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NODAL INFLUENCE ON *NAUCLEA DIDERRICHII* (DE WILLD AND T. DURAND) MERILL JUVENILE STEM CUTTING

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ABSTRACT

The experiment investigated effect of number of nodes on shooting and rooting ability of Nauclea diderrichii juvenile cuttings. The cuttings were approximately cut into one node cuttings (T_1), two nodes' cuttings (T_2), three nodes' cuttings (T_3) and four nodes' cuttings (T_4) experiment treatments. Five cuttings each of the treatment were set in planting trays and replicated four times making eighty (80) cuttings in total. It was arranged under a humid propagator chamber in Completely Randomized Design (CRD) and assessed variables such as survival rate, the number of leaves, root and shoot, the longest shoot and root length.The result showed that nodal cuttings in treatment T_4, had the best performance (4.50) in the survival rate while the least mean survival rate is T_1 with 2.75. It was also observed from the experiment that T_4 (four nodes' cuttings) had the highest performance in the number of root and shoot, the number of leaves, the longest shoot and root length while T_1 (one node cuttings) had the least performance in the number of root and shoot, the number of leaves, longest shoot and root length. This means that the more the nodes, the better the cutting performance. The ANOVA showed that the treatments are significantly differentat 0.05% probability level. It is therefore recommended that to have an optimum performance in survival rate, the number of root and shoot, the number of leaves, longest shoot and root length for its sustainablemass production N. diderrichii, four nodal cuttings should be used.

Keywords: Nodes, Juvenile Cuttings, Naucleadiderrichii, Nodal Position, Vegetative Propagations

INTRODUCTION

Nauclea diderrichii (De Wild & T.Durand) Merrill in Rubiaceaefamily is an evergreen tree, endemic in most West Africacountries including Nigeria. It is naturallyrainforest tree or tropical moist lowland forestshabitat(Keay, 1989). The stem hasgood form but slender, the bole is straight, usuallywithout branches and cylindrical in shape up to a height of30 m with little or nobuttress (Wagenfuhr,2000). The horizontal branches are often in whorls. The spherical crownof *N. diderrichii* has thick foliage (Depuy andMille 1993). The hard wood has a good look when worked upon. It has high durability.Its heartwood is borers and termites resistant(Wagenfuhr, 2000).*Nauclea diderrichii* is sought after in timber markets because it is good for out-door (harbour works and railway sleepers), in buildings (carpentry, indoor and outdoor woodwork, floors, facings, cabinet making) and constructions and these are possible becauseit has good mechanical properties which make it naturally durable(Dupuy and Mille, 1993).It can be treated with preservative and used for mortars and to make wooden poles, pit props, furniture and drums, mine-shaft guides in Ghana (Orwa *et al*. 2009).Its seeds are found in sphericalfleshy fruits and are tiny in size with short viability (Leakey*et al.* 1990). Seedlings from the seedsof this species could take 7 to 8 months where they are tended before attaining field heights(Caspa *et al*., 2009). The plants producedfrom seeds are not identical to themother plant genetically because of the flowers are allogamous in nature (Letouzey, 1983). This is the mainproblems encountered in certain forest ecologies when propagatingfor improvementphenotypically superior accessions. There is a paucity of information about the biology of *N.diderrichii*like many tropical trees. The species is threatened by deforestation and has been included in the IUCN red list of threatened species with a vulnerable status (African Workshop, 1998).

Artificial regeneration of *N.diderrichii*is now necessary because of the difficulty inits natural regenerationand theproblem of extinction threatened the species(Onyekwelu *et al*., 2003).Hence,the need to developother propagation methodsthat can give true totype planting materials in a large scale and atminimal cost (Meunier *et al*., 2006). Asexual propagation inforest trees is the seeds' alternative, to ensure sufficient planting stock withdesired genotypes (Zobel and Talbert, 1984).

Asexual propagation by stem cuttings is the majormethod applicablein most plants as it is tried here with *N. diderrichii*. The success of this method dependslargely on the genetic makeup of the species to root (the nodes are fundamental), and also on some nursery conditions which are environmental in nature (Hartmann *et al.* 1990); hence, the need to investigate the ability of *N. diderrichii* cuttings to root on the different number of nodes. This study investigated the ability of *N. diderrichii* juvenile stem cuttings to root on different number of nodes. Specifically, thisresearch was done to determine the influence of nodes on its rooting capability.

