STANDARDISATION OF CONTAINERS FOR GROWTH AND VIGOUR OF TREE SEEDLINGS IN THE NURSERY

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GOPAKUMAR, S. & GOPIKUMAR, K. 1993. Standardisation of containers for growth and vigour of tree seedlings in the nursery. A nursery study was conducted in the College of Forestry, Vellanikkara, India to evaluate the effect of various types of containers on growth and vigour of three selected tree species in the nursery. The growth of seedlings in terms of height, girth and leaf production was found to be more when grown in plastic containers. *Swietenia* seedlings recorded a mean height of 50.1 *cm* and a girth of 2.1 *cm*, *Terminalia* species a mean height of 45.2 *cm* and a girth of 2.7 *cm*, and *Ailanthus* species a mean height of 28.8 *cm* and girth of 2.2 *cm* when grown in plastic containers. Leaf production was also found to be high in plastic containers.

Key words: *Swietenia macrophylla* - *Terminalia catappa* - *Ailanthus triphysa* - nursery seedlings - containers - growth vigour

GOPAKUMAR, S. & GOPIKUMAR, K. 1993. Pempiawaian tabung-tabung bagi pertumbuhan dan kecerdasan anak-anak benih pokok-pokok di tapak semaian. Satu kajian terhadap kesan penggunaan berbagai jenis tabung ke atas pertumbuhan dan kecerdasan tiga spesies pokok yang di pilih di tapak semaian telah di jalankan di Kolej Perhutanan Vellanikkara, India. Pertumbuhan anak benih dari segi ketinggian dan lilitan batang dan pengeluaran daun adalah di dapati lebih baik bila di tanam dalam tabung-tabung plastik. Anak benih *Swietenia* mencatat purata ketinggian dan lilitan sebanyak 50.1 *cm* dan 2.1 *cm* masing-masing, bila di tanam menggunakan tabung plastik. Spesies *Terminalia* pula mencatat rekod ketinggian sebanyak 45.2 *cm* dan lilitan sebanyak 2.7 *cm* sementara spesies *Ailanthus* mencapai ketinggian 28.8 *cm* dan lilitan sebanyak 2.2 *cm*. Pengeluaran daun juga lebih banyak pada anak-anak benih yang di tanam dalam tabung plastik.

Introduction

In most tropical countries, the immense popularity of social and agroforestry systems has warranted large scale commercial production of nursery stock for extensive planting. The use of containers for raising seedlings has greatly increased during the past few years. Seedlings raised in different systems are in high demand since it is a well known fact that containers greatly influence the establishment and growth of seedling in the nursery. Xuo and Gao (1984) have experimentally shown that higher survival and growth rates are the advantages of containerised seedlings. Growth assessed by height and girth of *Betula alba* and *Plantanus aterifolia*, for example, was better than bare root seedlings of the same species (Anonymous 1981).

In spite of all the experimentally proven favourable effects of containers on plant growth, there seems to be no selection criteria fixed for the type of containers to be

used for raising tropical tree seedlings in the nursery. The present investigation was therefore undertaken to determine the effects of various types of locally available containers on the growth and vigour of seedlings of *Swietenia macrophylla*, *Terminalia catappa* and *Ailanthus triphysa* in the nursery.

Materials and methods

The study was conducted in the College of Forestry, Kerala Agricultural University, Trichur, Kerala (between 10^0 25' and 10^0 45' N latitude and 76^0 5' and 76^0 30' E longitude), India. The site enjoys a warm humid tropical climate. The mean maximum monthly temperature ranges from 32°C (August) to 38°*C* (April) and the minimum from 20°*C* (January) to 23.5°*C* (April). The mean annual precipitation for the period 1985 - 1991 was 2680 *mm* at Trichur. The four different types of containers (treatments) studied were of mud pots (baked earth), plastic, black polythene covers and transparent polythene covers. All the four containers were of uniform size, having an average height of 35 *cm* and average diameter of 23 *cm*. The black and transparent polythene covers used were potting bags made from polythene sheets. Uniform seeds were used for raising seedlings for the study. The study was done in Completly Block Design with the following details:

Number of treatments = 4
Number of replications per treatment = 5
Total number of experimental units per species = 20

So, twenty plants (one month old, average height 50 *cm* and girth 1.5 *cm*) each of *Swietenia macrophylla*, *Terminalia catappa* and *Ailanthus triphysa* were planted separately into the four different types of containers. All these containers were filled with 3000 *g* of potting mixture of sand, soil and farmyard manure in equal proportions. Watering of the plants was carried out daily.

