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Early Growth of Some Introduced Agroforestry Species in Akure, Nigeria: Influence of Potting Containers.

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ABSTRACT

This study investigated the early growth performance of potted seedlings of *Grevillea robusta, Dalbergia sissoo, Albizia lebbeck, Prosopis juliflora* and *Acacia mearnsii* . Two types of potting containers were used - the conventional black polypot (size: 10 cm x 15 cm) and the transparent "pure water' bags (size: 14 cm x 15 cm). Topsoil of known characteristics collected from Teaching and Research farm in the Federal University of Technology, Akure was used as the potting medium. Samples of 10 potted seedlings per container were randomly selected after 12 weeks of growth and the following parameters were measured: shoot height, tap root length, shoot dry weight, root dry weight and total plant dry weight. The results revealed that *Prosopis juliflora* exhibited the highest vigour with a total biomass of 3.99 g in 12 weeks while *Grevillea robusta* had the least (0.80 g). Type of potting container had no significant effect on seedling growth, indicating that used "pure water" bags can be re-used as alternative potting container for agroforestry seedlings.

KEYWORDS: agroforestry, tree seedlings, potting container

INTRODUCTION

Raising seedlings in container has replaced much of the traditional nursery field production methods. In the past decades, various types of containers have been used and new ones are being developed for the propagation and growing of tree seedlings. The trends of the recently developed containers is towards reducing handling costs, greater cultural control, handling ease, improving plant marketability and faster product turn over (Fonteno, 1988). There are various types of potting containers for raising seedlings in the nurseries. Polythene bags are the containers in wide use in places such as Europe, Australia, Newzealand and Nigeria. They are considerably less expensive than rigid metals or plastic containers. They are usually black, but one kind is black on the inside and light coloured on the outside. The lighter colour reflects heat and lowers the root temperature (Whitcomb, 1979).

Packaged water, commonly known as 'pure water' was introduced in Nigeria a few years ago as a cheap source of potable water for the teeming population. However, an undesirable aspect of this inovation is the menace which the used bags now constitute on our streets. Used 'pure water' bags are dumped indisriminately on the roads, in market places, in schools and it presents a very ugly sight in most of the open dump sites This paper presents the results of an experiment on seedling growth of *Grevillea robusta, Dalbergia sissoo, Albizia lebbeck Prosopis juliflora* and *Acacia mearnsii* in Akure, Nigeria in which 'pure water' bags was used as alternative potting container. It is believed that an alternative use for used pure water bags is a surer and easier way of ridding our streets of the menace which they now constitute.

MATERIALS AND METHOD

Site description

The study was carried out at the Forestry nursery site of the Federal University of Technology, Akure (lat. 7^{o} 17^{1}N, long $5^{o}10^{1}$E; 350m a.s.l.) Mean annual rainfall is 1500 with bimodal rainfall pattern.

Procurement of materials

The seeds of *Grevillea robusta, Dalbergia sissoo, Albizia lebbeck, Prosopis juliflora* and *Acacia mearnsii* were obtained from the New Forests Project, Washington D.C. USA. The seeds which originated from India were haevested in the year 2000. The conventional polypots used in this study were purchased from an agrochemical store in Akure while the transparent "pure water" bags were handpicked from around the campus. Topsoil of known characteristics was collected from the Teaching and Research Farm, Federal University of Technology, Akure. The soil was sandy loam in texture and had the following characteristics:

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Table 1: Growth characteristics of selected woody species after 12 weeks of growth

Parameter	*Albizia lebbeck* x	s	*Dalbergia sissoo* x	s	*Acacia mearnsii* x	s	*Prosopis juliflora* x	s	*Grevillea robusta* x	s
Shoot height (cm)	13.26	0.34	27.28	0.50	10.90	0.92	30.40	0.72	9.16	0.58
Length of tap root (cm)	17.75	5.67	25.21	7.05	25.00	9.27	29.30	6.87	13.65	4.54
Shoot dry weight (g)	1.81	0.31	1.21	0.26	0.87	0.50	1.97	0.51	0.69	0.27
Root dry weight (g)	2.18	0.47	0.60	0.25	0.22	0.15	0.71	0.18	0.11	0.06
Total dry weight (g)	3.99	0.49	1.81	0.28	1.09	0.21	2.68	0.24	0.80	0.18
Shoot : Root ratio	1:2		2:1		4:1		2:1		6:1	

x - mean; s - standard deviation

Table 2: Duncan's New Multiple Range Test for comparing growth of selected agroforestry species

Parameter	*Albizia lebbeck*	*Dalbergia sissoo*	*Acacia mearnsii*	*Prosopis juliflora*	*Grevillea robusta*
Shoot height (cm)	13.26^{c}	27.28^{b}	10.90^{d}	30.40^{a}	9.16^{c}
Length of tap root (cm)	17.75^{b}	25.21^{a}	25.00^{a}	29.30^{a}	13.65^{b}
Shoot dry weight (g)	1.81^{a}	1.21^{b}	0.87^{bc}	1.97^{a}	0.69^{c}
Root dry weight (g)	2.18^{a}	0.60^{c}	0.22^{d}	0.71^{b}	0.11^{d}
Total dry weight (g)	3.99^{a}	1.81^{c}	1.09^{d}	2.68^{b}	0.80^{d}

Means on the same row followed by different superscripts are significantly different ($P<0.05$)

organic matter 3.03%; total N 0.17%; pH-H_2O(1:1) 5.9 (Oke and Kadeba, 1997).

