years after planting

Year	Place	Height (cm)			
		C. thwaitesii	*C. nagbettai*	*C. stoloniferus*	*C. prasinus*
2001	N	21	32	20	29
	K	20	39	19	32
2002	N	24	38	24	36
	K	22	45	22	36
2003	N	29	48	26	39
	K	28	53	27	41
2004	N	37^{c}	64^{a}	28^{d}	47^{b}

Values superscribed by different letters differ significantly. K – Kacchithodu, N – Nelliampathy.

Table 5. Analysis of variance of data on mean height (cm) at Kacchithodu in logarithmic scale

Sources	Degrees of freedom	Mean sum of squares	F value
Species	3	0.15	188.33**
Replication	4	0.004	4.26*
Error(1)	12	0.001	
Period	2	0.050	399.67**
Species x period	6	0.001	3.92**
Residual	32	0.0003	

** - significant at P= 0.01 ; * - significant at P= 0.05

Nelliampathy

The mean annual height is given in Table 4. At the end of fourth year, *C. nagbettai* attained 64 cm followed by *C. prasinus* with 47 cm. *C. thwaitesii* attained 37 cm while *C. stoloniferus* had 28 cm (Fig. 2).

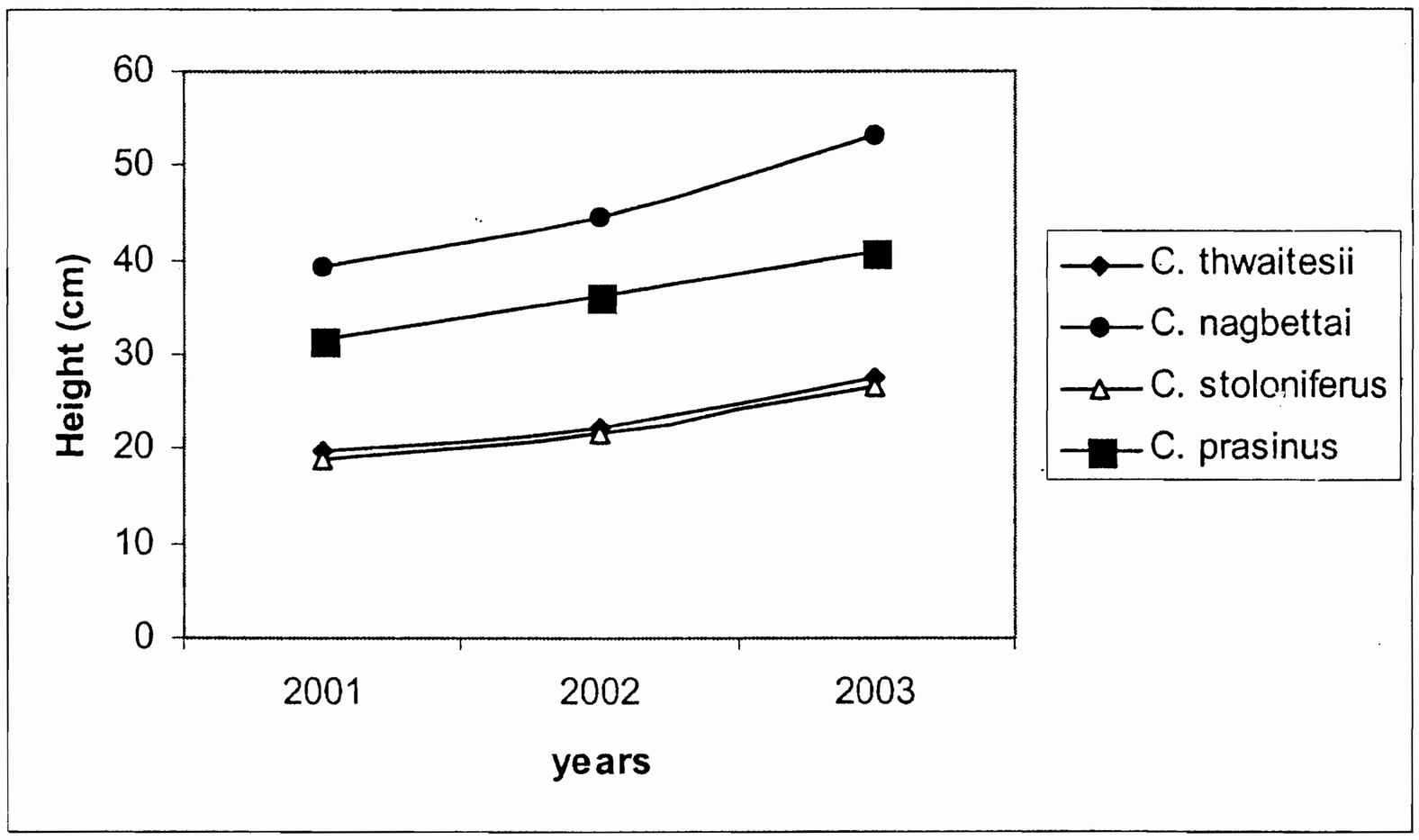
The analysis of variance (ANOVA) on mean height is reported in Table 6. The effects due to species, period and interactions between species and period turned out highly significant, indicating that the effect of species varies with the change in period.

