J. Bamboo and Rattan, Vol. 3, No. 3, pp. 187–193 (2004)

Also available online - www.vsppub.com

The growth performance of different commercially important rattans at eight years after planting

C. RENUKA *, P. RUGMINI, J. P. THOMAS and V. V. RANGAN

Kerala Forest Research Institute, Peechi, 680 653 Thrissur, Kerala, India

Abstract—A species trial with eight commercially important rattan species was conducted at two different elevations in the natural forests in Kerala. When both survival and total height are considered, *Calamus baratangensis* is the best species suited for areas around 1000 m elevation and *Daemonorops kurzianus* for 300 m. In the 6th year *C. baratangensis* produced 18 m of commercially utilizable cane at 1000 m and 45 m at 300 m. But during the 8th year the survival percentage of this species was reduced to 10% at 300 m. At the end of 6th year four species reached a harvestable length at 1000 m and five species reached a harvestable length at 300 m.

Key words: Rattan; growth performance; survival.

INTRODUCTION

Being an important forest produce next to timber, rattan forms an integral part of the rural and tribal populace in many of the tropical countries. It is a chief raw material for industries in various parts of the world, providing a source of livelihood for the people residing near the forest areas. Although economically important, rattan remained neglected as natural resource until recently. With the rampant destruction of forests and habitats, its stock at present is highly depleted. Presently, the quantity of rattans from natural habitats is not sufficient to meet the demands of the cane industry. Many of the cane industrial units in southern India are known to get their supplies from N.E. India, but the status of forests in N.E. India itself is also a matter of concern due to shifting cultivation and heavy logging [1]. Furthermore, in the Andaman and Nicobar islands the natural resources are decreasing at a faster rate due to over-exploitation [2]. If this depletion continues at the present rate, the natural rattan resources will almost be totally decimated in a few years.

*To whom correspondence should be addressed. E-mail: renuka@kfri.org

Rattans are gaining importance as a plantation crop since cultivation of commercially important species for the industrial sector can relieve the pressure on the wild stock. In Kerala, large-scale rattan plantations can be raised only in natural forests owned by the Government, since there are no private forests.

Before adapting each species for large-scale plantations outside its natural home, species trials should be conducted to assess the suitability of the species for a particular geo-climatic region. Although rattans occur from almost sea level to 2000 m, most of them show altitudinal preferences. Many of the species are distributed below 1000 m, while some are found only at higher altitudes. Some species are restricted to certain localities. To assess the performance of various species at a particular altitude, a species trial was conducted with eight commercially important species of rattans at two different altitudes for eight years and the results are discussed in this paper.

MATERIALS AND METHODS

Details on the selected species are given in Table 1. The experiment was conducted at two different altitudes in natural evergreen forests in Kerala. The first site was selected at Vazhachal Forest Division at an elevation of 300 m and second site was selected at Nelliampathy (Nemmara Forest Division) at an elevation of 1000 m. Vazhachal receives an annual rain fall of 2400–4600 mm. The temperature varies from 18 to 40°C. Nelliampathy receives an annual rain fall of 2512–4780 mm. The temperature varies from 8 to 32°C. The soil in both selected areas was dark brown sandy loam.

Table 1.
Species selected

Species number	Species botanical name	Place of seed collection	Number of plants
SP 1	*C. baratangensis* Renuka and Vijayakumaran	Andamans	50
SP 2	*C. pseudotenuis* Becc. ex Becc. and Hook. f.	Kerala (Peermedu)	40
SP 3	*C. caesius* Bl.	Malaysia	20
SP 4	*C. gamblei* Becc. ex Becc. and Hook. f.	Kerala (Moozhiar)	20
SP 5	*C. andamanicus* Kurz	Andamans	40
SP 6	*C. karnatakensis* Renuka and Lakshmana	Karnataka	10
SP 7	*Daemonorops kurzianus* Becc.	Andamans	10
SP 8	*C. rivalis* Thw. ex Trim.	Kerala (Quilon)	10

The number of plots for each species was decided depending on the number of available seedlings: each plot contained 10 plants; total number of plants in one block was 200; there were two blocks at one elevation with 400 plants in total.