Vegetative growth parameters like height (*cm*), girth (*cm*) and number of leaves produced by individual seedlings were observed at fortnightly intervals. At the end of the study after eight months, the root growth and the biomass (both green and dry) production were measured separately for seedlings grown in the four types of containers.

Results and discussion

The observations on the effect of containers on growth of seedlings of the various tree species are tabulated in Tables 1 to 3 and also depicted in the Figures 1 to 3. The height of seedlings of *Swietenia* species was significantly influenced by containers during the first, second, fourth and fifth fortnights. During these periods the plastic containers produced considerably taller seedlings. The mean height growth was 50.1 *cm* while the leaf production was 27.2 in plastic containers. Seedlings grown in plastic containers recorded maximum number of leaves throughout the study period (Figure 1). The girth increments recorded in the plastic containers were on par with those from other treatments.

Table 1. Effect of containers on the heights (*cm*) of seedling

Series	No.	Types of container	Fortnights								Mean
			1	2	3	4	5	6	7	8	
	1	Mud pots	44.8	44.8	44.9	46.0	45.9	47.3	47.4	49.2	46.3
Swietenia	2	Plastic containers	47.8	47.4	48.5	49.3	49.9	50.7	54.4	51.8	50.1
macrophylla	3	Black covers	39.0	39.7	41.1	41.8	42.4	44.3	46.9	44.4	42.5
	4	Transparent covers	40.3	40.4	42.2	43.2	41.5	45.5	47.9	48.4	43.8
		F test	*	*	ns	*	*	ns	ns	ns	*
		CD (0.05)	5.80	5.80	-	5.50	5.90	-	-	-	5.50
	1	Mud pots	44.3	43.6	43.1	43.3	44.5	45.3	45.9	48.7	44.5
Terminalia	2	Plastic containers	42.3	42.5	43.3	43.2	44.2	44.7	48.9	53.9	45.2
catappa	3	Black covers	37.1	37.6	39.7	39.4	40.4	42.2	45.2	49.1	41.3
	4	Transparent covers	36.8	37.1	35.9	39.0	39.6	40.4	41.8	45.9	39.2
		F test	ns	ns	ns	ns	ns	ns	ns	ns	ns
		CD (0.05)	-	-	-	-	-	-	-	-	-
	1	Mud pots	23.4	23.5	23.9	25.1	25.7	26.7	27.7	32.5	26.1
Ailanthus	2	Plastic containers	25.2	26.4	27.1	28.0	28.5	29.5	31.3	35.9	28.8
triphysa	3	Black covers	22.2	23.7	25.5	25.7	26.8	27.7	28.7	30.6	26.5
	4	Transparent covers	17.5	17.6	18.6	19.9	23.3	24.9	26.6	28.3	22.1
		F test	**	**	**	**	**	**	*	*	**
		CD (0.05)	2.90	2.70	2.60	2.60	2.40	2.50	2.97	4.47	2.40

Note: ns = not significant ; * = significant at 5 % level ; ** = significant at 1 % level.