MATERIALS AND METHODS

The experiment was conducted at Federal College of Forestry, Jericho, Ibadan. The location of the college is between 7.23^0N and 3.51^0E, the climatic condition of the area is tropical with rainfall ranging between 1400 and 1700mm annually, the average maximum temperature of 24^0C and the average minimum temperature of 31.8^0C (FRIN, 2013).

Method: The riversand was collected from a stream near the college nursery and washed thoroughly, sieved and sterilized using autoclave machine to remove pathogens. The sterilized riversand was allowed to cool for hours before used to fill the planting trays. Two-year-olddiseased free seedlings of *N. diderrichii*healthy and growing uniformly, were collected from Tree Improvement nursery ofSustainable Forest Management (SFM) Department, Forestry Research Institute of Nigeria (FRIN), Jericho Forest Hill, Ibadan, Nigeria. The seedlings were cut into 1 node (T_1), 2 nodes (T_2), 3 nodes (T_3) and 4 nodes (T_4). Five cuttings each of the treatment were set in a planting tray and replicated four times making a total of eighty (80) cuttings. It was arranged under a humid propagator chamber in a Completely Randomized Design (CRD) (Plate 1), well labelled and watered every other day with the aid of a hand sprayer.

Data Collection: After five weeks of planting (35days), the cuttings were assessed for mortality, survival, callus formation, root and shoot number, number of leaves, longest shoot and root length. Collected data were analyzed using percentages, means, Analysis of Variance and separated significantly different means with Least Significant Difference (LSD).

RESULTS AND DISCUSSIONS

Survived Cuttings: in Table 1, the result as presented above revealed that cuttings with 4 nodes (T_4) position had the highest survival

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rate of 97.50%, followed closely by 3 nodes (T_3) with 93.75%, and least is 1 node (T_1) having 88.75%(Plate 2). The shows that more the node, the better the chance of survival.

Dead Cuttings: It was evident from the findings that cuttings with 1 node position had the highest death rate with 11.25%, followed by 2 nodes' position cuttings with 7.50% and the least was 4 nodes (T_4) with 2.50%.

Table 1: Influence of the number of nodes on survival and death rate of the cuttings

Treatment	% Dead cuttings	% Survived cuttings
T_1	11.25	88.75
T_2	7.50	92.50
T_3	6.25	93.75
T_4	2.50	97.50
%CV	49.24	18.68

CV – Coefficient of Variation

There is no significant difference among the treatment means in number of roots, leaf and shoot (Appendix 1). However, Table 2 revealed influence of nodal position on the production of roots, leaves and shoot of *N. diderrichii* cuttings. It was evident from the table that cuttings with 4 nodal positions (T_4) had the best performance in root, leaf and shoot production with an average means of 4.5, 12.50 and 6.00 respectively. One node cutting had the least performance in terms of root, leaf and shoot production with average means of 2.75, 3.00 and 2.00 respectively. This means that the more the nodes, the better the performance. Further test was employed using LSD. The result indicates that 4 nodal cuttings gave high significant effect on root, leaf and shoot production at probability level of 5%.

Table 2: Influence of Number of Node on Root, Leaf and Shoot Production.

Treatment	Number of Root	Number of leaves	Number of Shoot
T_1	2.75^{b}	3.00^{b}	2.00^{b}
T_2	3.50^{ab}	8.50^{ab}	4.25^{ab}
T_3	3.75^{ab}	7.00^{ab}	4.50^{ab}
T_4	4.50^{a}	12.50^{a}	6.00^{a}
Pooled SD	1.04	6.95	2.94
GM	3.63	7.75	4.19
%CV	18.68	58.18	45.60

Note: Means with the same letter along the columnare not significantly different from one another.
SD – Standard Deviation
GM – Geometric Means
CV – Coefficient of Variation

There is no significant difference among the treatment means in the longest root length and shoot (Appendix 1). Table 3 revealed influence of nodal position on the length of shoot and root of *N. diderrichii* stem cuttings produced. It was evident from the findings that cuttings with 4 nodal positions (T_4) had the best performance in shoot and root length produced with average means of 1.43 and 6.78 respectively (Plates 1 and 2).