Experimental design

Five hundred polypots (made up of 250 conventional and 250 transparent polybags) were filled with the potting medium. The pots were arranged in five groups of 100 polypots each. The 100 polypot in each group were made up of 50 conventional and 50 transparent. The pots were placed randomly within each group. Watering was done regularly with water collected from a nearby stream and sprinkled on the seedlings with the aid of a watering can. Watering was done twice daily – early in the morning (7.30 a.m.) and in the evenings (6.00 p.m.)

Seeds of the agroforestry species were subjected to the necessary pre-germination treatments prior to sowing. Seeds of *Acacia mearnsii, Albizia lebbeck* and *Prosopis juliflora* were soaked in hot water and allowed to cool overnight (Fact Net,1995) while that of *Dalbergia sissoo* and *Grevillea robusta* were soaked in cold water overnight. The seeds were sown directly into pots at the rate of two seeds per pot. This was thinned to one immediately after germination.

Data collection

After 12 weeks of growth in the nursery, 10 seedlings each of *Grevillea robusta, Dalbergia sissoo, Albizia lebbeck Prosopis juliflora* and *Acacia mearnsii* comprising of 5 in conventional polypots and 5 in transparent polypots were randomly selected. Seedlings' height were measured from the plant base to the shoot apex with metre rule. The seedlings were harvested by carefully removing the polypots and washing off the soil. Tap root length was measured with metre rule. Each harvested plant was separated into root and shoot, put in envelopes and ovendried to constant weight at 60^{0}C after which the dry wieght was measured using an electronic 'Metler' weighing balance.

Table 3 : Influence of potting containers on plant tap root length (cm) after 12 weeks of growth

Tree species	Conventional polypot	Transparent polypot
Albizia lebbeck	19.5	16.0
Dalbergia sissoo	26.82	23.6
Acacia mearnsii	27.0	23.0
Prosopis juliflora	26.0	32.5
Grevillea robusta	12.2	15.1

Table 4 : Influence of potting containers on plant total biomass (g) after 12 weeks of growth

Tree species	Conventional polypot	Transparent polypot
Albizia lebbeck	3.81	4.18
Dalbergia sissoo	1.88	1.73
Acacia mearnsii	1.15	1.04
Prosopis juliflora	2.45	2.92
Grevillea robusta	0.80	0.80

Statistical analysis of data

Data was analysed using the ANOVA prpcedure for 2 by 5 factorial experiment in completely randomised design. The factors were potting containers at two levels and agroforestry species at five levels.

RESULTS AND DISCUSSION

Seedling growth

The means and standard deviations of the measured growth parameters 12 weeks after sowing is presented in (Table 1) Statistical analyses showed significant difference in shoot height, length of tap root, shoot dry weight, root dry weight and total plant weight among the woody species. (Table 2) shows the results of Duncan's New Multiple Range Test (DMRT) for comparing growth of the woody species. The results clearly indicated that seedlings of *Prosopis juliflora* were the most vigorous with highest mean shoot height (30.40 cm), longest tap root (29.30 cm) and highest shoot dry weight (1.97 g). Lowest values were recorded for *Grevillea robusta*. Since all seedlings were exposed to similar environmental conditions this difference in vigour among the seedlings can be attributed to the inherent physiological characteristics of the species (Wood and Burley, 1991).

Influence of potting containers on seedling growth

The means and standard deviations for tap root length and total plant weight of seedlings grown in conventional and transparent polypots are presented in Tables 3 and 4 respectively. Statistical analysis of data showed that the effects of potting containers was not significant. This implies that the potting containers had no influence on the growth of seedlings of the woody species used. Briscoe (1989) stated that coloring is not necessary in potting containers for multipurpose trees. He however afirmed that black polypots are more durable in sunlight than clear ones. The recommended pot size for agroforestry tree seedlings is 10 cm x 15 cm (Briscoe, 1989) but most of the used pure water bags are 14 cm x 15 cm. The implication of using this slightly larger pot is that larger area is occupied by fewer seedlings both in the nursery and during transportation to planting site. The larger pots also imply more room for root development.

CONCLUSION

The results of this study showed variations in seedling vigour among the five agroforestry species. *Prosopis juliflora* seedlings

were very vigorous while that of *Grevillea robusta* were slow growing. The knowledge of the growth rate of these agroforestry seedlings would aid in planning tree nursery activities in such a way that shorter time would be allowed between sowing in the nursery and planting out on the field for vigorous species like *prosopis* while longer period is allowed for less vigorous species like *grevillea*. This is important in preventing situations where seedlings would be overgrown in the nursery giving serious handling problems during planting out.

Type of potting container had no significant effect on seedling growth.The results of this study imply that "pure water" bags can be re-used as alternative potting container for agroforestry seedlings which are not usually expected to stay longer than 3 months in the nursery. Using pure water bags will reduce the cost of raising forestry nursery stocks as the bags could be obtained from around our towns and cities free of charge. It will also clear our streets of the nusance which the used bags now constitute thereby making our environment cleaner. This innovation is expected to make agroforestry practices more attractive to farmers who are not only conservative to new practices but are reluctant in adopting such practices that are expensive.

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