Table 2. Effect of containers on girth (*cm*) of seedlings

Series	No.	Types of container	Fortnight								Mean
			1	2	3	4	5	6	7	8	
	1	Mud pots	1.8	1.9	2.1	2.2	2.3	2.3	2.2	2.2	2.1
Swietenia	2	Plastic containers	1.7	1.9	2.1	2.2	2.2	2.4	2.1	2.2	2.1
macrophylla	3	Black covers	1.5	1.8	1.8	1.9	2.1	2.1	2.1	2.1	1.9
	4	Transparent covers	1.5	1.7	1.9	2.2	2.1	2.3	2.2	2.2	2.1
		F test	**	**	**	**	ns	ns	**	ns	**
		CD (0.05)	0.16	0.14	0.15	0.17	-	-	0.12	-	0.12
	1	Mud pots	2.4	2.5	2.8	2.8	2.9	2.9	2.8	2.7	2.7
Terminalia	2	Plastic containers	2.2	2.4	2.8	2.8	2.9	2.9	2.8	2.7	2.7
catappa	3	Black covers	1.9	2.2	2.5	2.6	2.6	2.6	2.7	2.5	2.4
	4	Transparent covers	2.0	2.0	2.4	2.4	2.4	2.3	2.5	2.5	2.3
		F test	**	**	**	**	**	**	ns	*	**
		CD (0.05)	0.02	0.23	0.21	0.21	0.21	0.71	-	0.18	0.17
	1	Mud pots	1.5	1.5	1.8	1.9	1.9	2.0	2.1	2.2	1.9
Ailanthus	2	Plastic containers	1.7	1.9	2.1	2.5	2.1	2.4	2.4	2.4	2.2
triphysa	3	Black covers	1.6	1.7	1.9	2.2	2.0	2.2	2.2	2.1	2.1
	4	Transparent covers	1.2	1.8	1.5	1.7	1.8	2.0	2.1	2.1	1.7
		F test	**	**	**	**	**	**	**	**	**
		CD (0.05)	0.13	0.12	0.15	0.14	0.12	0.11	0.09	0.17	0.11

Note: ns = not significant ; * = significant at 5 % level ; ** = significant at 1 % level.

Table 3. Effect of containers on leaf production (number) of seedlings

Series	No.	Types of container	Fortnight								Mean
			1	2	3	4	5	6	7	8	
	1	Mud pots	14	16	17	21	22	27	30	40	23.4
Swietenia	2	Plastic containers	15	18	23	26	25	31	34	42	27.2
macrophylla	3	Black covers	13	17	20	23	23	29	30	38	24.5
	4	Transparent covers	12	15	20	22	26	28	28	37	23.5
		F test	ns	ns	*	**	*	ns	ns	ns	*
		CD (0.05)	-	-	2.60	3.20	3.3	-	-	-	2.80
	1	Mud pots	7	7	7	8	10	9	10	11	9
Terminalia	2	Plastic containers	8	10	10	10	12	10	11	14	10
catappa	3	Black covers	7	9	10	11	11	10	11	13	10
	4	Transparent covers	6	8	9	10	11	9	9	12	9
		F test	ns	**	**	**	*	**	ns	**	**
		CD (0.05)	-	0.23	1.11	1.26	1.38	1.10	-	1.60	0.99
	1	Mud pots	39	43	48	48	51	55	38	61	48
Ailanthus	2	Plastic containers	43	49	54	55	52	56	37	70	52
triphysa	3	Black covers	43	50	55	55	57	62	38	75	54
	4	Transparent covers	37	44	48	56	57	61	32	71	51
		F test	ns	*	**	*	ns	ns	ns	*	ns
		CD (0.05)	-	5.70	5.90	6.20	-	-	-	8.30	-

Note: ns = not significant ; * = significant at 5 % level ; ** = significant at 1 % level.