Table 5. Analysis of variance of data on mean height (cm) at Nelliampathy in logarithmic scale

Sources	Degrees of freedom	Mean sum of squares	F value
Species	3	1.01	208.79**
Replication	4	0.01	2.00
Error(1)	12	0.005	
Period	2	0.50	368.17**
Species x period	6	0.01	8.46**
Residual	32	0.001	

** - significant at P= 0.01

Kachithodu



Nellaimpathy

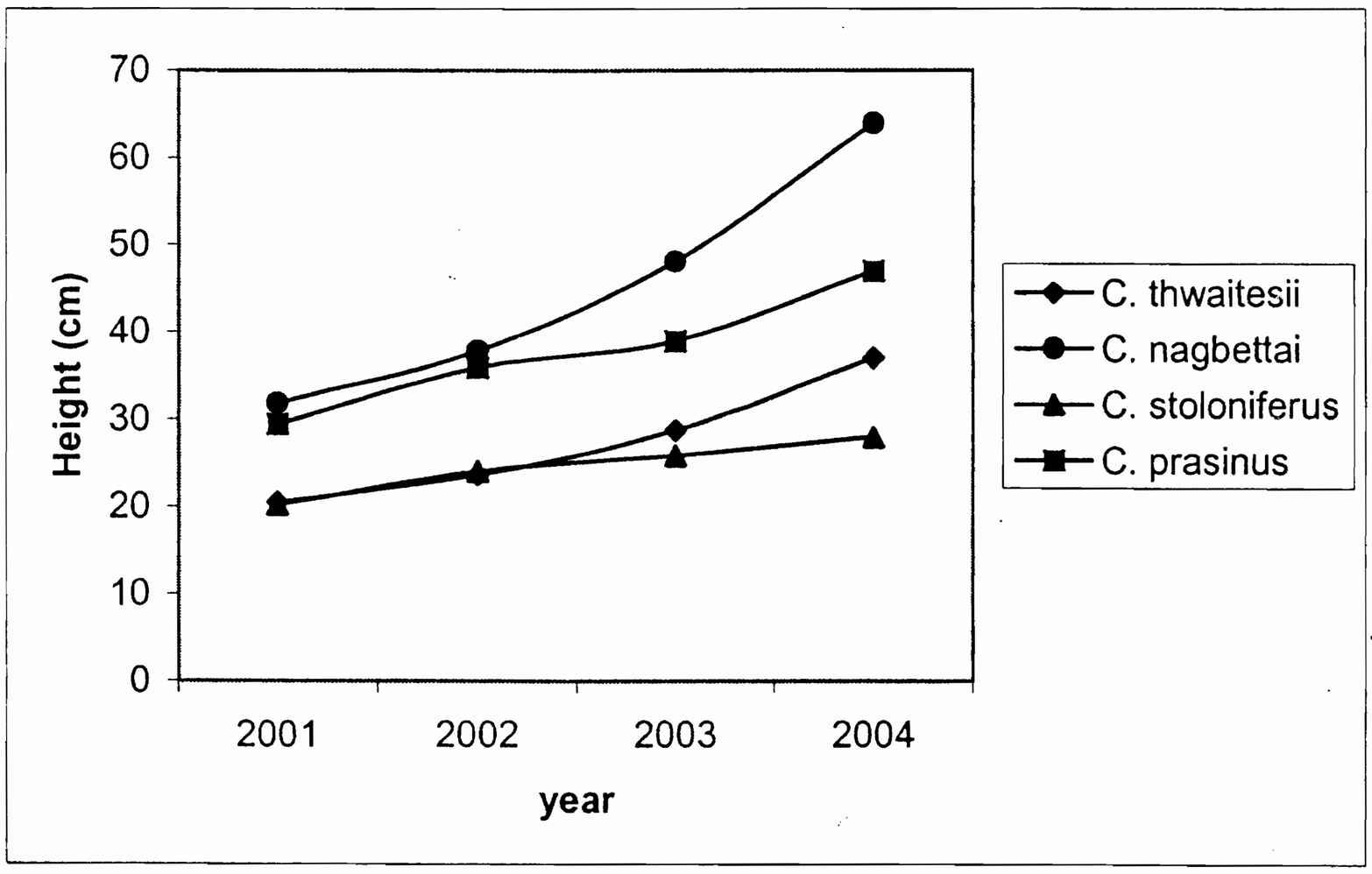


Fig. 2. Growth in height of the four species at consecutive years after planting

At Nelliampathy pair-wise comparison between the species at the end of fourth year showed that the species differed significantly from each other (Table 4). *C. nagbettai* showed higher growth in height than the other species.

