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ROOTING POTENTIALS OF *Ceiba petandra* L. Gaertn STEM CUTTINGS IN DIFFERENT MEDIUM AND ROOT GROWTH STIMULATOR

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ABSTRACT

This study was conducted to evaluate the effort toward asexual propagation by stem cuttings in response to various root growth regulators and sowing media as alternative way for seedling production. Stems of C. Pentandra were carefully cut into three nodes size with surgical blade, the stems were quick-deep into the prepared solutions of Indole-3-Butyric Acid IBA, honey and coconut water attwo concentrations of 100 % and 50%with the control and sown into different sowing media (top soil, decomposed sawdust and river sand) in an equal moderately sized plastic sieves. Ten weeks after sowing, the results revealed that river sand medium had the highest number of leaves, root length, shoot length and number of roots at 1.07, 0.98, 1.26 and 1.28 respectively. The result also showed that coconut water performed better when compared with other root growth stimulators. This research study reveals that both river sand and coconut water irrespective of their concentrations performed excellently in stem cutting propagation of ceiba petandra seedlings.

Keywords: Asexual propagation, root growth stimulators, media, plantation. Stem cuttings

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INTRODUCTION

Ceiba petandra is a tropical tree of the order Malvales (formerly known as Bombacaceae). It is a deciduous tree with a thin crown with a height of 70m and a diameter of 100-300cm (Chaiarrekij *et al.*,2011). The tree is cultivated for the seed fibre and also known as Java cotton, Java kopok, silk- cotton or ceiba. It is commonly known amongst the Yorubas as Araba. It is generally used as timber species especially where more timber strength is not required (Friday *et al.*, 2011). The tender leaves, buds and fruits are mucilaginous and are eaten as okra (Orwa *et al*., 2009).

Stem cutting is an old system of vegetative propagation technique and a commonly useful method of mass propagation especially with some plant species which are sterile or are difficult to raise through seeds so that desirable clonal plants can be produced for plantation and commercial nursery stock purposes (Kesari *et al.*, 2010). Propagation by vegetative means is often the best way to preserve selected traits in tree species. Asexual or vegetative propagation of plants is that form of plant propagation in which this new individual possesses exactly the same characteristics as the parent plant from which it was taken (Sandra and Mack, 2011; Gupta *et al.*, 2002). It is also a mean of securing pathogen free plants. Other advantages assured by this method include large number of plant production in shorter time period, irrespective of the season (Mulabagal and Tsay, 2004). It is the most commonly used method of vegetative propagation. A piece of the stem or roots of the

source plant is placed in a suitable media such as moist soil. If the conditions are suitable, the plant piece will begin to grow as a new independent plant or seedlings. Some plants form roots much more easily than others. However, a root growth stimulator may be administered to hasten the root growth and to increase the success rate of the shoot growth. Pure honey can be applied to aid the rooting potential through its natural antibiotic and antiseptic properties. Honey is an excellent natural material that possesses antiseptic and antifungal properties which helps in healing process of plant parts and this may contribute to effective stem rooting system of the species.

According to Kesari *et al*., (2010) application of growth stimulator and rooting hormones both natural and synthetic ones are the important factors to overcoming challenges such callousing and poor rotting potential, which ultimately leads to an increase in product diversity. Many plants especially the (ornamental) have been said to have reproduced under natural conditions by asexual means (Mohammed and Hamid, 2014). Therefore, cuttings from the woody plants are treated differently, depending on the maturity and the plant physiological processes. *Ceiba petandra* seed is a recalcitrant species which loses viability when stored for a long time and this may not encourage mass seedlings production to meet massive plantation establishment (Adeniji, *et al,* 2019). Also, long storage of the seeds of the species encourages fungi attack which fosters die-back when sowing. Therefore, this study aimed to assess the influence of sowing media on the root growth of *C. petandra* stem cuttings, to determine the effects of natural root growth stimulators and compare the outcome with the synthetic hormone on the root growth of *C. petandra* stem cuttings.

MATERIALS AND METHODS

Collection and Preparation of the stem cuttings

Plant materials used were succulent stem cuttings of *Ceiba petandra* carefully cut from the six years old plantation (arboretum, Forestry Research Institute of Nigerian, Ibadan) very early in the morning. Collected stocks were brought to the nursery and cut cleanly into moderate size of node (3nodes). Good plant stems of *C. petandra* were selected from where two - three nodes stems were cut in a slant form with the aid of sharp surgical blade from the succulent / tendered parts from the entire collections and carefully prepared into the basin filled with water. Stem diameters were measured with an electronic veneer caliper, this was done to determine the increment at the end of the experiment. This was done to reduce the transpiration rate. After cutting, the stems were sorted out and leaves on the stem were reduced to a moderate size to reduce transpiration, the stems were carefully put into basket sieves and allowed to drain out the excessive moisture on the leaves prior to sowing.