Plate 1: Cuttings growing inside Mist Propagator

Plate 2: Survived Cuttings after 5 weeks

Cuttings with one nodal position (T_1) had the least length of shoot and root with average means of 0.55 and 0.85 respectively. Further test was employed using LSD. The result indicates that 4 nodal

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cuttings gave high significant effect on the longest shoot length and the longest root length at 5% level of probability.

Table 3: Influence ofNumber of Nodes on the longest Shoot and Root Lengths (cm)

Treatment	Longest Shoot Length (cm)	Longest Root Length (cm)
T_1	0.55^b	0.85^c
T_2	1.23^a	3.75^b
T_3	0.93^{ab}	3.63^b
T_4	1.43^a	6.78^a
Pooled SD	1.09	4.10
GM	1.03	3.75
%CV	68.87	71.05

Note: Means with the same letter along the column are not significantly different from one another at 5% probability level.

SD – Standard Deviation
GM – Geometric Means
CV – Coefficient of Variation

DISCUSSION

The significant variations observed among the number of nodes in some of the morphological parameters studied are an indication of explorative variation within the species. The significant levels obtained in seedling shoot height growth and collar diameter increment agreed with the earlier findings of Ladipo *et al.,* (1991). To a breeder, these genetic variations among the cutting nodes in terms of growth variables such as height and collar diameter and number of leaves are of great importance in selection and breeding programme. *Naucleadiderrichii* Leafy juvenile stem cuttings rooted very easily even without growth hormone. The achievement of a well-formed rooting system is of vital to its survival; therefore, there is need to optimise this factor. It has a greater rooting ability than some other hardwoods in West African, even compare to other easy-to-root species like *Triplochiton schleroxylon* (Leakey and Coutts 1989), and *Terminalia superba* Engl. and Diels (Koyo 1983). Reason for the rooting variation in these species is not well understood, though many factors come to play in plants' ability to root (Leakey 1985). There is a possibility of interactions among such factors, and the scope of immense variation. One of the factors which seem to be of particularly importance is the role of the leaf and number of nodes when rooting is not affected by physiological stress. The species under study rooted easily without the application of hormone. This implies that *N. diderrichii* is endowed with endogenous auxins hence may not require the application of synthetic auxin to induce rooting of the leafy stem cuttings for mass clonal propagation and it should therefore not be referred to as a difficult-to-root species. This is an indication that farmers can vegetatively propagate this species through stem cuttings without hormonal treatment.

The importance of nodal positionin the rooting ability of juvenile cuttings has been widely noticed (Hartmann *et al*. a",''1990). An appropriate rooting position is described as a point with thehighestamount of airs-filled pore space and movement rate enough for the needs of root growth. This case is noted in4 nodal positionsthat had a highestnumber of rooted cuttings, most and longest roots per cutting; and more best shoots compared with other positions. 4 nodes' cuttings have the capability to manufacture food betterthan the others. Plant species differ in their responses to different node numbers. Shiembo *et al*. (1996) and Ofori *et al.* (1996) worked on vegetative propagation of*Irvingia gabonensis* and *Milicia excelsa*and found similar results to the one obtained here with *N. diderrichii* which produced highest rooting percentage in 4 nodes' cuttings; Against Leakey, *et al*. (1990) who reported successful rooted cuttings using single nodal leafy stem in clonal propagation of *N. diderrichii* cuttings.

CONCLUSION

The results obtained from this study revealed that *N. diderrichii* can be propagated successfully by juvenile stem cuttings inside a non-mist propagation system without the application of rooting hormones. This suggests that asexual multiplication of this species is possible. The result obtained from the experiment shows that 4 nodal cuttings had the highest average mean value for all variables assessed (survival, the number of roots, the number of shoots, the longest shoot and root length). It is therefore concluded that 4-nodes' cutting is best for mass propagation of *N. diderrichii* through juvenile stem cuttingsin view of its economic importance and plantation establishment.

Recommendations

With its capability to produce more dense rooting system and the ability to develop a vigorous shooting system, four node is recommended for the mass production of true-to-type *N. diderrichii* planting materials at lower cost using juvenile stem cuttings.

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Appendix 1

Analysis of variance for the variable assessed

Source of Variation	df	Number of root	Number of leaf	Number of shoot	Length of longest root	Length of longest shoot
Treatment	3	2.0833*	61.6667ns	10.8958ns	23.4350ns	0.5806ns
Error	12	0.4583	20.3333	3.6458	7.0979	0.5044
Total	15					

*significant at 0.05% probability