When mean height is considered *C. nagbettai* is the best species suited for both the elevations.

Observations from the KFDC plantations

Survival

The survival of the seedlings in KFDC trial plots (Maps 1-5) at various places was monitored. The survival status at the end of four years is given in Table 7. *C. pseudotenuis,* planted at all the locations, showed good survival except at Nemmara. At Nammara the survival of all the species was poor at the end of four years. *C. pseudotenuis* had 48 per cent survival and *C. thwaitesii*, 45 per cent, while *C. rivalis* registered 66 per cent. The main reason for the decline in the survival percentage was the exposure of roots due to rodents' activity and soil erosion.

Table 7. Mean survival (%) at the end of four years

Altitude (m asl)	Survival (%)		
	C. pseudotenuis	*C. thwaitesii*	*C. rivalis*
650 (Kuttakuzhy)	97	NP	NP
1000 (Nemmara)	48	45	66
1150 (Mankulam)	90	78	NP
1550 (Kadalar)	100	80	80

NP- Not planted

Height

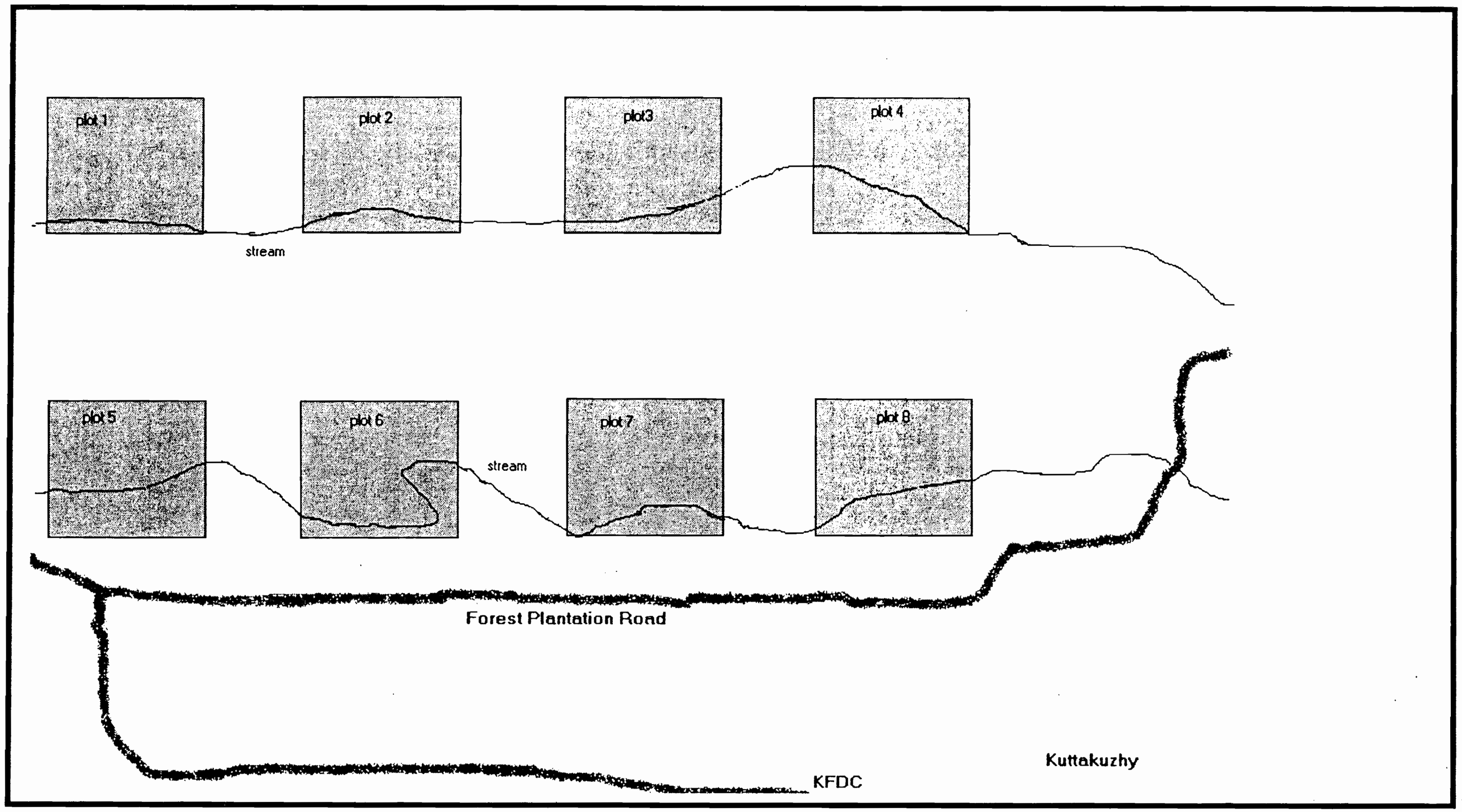
Table 8. Mean height at the end of four years