In each site, randomised complete block design was used with the eight species replicated in two blocks. A line of 10 plants constituted a plot. Within a block, the number of plots for a species depended on the availability of seeds. The number of plots for a species remained the same for the two blocks. One year old seedlings were out planted at the onset of monsoon. The seedlings were planted with 2 m spacing.

Yearly observations were taken on the survival, number of suckers produced, height of the main stem and total height (height of the main stem and height of all suckers) for eight years. Some of the seedlings perished in the rosette stage (the seedlings remained without stem formation at least for four years). The data obtained from each location pertaining to the total height and survival percentage over different periods were subjected to analysis of variance separately. Comparison of means was carried out using Duncan's Multiple Range test (DMRT) wherever needed. The analysis of variance conformed to that of a univariate mixed model analysis. The total height values were subjected to logarithmic transformation and the survival percentage was transformed to angular scale before the analysis.

RESULTS AND DISCUSSION

The data collected for 8 years have been analysed for survival percentage and growth in height.

Survival

At Nelliampathy the analysis of variance (Table 2) shows a non-significant interaction between species and period indicating the effect of species did not differ over periods with reference to survival, contrary to Vazhachal. Mean values of survival percentage of the eight species corresponding to different periods are reported in Table 3. At Nelliampathy, *C. gamblei* (SP4) and *C. karnatakensis* (SP6) recorded higher survival percentage. At the end of the reporting period, at Vazhachal, *D. kurzianus* (SP7) showed higher survival percentage compared to other species (Table 4). Even though there was a gradual reduction in the survival rate at both places, in Vazhachal it was very prominent. This can be attributed to the heavy reed growth and disturbance from the elephants.

Total height

The analyses of variance (ANOVA) on total height, for both the locations, are presented in Table 5. At Nelliampathy, only period had significant influence on total height. The mean height values of different species are reported in Table 6. *C. baratangensis* (SP1) recorded the maximum total height. The reduction in total height in some years is due to the damage caused by the wild animals.

Table 2.
Analysis of variance of data on survival percentage of plants at Nelliampathy and Vazhachal in angular scale

Source	df	Nelliampathy		Vazhachal	
		MSS	*F* value	MSS	*F* value
Species	7	3692.13	1.82 (ns)	1231.22	1.99 (ns)
Block	1	8576.24	4.23 (ns)	5755.79	9.32*
Species×block	7	2028.65	1.65 (ns)	617.65	2.02 (ns)
Replication within block×species	24	1227.01	—	305.45	—
Period	6	2107.77	8.52**	10 842.09	62.16**
Species×period	42	102.98	0.42 (ns)	305.45	1.75*
Block×period within species	48	247.49	0.90 (ns)	174.42	1.54*
Residual	144	275.71		113.39	

Abbreviations: df, degrees of freedom; MSS, mean sum of square; ns, not significant.
*Significant at $P = 0.05$.
**Significant at $P = 0.01$.

Table 3.
Mean survival percentage of eight species at Nelliampathy at various time points

Period (years after)	Survival percentage							
planting	SP1	SP2	SP3	SP4	SP5	SP6	SP7	SP8
2	90	70	40	80	75	100	90	100
3	90	66	25	80	70	100	80	90
4	83	50	15	65	62	100	80	80
5	81	42	15	60	55	100	80	80
6	71	53	15	60	52	80	40	50
7	70	53	15	60	45	80	40	50
8	54	53	15	60	40	60	10	50

SP1, *C. baratangensis*; SP2, *C. pseudotenuis*; SP3, *C. caesius*; SP4, *C. gamblei*; SP5, *C. andamanicus*; SP6, *C. karnatakensis*; SP7, *Daemonorops kurzianus*; SP8, *C. rotang*.