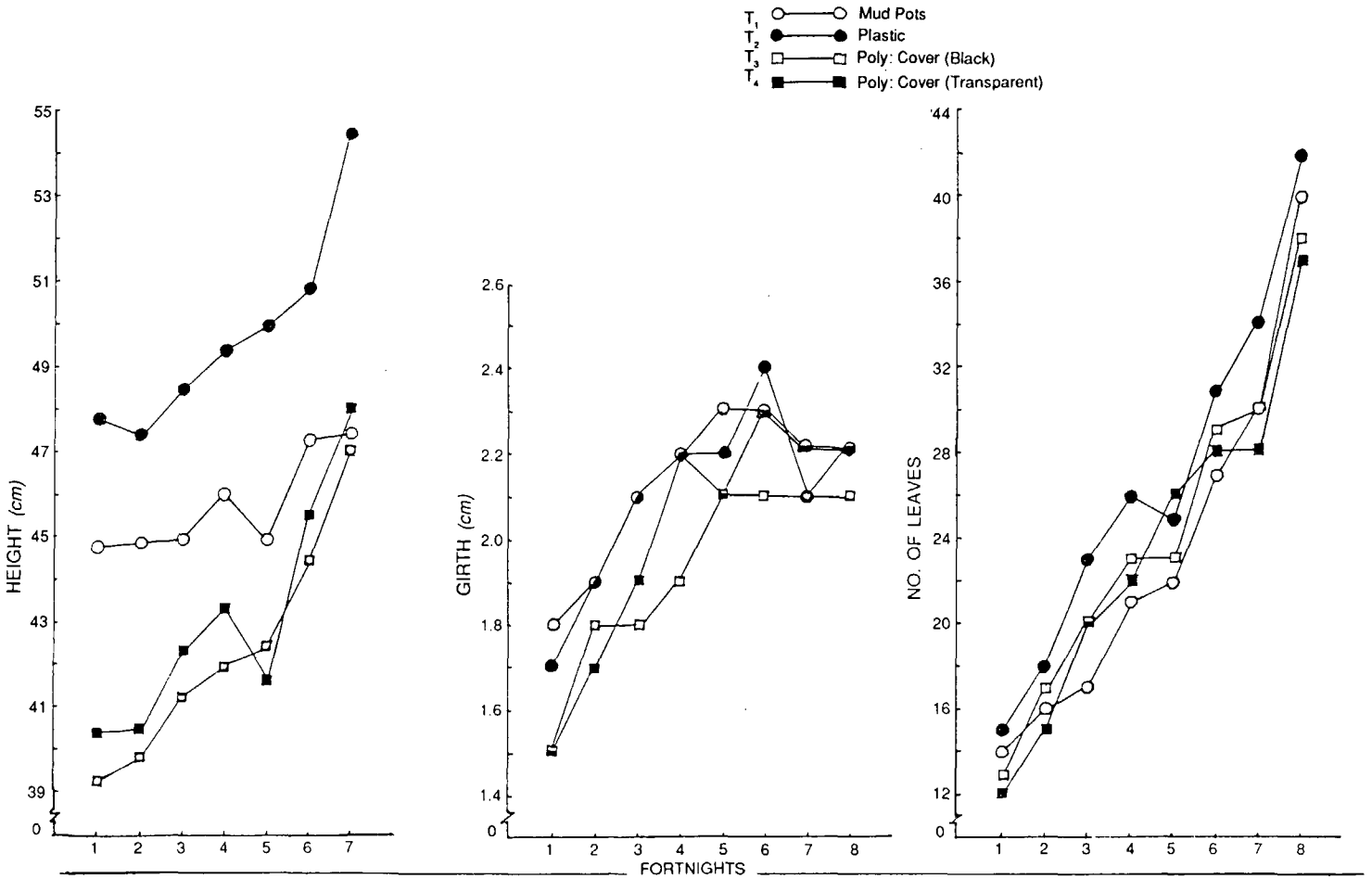

Figure 1. Fortnightly growth of seedlings in the nursery (*Swietenia* sp.)

