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Original Article

Potentials of Stem Cuttings of Four Selected Tree Species for the Establishment of Shelterbelt in the Semi-Arid Zone, Kano Nigeria.

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ABSTRACT

Four selected tree species obtained from Forestry Research Institute of Nigeria (FRIN), Kano Nigeria, were used to elucidate genetic variability in fast-growing multipurpose tree-cutting through locally constructed high humidity propagators for establishment of shelterbelt in semi-arid zone. Indices used in selecting one of the four tree-cuttings for their suitability for establishment of shelterbelt in semi-arid zone included days to first shooting and rooting, days to 50% shooting and rooting, number of leaves and roots, length of roots and number of plants that survived among others. Analysis of these indices showed significant differences among the four tree-cuttings. *Dalbergia sisso* had shortest mean number of days to shooting and rooting and days to 50% rooting. It also had the highest mean survival count. Hence, its recommendation as a fast growing multipurpose tree-cutting suitable for establishment of shelterbelt in semi-arid zone among the four plant species considered.

Keywords: Shelterbelt, Tree species, *Dalbergia sisso* and Tree-cutting.

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INTRODUCTION

Shelterbelts are a valuable factor to landholders for the enhancement of environment, productivity and natural habitat. Shelterbelts fulfill significant functions in agricultural landscape mainly by decreasing wind and soil erosion (Szajdak *et al*., 2005; Cole, 2007; SSN, 2007).

Interest in fast growing trees for establishment of shelterbelt and other uses has increased since the early 1960s and gained more momentum after multipurpose species had been declared by FAO/World Bank (1980), as their focus for Forestry Research for the decade 1980-1985. This has been a natural response to the growing demands worldwide for wood shelterbelt and other forest products.

It is estimated that nearly 3 million hectares of industrial plantations are established annually in the Tropics often using seeds of inferior quality (Palmberg, 1989). The situation is even worse in arid and semi-arid regions where meager tree planting is done with mostly unsuitable species (Burdon and shelbourne, 1974). In Nigeria, for instance, the limited success so far achieved by natural regeneration (self-sown seeds) methods has led to changes in emphasis from natural to artificial regeneration tree-cutting (clones) methods (Ikekhuamen, 1966).

Fortanier and Jonkers (1976) opined that tree cutting propagations have more gains than seed sown propagation because with tree-cuttings, large areas for shelterbelt can be covered more quickly and more reliably. In addition, tree-cutting is very

attractive on two counts; (1) promising tree species which produce few seeds or seeds that are short lived need no longer be excluded from shelterbelt or reafforestation progammes, and (2) tree-cutting propagation if confined to selection of good phenotypes within the natural populations, may provide both a considerable gain and an increase in uniformity.

In view of the threat posed by desert encroachment in the northern part of Nigeria, it is necessary to develop techniques that are simple and cheap and yet allow the production of tree-cuttings (clone) on a scale large enough to permit economic establishment of reafforestation and shelterbelt in semi arid zones. This work therefore, aims at comparing rooting and shooting of stem-cuttings of *Azadirachta indica* A. juss., *Balanites aegyptica* del., *Dalbergia sisso* Linn. and *Eucalyptus camaldulensis* Linn., to monitor the subsequent early growth and development of the four plants in order to assess the potential of each in establishment of shelterbelt; and identifying a fast and cheap method of propagating trees for establishment of shelterbelt.

MATERIALS AND METHODS

Tree-cuttings of *Azadirachta indica, Balanites aegyptica, Dalbergia sisso* and *Eucalyptus camaldulensis* were obtained from Shelterbelt Research Station, Kano, an outstation of Forestry Research Institute of Nigeria (FRIN). The four species were selected because they are the most used in the northern part of the country. Young branches were selected for cuttings from trees of five years old and above. Branches of almost equal diameter were cut into cuttings of 25cm in length with surface sterilized secateurs

Two locally built high humidity propagators were used to induce shooting and rooting of tree-cuttings. These propagators are independent of electricity and pipe-borne water supplies or expansive mist equipment and yet allow for production of large number of cuttings. The propagators were constructed simply from polythene sheets stretched on a light wooden frame (1.5m x 1.0m x 0.9m) and placed on a bed of sterilized gravel lined with polythene sheets. When watered, this ensures a high humidity within the propagators. The propagators were sprayed internally with clean water (of pH 7.0) twice daily (morning and evening) using sprayer which also provided a regular change of air. The propagators were placed under nursery shed to provide adequate shade which is necessary to keep temperatures and light intensities conducive.

A total of 400 cuttings, (100 cuttings of each of the plants in four porous propagating trays) were planted. Each propagating tray has a diameter of 27cm, depth of 7.8cm and each contained sterilized river fine sand of pH 7.2 and texture of 0.02mm. Thus 25 cuttings of the same species were planted in each of the four propagating trays and each propagator contained four propagating trays. The space between the propagating trays was 10cm while a space of 2cm was maintained between the cuttings in the propagating trays. The experiment was terminated at the end of the seventh week.