Table 4.
Mean survival percentage of eight species at Vazhachal at various time points

Period (years after	Survival percentage							
planting)	SP1	SP2	SP3	SP4	SP5	SP6	SP7	SP8
2	95	96	73	98	73	85	80	95
3	95	88	70	98	70	85	75	95
4	92	79	38	95	60	85	70	85
5	86	73	38	95	50	85	70	85
6	39	49	28	25	49	25	40	55
7	34	29	20	5	26	25	35	25
8	10	14	10	0	19	20	35	25

SP1, *C. baratangensis*; SP2, *C. pseudotenuis*; SP3, *C. caesius*; SP4, *C. gamblei*; SP5, *C. andamanicus*; SP6, *C. karnatakensis*; SP7, *Daemonorops kurzianus*; SP8, *C. rotang*.

Table 5.
Analysis of variance of data on total height (cm) of eight species at Nelliampathy and Vazhachal

Source	df	Nelliampathy		Vazhachal	
		MSS	*F* value	MSS	*F* value
Species	7	10.461	2.44 (ns)	25.119	10.60**
Block	1	35.165	8.20*	10.157	4.29 (ns)
Species×block	7	4.287	0.90 (ns)	2.369	0.86 (ns)
Replication within block×species	24	4.741	—	2.764	—
Period	6	16.249	6.13**	2.283	1.26 (ns)
Species×period	42	4.224	1.59 (ns)	1.506	0.83 (ns)
Block×period within species	48	2.649	0.89 (ns)	1.812	0.95 (ns)
Residual	144	2.965		1.903	

Abbreviations: df, degrees of freedom; MSS, mean sum of square; ns, not significant.
*Significant at $P = 0.05$.
**Significant at $P = 0.01$.

Table 6.
Mean total height (cm) of eight species at Nelliampathy at various time points

Period (years after planting)	Total height (cm)							
	SP1	SP2	SP3	SP4	SP5	SP6	SP7	SP8
2	207	58	134	126	215	27	48	71
3	281	57	100	130	300	43	89	104
4	264	83	34	179	282	45	93	121
5	307	66	27	209	249	60	108	126
6	512	188	43	531	561	127	293	168
7	477	157	47	578	571	124	114	142
8	3697	486	528	480	1223	78	177	166

SP1, *C. baratangensis*; SP2, *C. pseudotenuis*; SP3, *C. caesius*; SP4, *C. gamblei*; SP5, *C. andamanicus*; SP6, *C. karnatakensis*; SP7, *Daemonorops kurzianus*; SP8, *C. rotang*.

At Vazhachal, from the ANOVA (Table 5) follows the effect due to species was not significant. Mean values of total height of the eight species corresponding to the different periods are reported in Table 7.

In order to evaluate the performance of different species at the end of the trial, pair wise comparison between the species means at the 8th period was carried out. This comparison shows that *C. baratangensis* (SP1) differed significantly from all the other species. In the 8th year after planting *C. baratangensis* (SP1) was found to have a higher height value when compared with that of other species in both the locations. This may due to the small diameter of the cane and to the greater number of suckers produced within this time, many of which had attained commercially utilizable length.

Table 7.
Mean total height (cm) of eight species at Vazhachal at various time points

Period	Total height (cm)							
(years after planting)	SP1	SP2	SP3	SP4	SP5	SP6	SP7	SP8
2	259	87	93	153	265	37	54	60
3	355	135	144	207	323	58	68	81
4	579	257	151	298	440	72	95	108
5	971	324	148	372	582	109	110	150
6	7298	1976	3794	34	2325	172	96	2781
7	2135	1795	445	0	2025	0	549	452
8*	3328[a]	1029[c]	0[e]	0[e]	1723[b]	85[d]	1576[b]	1087[c]

SP1, *C. baratangensis*; SP2, *C. pseudotenuis*; SP3, *C. caesius*; SP4, *C. gamblei*; SP5, *C. andamanicus*; SP6, *C. karnatakensis*; SP7, *Daemonorops kurzianus*; SP8, *C. rotang*.

