Journal of Tropical Forest Science 10(1): 66 - 72 (1997)

STUDIES ON CURTAILING NURSERY PERIOD IN TEAK (*TECTONA GRANDIS*)

M. Murugesh, V.M. Srinivasan, R.S. Vinaya Rai & R. Annamalai

Forest College and Research Institute, Tamil Nadu Agricultural University, Mettupalayam 641 301, India

Received November 1995

MURUGESH, M., SRINIVASAN, V.M., VINAYA RAI, R.S. & ANNAMALAI, R. 1997. Studies on curtailing nursery period in teak (*Tectona grandis* L.f.). A study was carried out at the Forest College and Research Institute, Mettupalayam, India on teak (*Tectona grandis* L. f.) to elicit information on the optimal age and performance of container seedlings and stumps under irrigated conditions. Based on the field performance, the optimal age of container seedlings and stumps for field planting was found to be three and seven months respectively. Container seedlings had higher survival (96 - 100%) than stumps (58 - 96%) but growth (early basal diameter and shoot height increments, 0.65 cm and 23.10 cm respectively at seven months) was superior in stumps. Container seedlings were also characterised by root coiling and multiple shoot formation the management of which is not cost effective. Thus the results favour the use of stumps. Optimal size of stumps is indicated to be between 1 and 2 cm which is obtained in 7-month-old stumps.

Key words: Teak - age - survival - growth - seedlings - stumps

MURUGESH, M., SRINIVASAN, V.M., VINAYA RAI, R.S. & ANNAMALAI, R. 1997. Kajian mengenai tempoh pemotongan di tapak semaian pokok jati (*Tectona grandis* L.f.). Kajian dijalankan di Kolej Hutan dan Institut Penyelidikan, Mettupalayam, India mengenai jati (*Tectona grandis* L.f.) untuk mendapatkan maklumat mengenai umur optimal dan prestasi biji benih tabung dan tunggul di bawah saluran air. Berdasarkan prestasi di ladang, umur optimal biji benih tabung dan tunggul untuk tanaman ladang ialah tiga dan empat bulan masing-masing. Anak benih tabung mempunyai kemandirian yang lebih tinggi (96-100%) berbanding tunggul (58-96%) tetapi pertumbuhan (pertambahan diameter luas pangkal awal dan ketinggian pucuk , 0.65 cm dan 23.10 cm masing-masing pada 7 bulan) adalah superior bagi anak benih tunggul. Anak benih tabung juga dicirikan melalui lingkaran akar dan pembentukan berganda pucuk yng mana pengurusannya tidak menjimatkan kos. Dengan demikian keputusan mengesyorkan penggunaan anak benih tunggul. Saiz optimal tunggul didapati antara 1 dan 2 cm yang diperoleh dalam tunggul berumur 7 bulan.

Introduction

Teak (*Tectona grandis* L. f.), a species of worldwide reputation as a paragon among timber species, is distributed predominantly in tropical or subtropical regions. The species is indigenous to India and southeast Asian region (Myanmar-Thailand-Lagos). Teak timber is sought-after for many uses because of its durability and aesthetic appeal. However, the production of teak has been dwindling in the last two decades. From an annual production of 20 million m^3 in the sixties, it has

come down to a meagre 0.5 million m^3 in the last few years. Possibly motivated to arrest this diminishing trend, many corporate firms, mostly financial institutions have started promoting short rotation teak plantations. Against the normal rotation of 60 y, these teak based companies propose to harvest the trees at the end of 20 y. Normally 1-y-old stumps are used for outplanting. Stumps are produced from 1-y-old seedlings by retaining 22.5 cm of root portion, 2.5 cm of shoot and pruning away all lateral roots and shoots. Use of stumps ensures fast, straight growth. To conform to the emphasis on short rotation it was proposed to investigate whether the nursery period could also be correspondingly shortened.