Altitude (m asl)	Average height (cm)		
	C. pseudotenuis	*C. thwaitesii*	*C . rivalis*
650 (Kuttakuzhy)	19	NP	NP
1000 (Nemmara)	34	29	110
1150 (Mankulam)	25	14	NP
1550 (Kadalar)	32	16	160

NP – Not planted

At the end of four years *C. rivalis* showed a mean height of 110 cm and 160 cm at 1000 m and 1550 m elevations respectively (Table 8). This is a small diameter rattan and hence will grow faster when compared to the other two species. *C. thwaitesii* is a large diameter rattan and the time taken for the initial formation of the basal part of the stem will be longer when compared to medium diameter *(C. pseudotenuis*) and small diameter rattans.

In the natural conditions also *C. pseudotenuis* is seen above 700 m asl. When both survival and growth are considered, *C. pseudotenuis* can be considered as a good choice for plantations at higher altitudes.



0 142 284

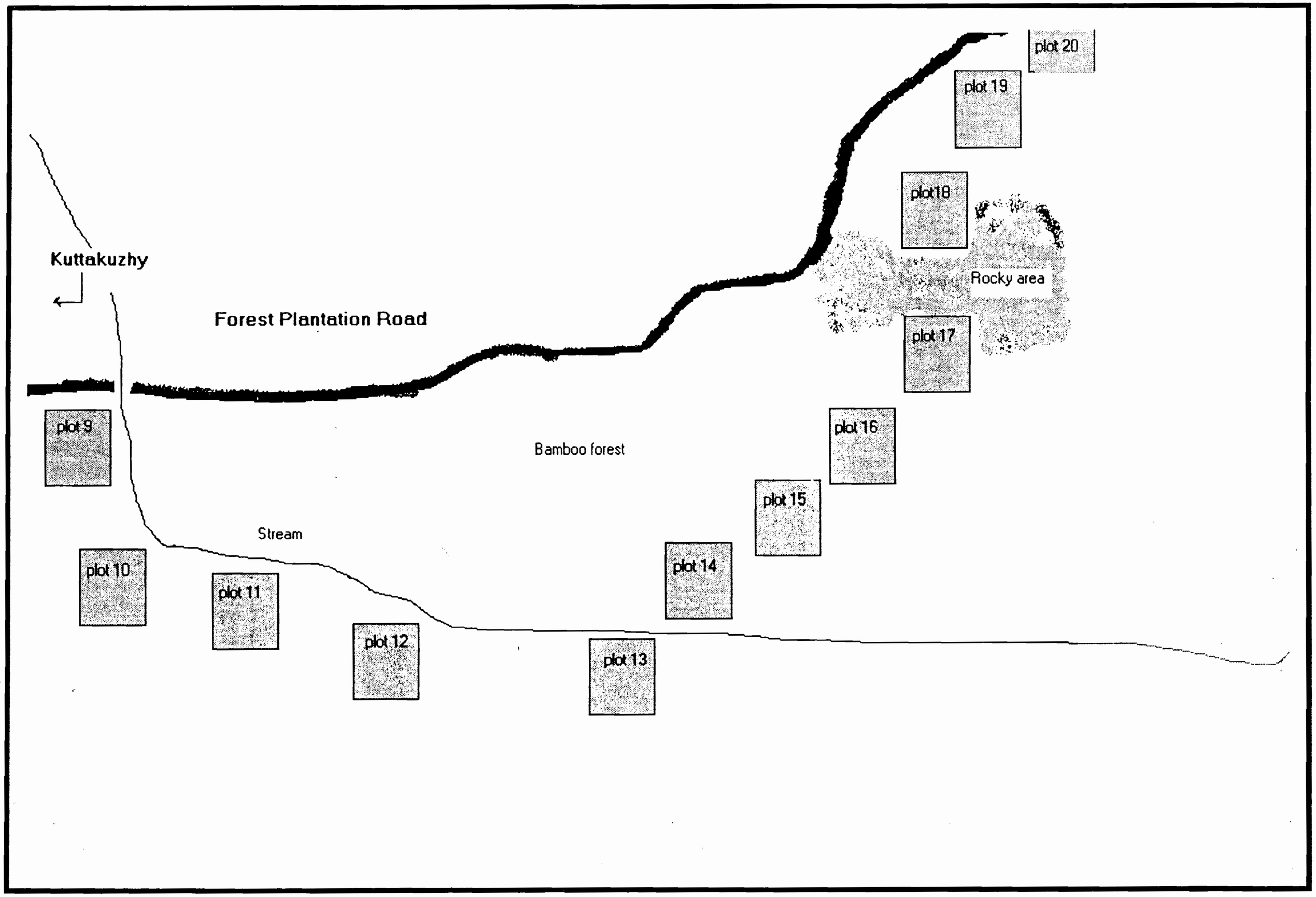
metres

LEGEND

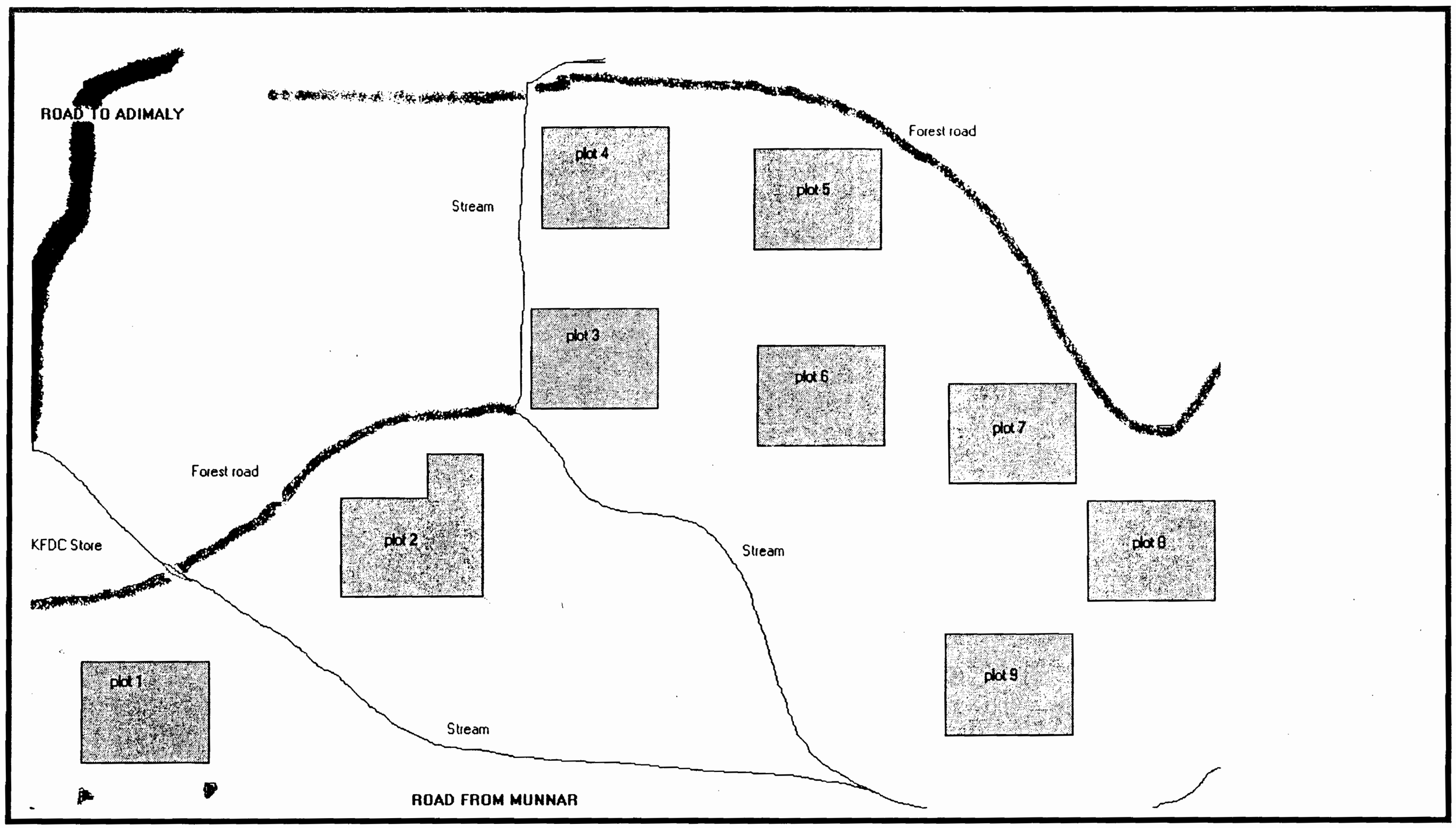
Forest plantation road

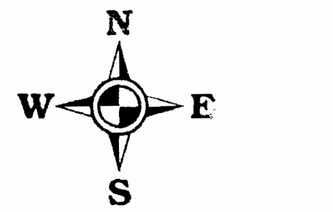
Streams

Plot map I. Kuttakkuzhy Area I – 650 m.