A number of records such as days to first shooting and rooting, number of leaves and roots, and root lengths were taken. Other observations include number of cuttings that survived, plant height, days to 50% shooting and rooting. The data taken from the randomly selected tree cuttings were subjected to an Analysis of Variance (ANOVA) for each parameter to test the significance of the differences among the plant cuttings.

RESULTS AND DISCUSSION

Table 1 shows data on mean growth parameters as well as survival counts, while Table 2 shows Analysis of Variance for survival counts.

The results clearly showed species differences, especially with respect to first shooting, even though variation in **growth** and potential of the four plant cuttings. The number of days to

Table 1: Mean growth parameters

Days to First Shooting	Days to First Rooting	Days to 50% Shooting	Days to 50% Rooting	Number of Leaves	Number of Roots	Length of Root (cm)	Plant Height (cm)	No of cuttings that survived
A indica	11	28	15	32	10.87	8.25	1.33	22.14	49.67
B aegyptica	13	32	17	36	8.17	5.00	0.9	21.87	38.83
D. sisso	11	23	14	26	14.67	7.50	1.4	22.13	68.83
E camaldulelensis	15	32	18	37	4.00	5.00	0.9	21.40	37.20
S. E.	0.54	1.10	1.02	1.14	1.45	0.031	0.03	0.07	3.39
C. D. at 5%	2.13	3.86	3.04	3.89	4.03	0.16	0.07	1.45	8.95

similar in both *A. indica* and *D. sisso*, differs significantly from the other two plants. Days to 50% shooting follows similar pattern as days to first shooting in the four plants. Days to first shooting and days to 50% shooting are necessary parameters because earlier to shoot translate to earlier to produce leaves which reduces the negative effect of wind on man, livestock and residential buildings.

Analysis of the results showed that number of days to first rooting is earlier in *D. sisso* while *B. aegyptica* and *E. camaldulensis* had similar value. This difference in rooting could probably be due to their inherent genetic variability (Adegoke, 1983). The days to 50% rooting ranged from 26 days in *D. sisso* to 37 days in *E. camaldulensis*. The trend may have been influenced by the nature of root hormones in each plant as also reported by Okoro (1974). *B. aegyptica* and *E. camaldulensis* had similar mean root number (5). There is positive increase in the number of roots throughout the experiment. Jones (1970) also reported similar increase in the number of roots of *Terminalia ivorensis* and *Triplochiton scleroxylon* when planted in an electrically controlled mist propagator. This goes on to show that locally made propagators are as good and efficient as the electrically controlled mist propagator.

As evidenced from the ANOVA, the mean plant height differed very significantly among the plant cuttings. *A. indica* is the tallest and was closely followed by *D. sisso* while *E. camaldulensis* recorded the shortest height. There was positive increase in the height of the cuttings throughout the study, which is an indication of their suitability for establishment of shelterbelt in semi arid zone. Dorrigo Nursery, (2008) opined that the higher the timberbelt, the greater the area that will be protected.

The average number of cuttings that survived differed significantly, with *D. sisso* and *E. camaldulensis* recording the highest and the least respectively. The number, however, dropped as from the 5th week except in *D. sisso* that maintained its trend of increase up to the end of the experiment. It is, however, believed that death of some of the plants may be due to transpiration in the propagator which kills young buds because they are heated up. But on a comparative basis, the results remain valid because all the plants experienced the same condition.

The result from this research showed major genetic differences among the four tree-cuttings for their suitability for establishment of shelterbelt in semi arid zone. Plant height also showed significant difference among the four plants tried. ANOVA results showed that there was a significant difference in variations among the treatment means in days to first shooting, days to first rooting, days to 50% rooting, leaf number, root number, root length, plant height and number of tree cuttings that survived.

Table 2: ANOVA for survival Counts

Source of Variation	DF	SS	MS	F-Ratio Calculated	F-table
Replicates	3	18.26	-	-	-
Treatments	3	685.35	66.08	8.95	3.76*6.99*
Error	9	198.25	7.34	-	-

In conclusion, *D. sisso* performed better than other three plants in most of the growth parameters considered. The degree of shelter provided by trees according to Onyewotu (1990) and Nursery (2008) depends on many factors which include the height of the barrier (trees), the permeability of the barrier (leaf crown), the root pattern for their adaptability to uphold the trunk and search for plant nutrients and water in semi arid zone. It is, therefore recommended to be used for establishment of shelterbelt in semi arid zone having satisfied all these requirements. It must be, however, noted that the other three plants are also good. But in a plantation where blank space is to be filled, *D. sisso* is recommended, because of its fast growth, in addition to its being used in establishment of shelterbelt.

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