Materials and methods

Seeds were collected from a 63-y-old seed production area in Top Slip in Tamil Nadu province. The collected seeds were graded and stored at room temperature for one year. Since seeds are characterised by chemical dormancy besides their physical attributes, seeds less than one year old have recorded poor germination (Murthy 1973, Willan 1985). The seeds were used for preparing stumps and container seedlings. For stumps, every month one kg of seed was soaked in cold water for 6 days (Yadav 1992) and then broadcast on raised beds measuring 1 × 1 × 0.45 m at monthly intervals from January to October 1994. Germination was accomplished in 15-30 days. In January 1995, 3- to 12-month-old seedlings were processed into stumps. Another set of seeds were sown in polybags (25 × 13 cm), 2 per bag, at monthly intervals as above. Ten weeks following sowing the seedlings were thinned to one. While beds were raised on nursery soil, the polybags contained a mixture of field soil, sand and farm yard manure in the ratio of 4:1:1.

The calender of operation is given below:

Date of sowing in beds/polybags (1994)	Date of stumping and field planting (1995)	Age of stumps/ seedlings at planting (months)
January	January	12
February	January	11
March	January	10
April	January	9
May	January	8
June	January	7
July	January	6
August	January	5
September	January	4
October	January	3

The stumps and container seedlings of corresponding ages were outplanted at a spacing of 1 × 1 m in a factorial randomised block design (2 stock type × 9 age groups) with 3 replications. Each replication comprised 16 stumps/plants. Twelve-month aged stock represented the control treatment. Irrigation was done when IW/CPE ratio was reduced to 0.6. This approximated irrigation was conducted once in 15 days during winter and once in 10 days during summer. Survival, shoot height and basal diameter increment were recorded 90 days after planting. Data were subjected to an analysis of variance following Panse and Sukhatme (1961).

Results

Performance of stumps of different ages

Compared to the control (12 months), survival 90 days after field planting was high in the age groups of 5 to 9 months (up to 96.0% at 7 months) (Table 1). However, among these, the age groups of 6 to 9 months were on par. Considering basal diameter increment, ages 7 and 8 months proved outstanding (0.65 and 0.54 cm respectively) (Table 2), but from the standpoint of shoot height increment, 7-month stumps were the best (23.10 cm) (Table 3).

Performance of container seedlings of different ages

While field survival did not vary among the different ages (96.0 - 100%) (Table 1), diameter and height increments were maximum in 3-month-old seedlings (0.50 cm and 13.58 cm respectively) (Tables 2 and 3). With increase in age there was a concomitant decline in these parameters.

Comparative performance of stumps vs. seedlings

Across all ages, container seedlings recorded a higher survival by 24.6 % than stumps (Table 1). But growth rate (basal diameter and shoot height increments) was markedly higher in stumps, the magnitude of increase being 43.3% in respect of basal diameter and 106.1% in respect of shoot height (Tables 2 and 3). Another notable feature was the universal occurrence of root coiling in container seedlings and its conspicuous absence in stumps (Table 4). However, root coiling was less frequent in 3- and 4-month-old containers whereas containers of all other ages exhibited 100 per cent coiling.

Discussion

Performance of stumps of different ages

Evaluated conjointly by all parameters of survival, diameter and height increment growth, the superiority of 7-month-old stump is distinctly brought into focus. This

Table 1. Effect of age and planting stock on teak survival (%) 90 days after field planting

Planting stock (PS)	Stock age (months)									Mean
	3	4	5	6	7	8	9	10	12	
Container seedling	100	100	100	100	100	100	100	100	96	100
Stump	58.6	67.0	75.0	87.6	96.0	91.3	87.6	58.3	57.6	75.4
Mean	79.33	83.50	87.50	93.83	98.60	95.67	93.83	79.17	76.84	87.52

Source	SEd	CD ($p \leq 0.05$)
Planting stock (PS)	2.30	4.69
Age (A)	4.89	9.95
PS x A	6.92	14.17

Table 2. Effect of age and planting stock of teak on basal diameter increment (cm) 90 days after field planting

Planting stock (PS)	Stock age (months)									Mean
	3	4	5	6	7	8	9	10	12	
Container seedling	0.50	0.37	0.32	0.25	0.27	0.29	0.22	0.26	0.25	0.30
Stump	0.30	0.25	0.30	0.42	0.65	0.54	0.53	0.50	0.41	0.43
Mean	0.40	0.31	0.31	0.34	0.46	0.39	0.39	0.37	0.33	0.37