Plot map 2 Kuttakkuhy area II – 650 m.

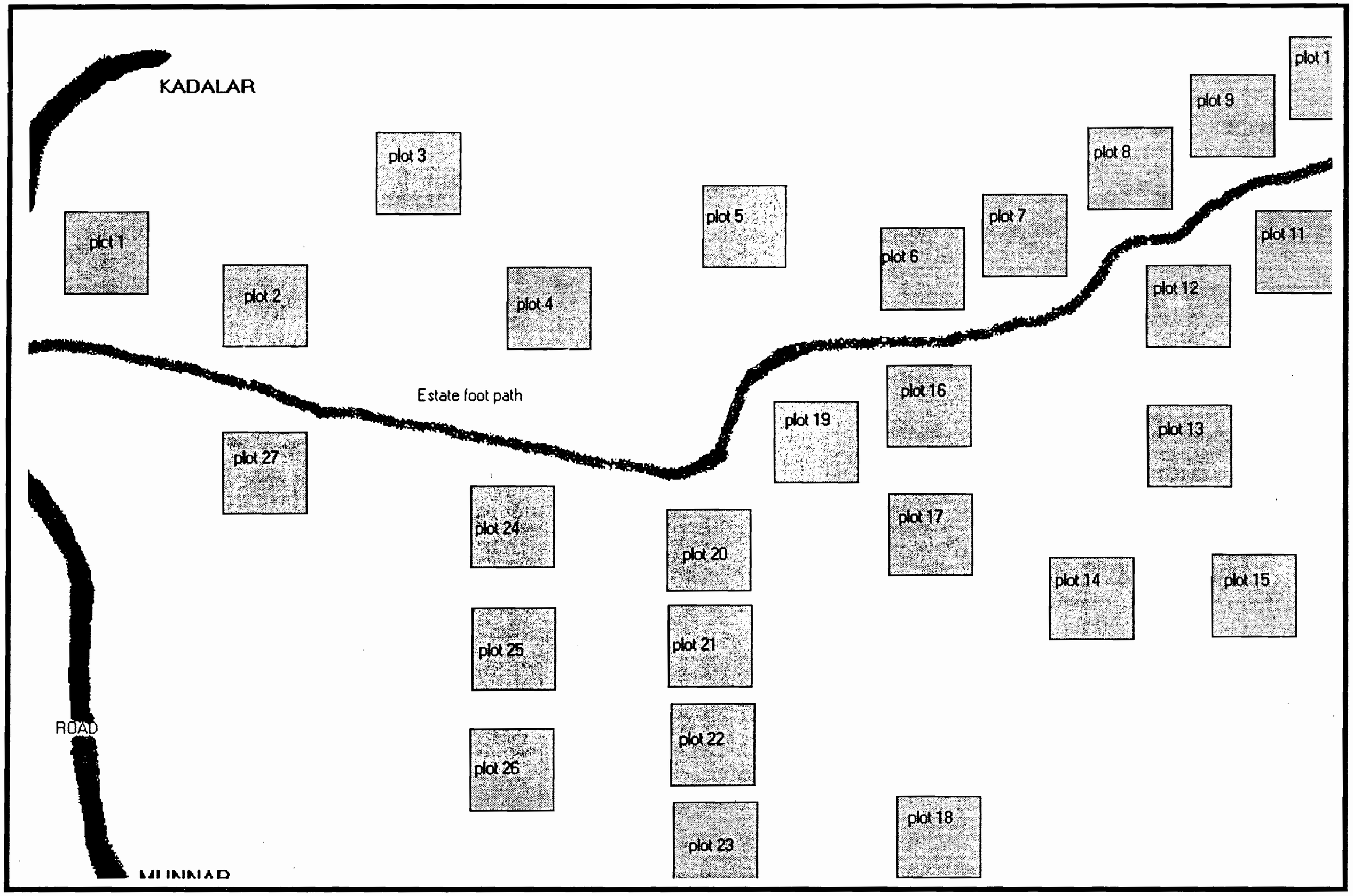


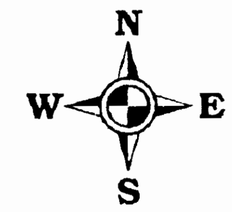


LEGEND

- Road
- Forest road
- Stream

Plot map 3. Valapara, Mankulam – 1150 m.