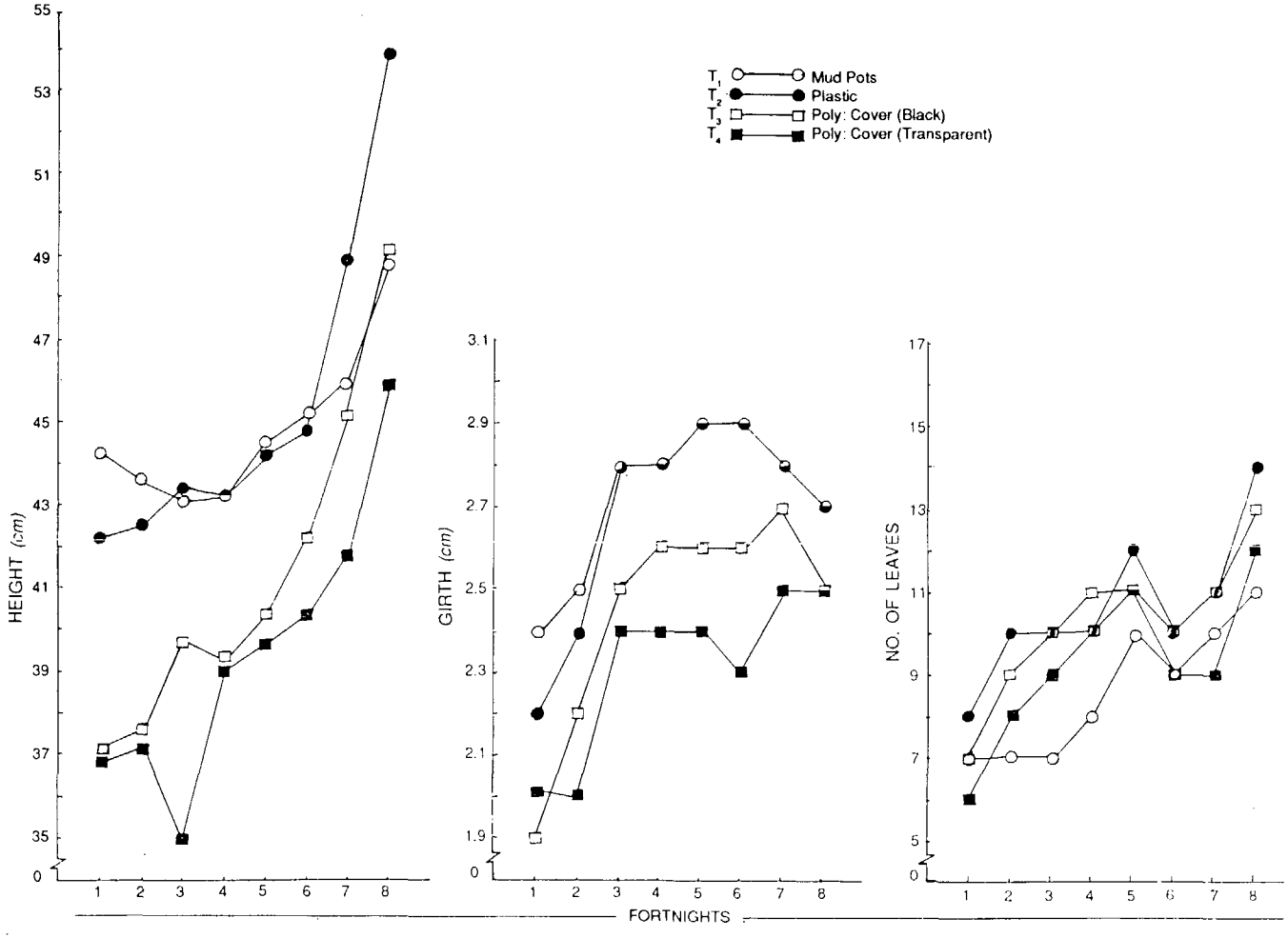

Figure 2. Fortnightly growth of seedlings in the nursery (*Terminalia* sp.)