Source	SEd	CD ($p \leq 0.05$)
Planting stock (PS)	0.02	1.04
Age (A)	0.04	0.08
PS x A	0.06	0.12

Table 3. Effect of age and planting stock of teak on shoot height increment (cm) 90 days after field planting

Planting stock (PS)	Stock age (months)									Mean
	3	4	5	6	7	8	9	10	12	
Container seedling	13.58	9.17	8.69	7.09	7.54	6.96	5.77	4.45	4.5	7.53
Stump	10.49	10.71	10.11	16.56	23.10	18.27	18.15	17.21	15.08	15.52
Mean	12.04	9.94	9.40	11.83	15.32	12.62	11.96	10.83	9.79	11.53

Source	SEd	CD ($p \leq 0.05$)
Planting stock (PS)	0.66	1.34
Age (A)	1.40	2.84
PS x A	1.98	4.01

is in consonance with the report that 6- to 7-month-old stumps were ideal for outplanting (Anonymous 1991). But several other workers have reported one-year stumps to perform better under natural conditions (Champion & Pant 1982, Anonymous 1991). The report of Totey *et al.* (1986) that stumps could be prepared from 4-month-old seedlings, however, is not borne out by the results of the present study. The better performance of 7-month-stumps may be attributed to the optimal size of its collar diameter (1.46 cm). Optimal collar diameter for better survival and growth of teak stumps was reported by several workers to be between 1 and 2 cm (Venkataramany 1956, Kermode 1957, Mishra 1958, Wanichkul 1966, Champion & Seth 1968, Kokogyi 1972). In the present study, stumps younger than 7 months possessed a diameter of <1 cm and those older then 9 months were characterised by a diameter of > 2 cm. This perhaps accounts for their poor survival and lesser growth rate.

Table 4. Effect of age and planting stock of teak on collar diameter and root coiling

Age (months)	Collar diameter (cm)		Root coiling (%)	
	Mother bed seedling (MBS)	Container seedling (CS)	MBS	CS
3	0.45	0.31	-	3
4	0.69	0.62	-	11
5	0.75	0.70	-	100
6	0.84	0.80	-	100
7	1.46	0.97	-	100
8	1.52	1.08	-	100
9	1.71	1.14	-	100
10	2.10	1.30	-	100
12	2.30	1.45	-	100
Mean	1.31	0.93	-	79.33
Source	SEd	CD	SEd	CD
Planting stock (PS)	0.01	0.02	-	-
Age (A)	0.02	0.05	1.87	3.96
PS x A	0.03	0.07	-	-

Performance of container seedlings of different ages

Survival did not vary among the different ages. But height and diameter increments were markedly high in the 3-month-old seedlings and progressively decreased with increasing age. Higher survival and growth of 3-month-old container seedlings has also been reported by Delizho (1964). The declining growth of seedlings older than 4 months may plausibly be ascribed to coiling of roots. Poor field establishment due to root coiling has been reported in *Acacia nilotica* (Kumar & Gulta 1990) and other tree species (Anonymous 1994). Multiple shoots were also evident in planted seedlings of all ages except those of 3 months which inhibited the growth of the leading shoot.

Performance of stumps vs. seedlings

Though container seedlings recorded a survival of 24.6% more than the stumps, they were characterised by poor growth in terms of height and diameter increments. In addition, they also exhibited root coiling and multiple shoot formation. Root coiling can possibly be precluded by use of hardwalled containers having ribs that direct the lateral root downwards. Coating the inner wall of the containers with copper compounds or use of media like peat moss, bark mulch, etc. may also restrain root growth but these options are not cost effective. Multiple shoot formation may necessitate pruning further adding to the cost of management. Thus the choice swerves the scales in favour of stumps. Better performance of stumps relative to entire transplants has also been documented earlier (Anonymous 1991). Stumps with a collar diameter 1-2 cm appear to be the best planting stock and these are obtained in 7-month-old seedlings.

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