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metres

LEGEND

Road

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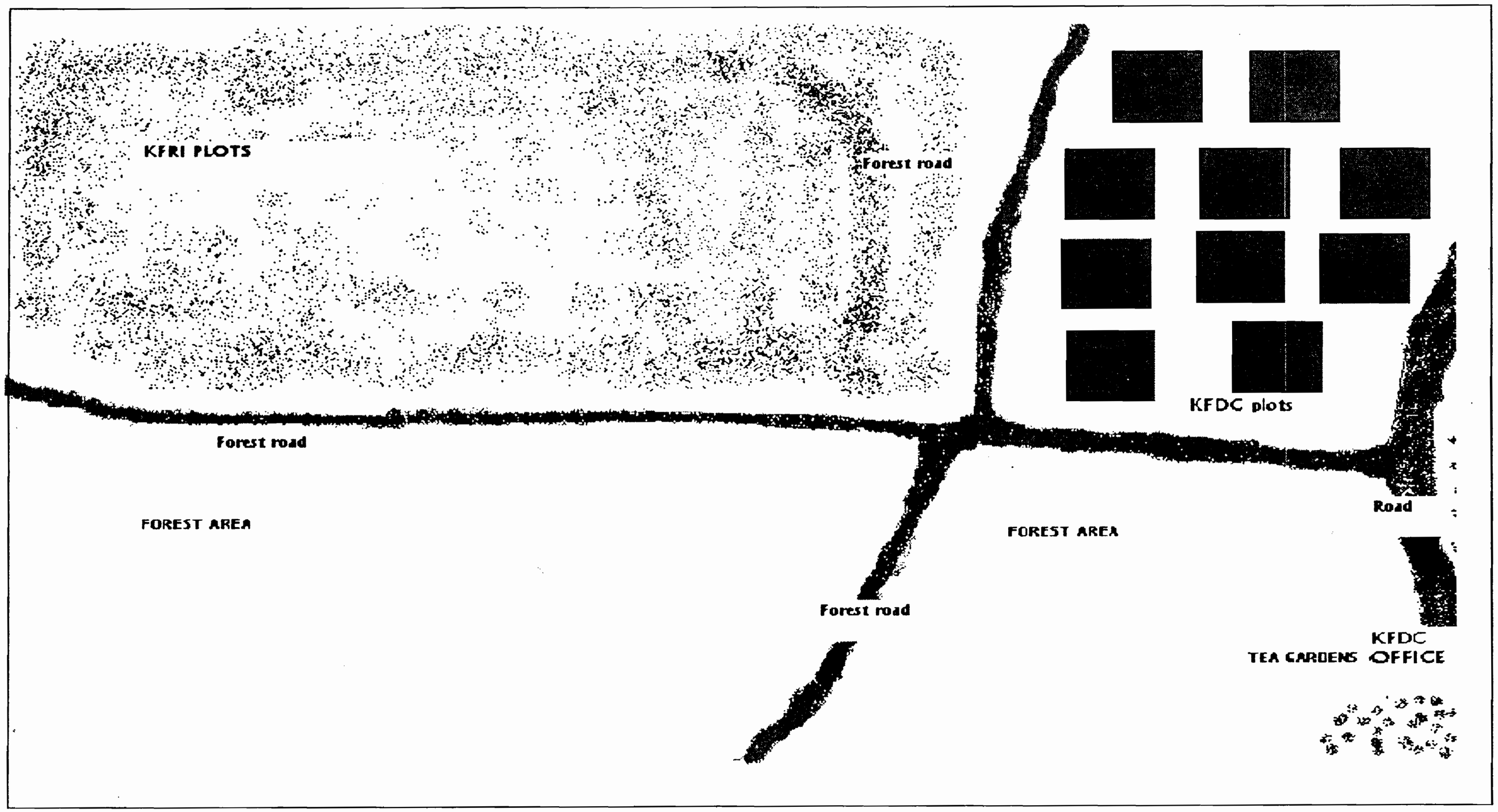
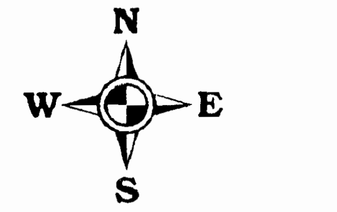
Plot map 4. KADALAR – 1550





Plot map 5. Nelliampathy – 1000 m

CONCLUSIONS

The species trials show that of the four species tried, *C. nagbettai* is the best species suited for both 300 and 1000 m elevations.