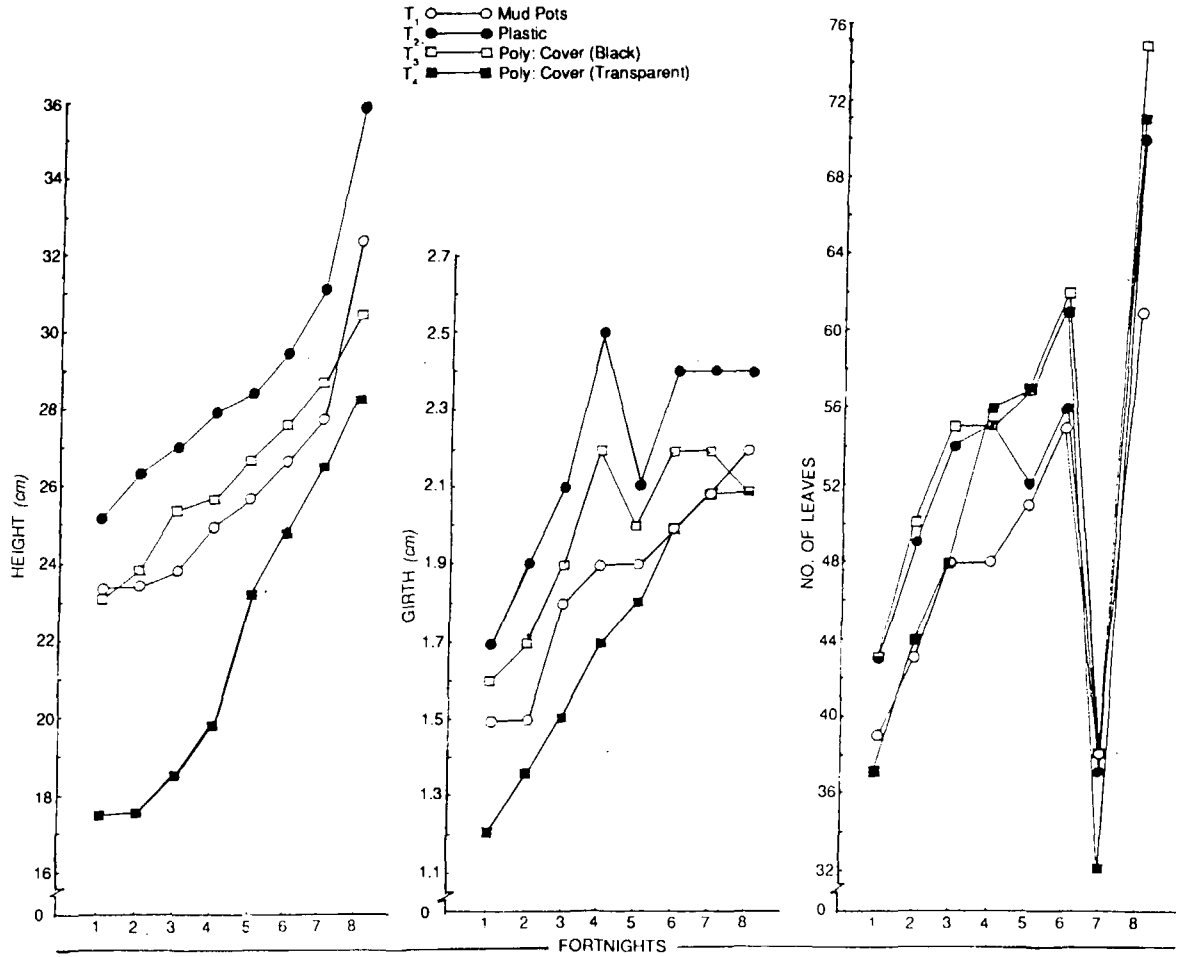

Figure 3. Fortnightly growth of seedlings in the nursery (*Ailanthus* sp.)

The container influence is also quite significant in *Terminalia* species (Figure 2). Here the mean height of seedlings was not influenced significantly by the treatments. However, the seedlings grown in plastic containers had a mean height of 45.2 *cm* (86.7% more height growth) while the mean height was only 39.2 *cm* in seedlings grown in polythene covers. The leaf production and girth were better in seedlings grown in plastic containers.