* Values with the same superscript in the last row do not differ significantly.

In Vazhachal the height of most of the species decreased drastically in the 7th year. This is due to the cutting of the extractable length of rattan by the local people as well as the damage caused by the elephants.

As stated already, *C. baratangensis* (SP1) had higher values in total height at Nelliampathy and at Vazhachal, while *D. kurzianus* (SP7) performed well at Vazhachal and not at Nelliampathy. This can be attributed to the altitudinal differences in the localities. *D. kurzianus* grows below an altitudinal level of 300 m in the natural forests. *C. gamblei* (SP4) occurs naturally above 700 m and, hence, the better growth in Nelliampathy which is at 1000 m elevation.

When both survival and total height are considered *C. baratangensis* is the best species suited for 1000 m elevation. At 300 m *D. kurzianus* performs better. In the seedling stages, *D. kurzianus* showed better growth performance at higher elevations also [3]. It showed 80% survival up to the 5th year, and then suddenly decreased to 40% in the next year and to 10% in the 8th year. *C. caesius* (SP3) was not performing well in both elevations. Manokaran [4–6] reports that survival in *C. scipionum, C. manan* and *C. caesius* after 5–7 years is only about 20%. After 7 years no stem was ready for harvest and neither had flowered. In the present experiment, at 1000 m elevation, *C. gamblei* and *C. karnatakensis* recorded 60% survival percentage and, at 300 m, *D. kurzianus* showed 35% survival percentage after 8 years. Certain species attained a harvestable length at the end of 6 years. Some of the stems were harvested by the local people, which is reflected in the total height in the next year. After 6 years at 1000 m elevation (Nelliampathy) *C. baratangensis* produced a total of nine stems 3 m or more in height with a total length of about 36 m. Discarding 1 m each from the basal and top portion from the 9 stems, 18 m can be utilized. *C. pseudotenuis* produced one stem longer than 3 m, *C. rotang* produced two, *C. caesius* produced four and *C. gamblei* one. At 300 m elevation (Vazhachal) *C. baratangensis* produced 28 stems longer than 3 m in height with 45 m of utilizable length of cane. *C. caesius* produced 6 stems with

21 m of utilizable cane. *C. gamblei* produced one stem with 9 m, *C. pseudotenuis* one stem with 1 m and *C. rotang* 3 stems with 8 m of utilizable cane.

CONCLUSIONS

C. baratangensis is the best suited species at 1000 m elevation and *D. kurzianus* at 300 m. A provenance trial of these species will be useful for further selection.

Acknowledgements

We are grateful to Dr. J. K. Sharma, Director, KFRI, for providing all the facilities for the work. The statistical advice was given by Dr. K. Jayaraman, whose involvement during the formulation of the experiment and data analysis is much appreciated. The financial assistance for the work was given by the Kerala Forest Department (Development).

REFERENCES

1. C. Renuka, Rattans of North Eastern India — A cause for great concern, *Arunachal Forest News* **14** (2), 8–11 (1996).
2. C. Renuka, *A Manual of the Rattans of Andaman and Nicobar Islands*. KFRI, Kerala (1995).
3. C. Renuka and P. Rugmini, Studies on the *ex-situ* performance of different species of rattans, *Indian For*. **122** (3), 235–240 (1996).
4. N. Manokaran, Survival and growth of the economically important rattan *Calamus manan*, in Ulu Langat, *Malay. Forester* **40** (4), 192–196 (1977).
5. N. Manokaran, Survival and growth of Rotan sega (*Calamus caesius*) seedlings at $5^1/_3$ years after planting, *Malay. Forester* **45** (2), 193–202 (1982).
6. N. Manokaran, Survival and growth of Rotan semambu (*Calamus scipionum*) seedlings at 7 years after planting, *Malay. Forester* **46** (1), 81–85 (1983).