Calamus nagbettai Fernandez & Dey is a clustering, large diameter rattan. Stem without sheaths measures up to 3 cm in diameter. The stem has characteristic black patches at the basal portion. Juvenile leaves are brown in colour (Fig. 3).The mature leaves are cirrate. The young leaves are ecirrate. The cirrus develops when the plant is of about 4 years of age. Leaf sheath is yellowish green to green, lower half densely armed with spines. Fruits are ovoid, about 1.6 x 0.9 cm, scales brown with a thin, dark brown margin.

The species is seen in the Subramanya forests of Dakshina Kannada district, Karnataka. To a smaller extent it is found in the adjacent Bisle State Forest of Hassan district (Lakshmana, 1993). Even though this species is reported from Kerala also, only one or two plants are seen in that area (Sasidharan and Anto, 1997).

Bhat(1992) reported this species as a comparatively strong rattan. This is used in the furniture industry especially for frame work where strength is required. It is claimed to have medicinal uses (Lakshmana, 1993).

Observations from the KFDC plots show that *C. pseudotenuis* has more than 90 per cent survival in all the areas except at Nemmara where the survival declined drastically for all the species. The main reason for the decline in the survival was the exposure of roots due to rodents' activity and soil erosion. In the natural forests also *C. pseudotenuis* prefers higher altitudes, ie., from 700 m and above. This species is a good choice for plantations at higher altitudes.

Juvenile plant

Mature plant

Leaf sheath

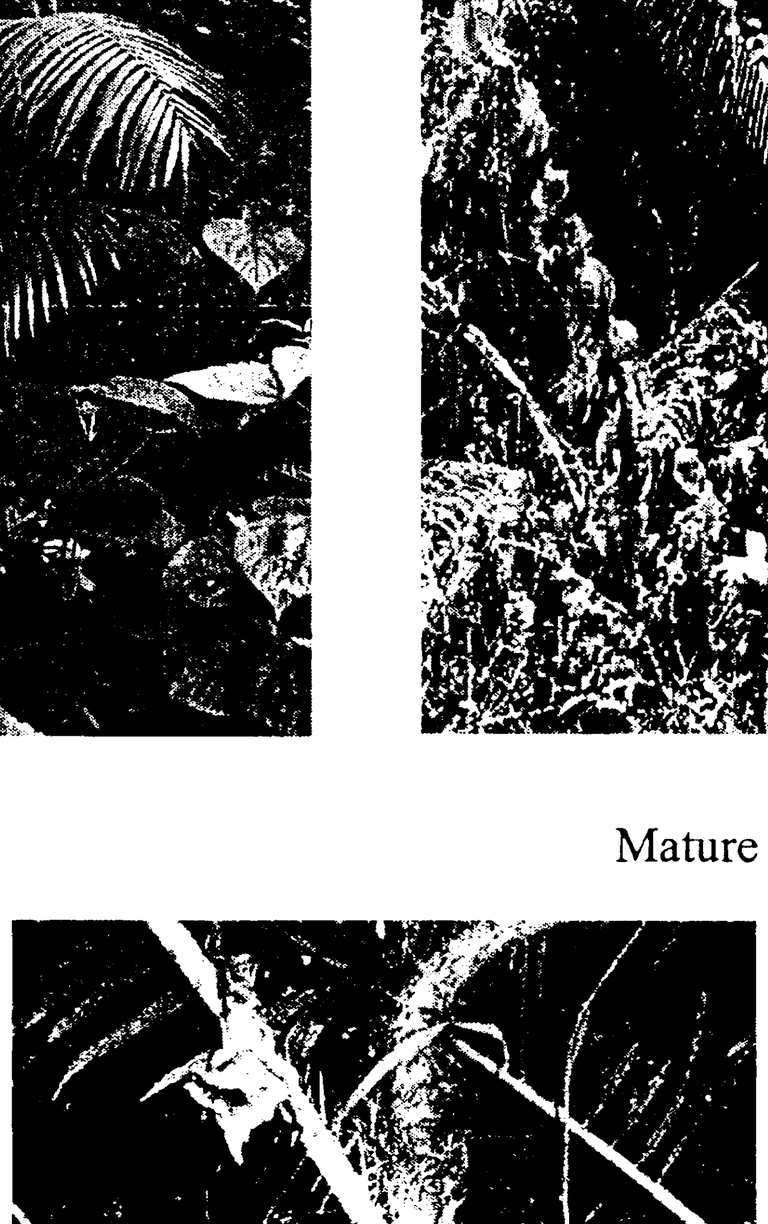


Fig. 3. Calamus nagbettai

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