The seedlings of *Ailanthus* showed similar response as the other two species in plastic containers (Figure 3). Throughout the course of the experiment, the seedlings raised in plastic containers produced remarkably taller seedlings compared to other treatments. The mean height was more (28.8 *cm*) with a girth of 2.2 *cm.*

The superiority of plastic containers was also observed by Noste and Phipps (1978) who obtained better growth of seedlings of red pine and Jack pine in polymer containers in northern Wincosin. Elvan (1983) attributed the better vigour of seedlings to the better capability of the plastic containers to retain more moisture and relatively higher temperature. He stated that this enhanced better organic matter decomposition and better release of nutrients like N and K to the plants. In the present study also, the presence of more moisture and temperature of the medium filled in plastic containers might have contributed for the better release of N and K through organic matter decomposition to the seedlings grown in them, which would have definitely contributed to their better growth. Barnett and Brissette (1986) noted that as long as the type of containers and cultural treatments are satisfactory to produce good quality seedlings, height and girth at the time of transplanting seem to be the best indicators of field performance. In addition, it could be easily measured.

Table 4. Effect of containers on shoot weight (*g*)

Sl No.	Types of containers	Fresh weight			Dry weight		
		A	B	C	A	B	C
1.	Mud pots	31.1	48.1	32.7	15.1	15.1	9.1
2.	Plastic containers	32.9	55.9	30.1	14.9	61.1	8.3
3.	Black covers	36.9	52.3	36.8	13.5	14.9	10.3
4.	Transparent covers	35.9	47.4	34.4	14.1	12.9	11.0
	F test	ns	ns	ns	ns	ns	ns
	CD (0.05)	-	-	-	-	-	-

Note: A = *Sweitenia macrophylla*; B = *Terminalia catappa* ; C = *Ailanthus triphysa*; ns = not significant.

In the present study, the containers did not generally influence the shoot weight and root growth parameters significantly (Tables 4 and 5). Root growth of *Swietenia* species was high in seedlings grown in black polythene covers and plastic containers, and the fresh and dry weights of roots were not influenced by containers. In *Terminalia*, the numbers of secondaries produced by seedlings raised in mud pots, plastic containers and transparent polythene covers were on par. The fresh weight of roots did not show any significant difference between various treatment. The dry weights were influenced by the type of containers.

Table 5. Effect of containers on the root growth parameters

Types of containers	Tap root length (*cm*)			Number of secondaries			Root Fresh weight (*g*)			Root Dry weight (*g*)		
	A	B	C	A	B	C	A	B	C	A	B	C
Mud pots	18.7	38.7	20.9	35	32	10	6.5	15.5	9.6	3.0	5.9	2.5
Plastic containers	20.1	30.8	19.2	28	30	13	6.4	15.1	9.7	3.2	4.5	2.7
Black covers	23.8	28.7	34.9	41	21	13	7.7	13.6	11.3	3.5	4.3	3.5
Transparent covers	19.5	43.5	26.7	35	32	8	6.9	10.6	11.2	1.6	3.2	3.5
F test	ns	ns	*	ns	**	*	ns	ns	ns	ns	*	ns
CD (0.05)	-	-	10.14	-	6.40	2.98	-	-	-	-	1.70	-

Note: A = *Swietenia macrophylla*; B = *Terminalia catappa*; C = *Ailanthus triphysa*; ns = not significant; * = significant at 5 % level; ** = significant at 1 % level.

Similarly in *Ailanthus,* the numbers of secondary roots produced by seedlings grown in plastic and black polythene covers were on par. The biomass production was also not affected significantly by any type of containers. The effect of containers on the production of roots was also stressed by Ruter *et al.* (1988) who confirmed that containers influence favourably the production of better and healthy root system. In the present study the containers were not found to influence the fresh and dry weights of shoot of any of the species studied.

Conclusion

In the present study, the containers were found to influence the vegetative growth parameters like height, girth and leaf production in the three species studied. The growth and vigour of seedlings were better in plastic containers compared to the other three types. This observation could be taken to recommend plastic containers as the most ideal containers for the nursery stock production of the three tropical forest tree species studied. However , considering its high cost, it would be worthwhile to limit the use of plastic containers to raise seedlings only for research purposes. Locally available low cost containers made from polythene sheets (polythene cover) could be used for the large scale production of planting materials for agro- and social forestry planting programmes.

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