Preparation of the Root Growth Stimulator (Honey and Coconut water)

A volume of2ml of pure honey was measured out into a clean container and 2ml of distilled water added and gently stirred to form a homogenous mixture. Also, another 4ml of honey was measured out into another clean container and to make a separate homogenous mixture, this serves as 50% and 100% portion respectively and the control (without honey). The above procedures were repeated for the coconut water in the same order.

Preparation of sowing media

Sterilized river sand was measured into germination tray (moderate sized sieve) of dimension (30 x 30 x 10) cm unto fullness. This was repeated for the decomposed sawdust and the topsoil.10 pieces of the prepared stem of *C. petandra* were taken together and quick dipped into the prepared root growth stimulators. The control was planted without any pretreatment for the stems. The germination baskets were placed inside the mist propagator and monitor for root and shoot growth and monitored every three months. The experiment was design in 3 x 3 x 3 factorial and arranged in Completely Randomized Design. Total number of 270 cuttings (3 x 3 x 3 x 10) was used for the experiment.

Data Collection

Parameters assessed include number of survived cuttings, shoot length (cm), number of leaves per cutting, number of roots formed and the root length (cm).

Statistical Analysis

The results from this study were analyzed using analysis of variance (ANOVA) and Duncan Multiple Range Test was to test the level of significance at $P \leq 0.05$, tables and graphs were also used for data presentations.

RESULTS

According to table 1 below, the result shows that the stem cuttings propagated using river sand had the highest value of number of leaves, shoot length, number of roots as well as root length of 1.07, 1.26 cm, 1.28 and 0.98 cm respectively and were significantly different from all the treatments both in terms of the media and the growth regulators. Also, cuttings subjected to coconut at 100% was significantly different in shoot length and root length with the values 1.32 cm and 1.02 cm respectively, while honey at 50% was significantly different from all the other regulators with the highest value of 1.13. However, the results from the control with all the parameters assessed had the least values. River sand had highest mean number of leaves, shoot length, number of roots and root length of 1.03, 1.26 cm, 1.26 and 0.98 cm respectively and significantly different from all other media. However, root stimulators did not have significant effect on the number of leaves of *C. pentandra* stem cuttings. Cuttings subjected to coconut water treatments at 100% concentration showed remarkable mean shoot length of 1.32cm while those subjected to honey 50% are not significantly different from each other. The result also indicated that A2B7 (Fig 2) has the highest number of sprouted cuttings and was significantly different from cuttings from other treatments.

In the table 2, the result indicates that A2B7 has highest shoot and root length and highest number of leaves of survived cuttings. Also, A2B4 and A2B6 have the highest number of roots.

Table 1: Mean performance for number of leaves, shoot length, number of roots and root length as expressed by the cuttings of *C. petandra*.

Treatments	Number of leaves	Shoot length (cm)	Number of roots	Root length (cm)
Control	0.57^{ns}	0.65^{b}	0.50^{b}	0.38^{b}
Honey 50%	0.67^{ns}	0.99^{b}	1.13^{a}	0.82^{b}
Honey 100%	1.00^{ns}	1.02^{ab}	0.70^{ab}	0.80^{b}
IBA 50%	0.67^{ns}	0.68^{ab}	0.90^{ab}	0.40^{ab}
IBA 100%	0.87^{ns}	1.09^{ab}	1.03^{ab}	0.60^{ab}
Coconut 50%	0.83^{ns}	1.21^{ab}	0.87^{ab}	0.94^{a}
Coconut100%	1.03^{ns}	1.32^{a}	0.80^{ab}	1.02^{a}
Top soil	0.49^{ab}	0.67^{b}	0.44^{c}	0.38^{b}
Decomposed saw dust	0.91^{a}	1.05^{a}	0.84^{b}	0.76^{a}
River sand	1.07^{a}	1.26^{a}	1.28^{a}	0.98^{a}

** Mean values with the same letters along the column are not significantly different at ($p<0.05$).*

Plate 1: Picture of sprouted cuttings of *Ceiba pentandra* from the interaction of river sand and coconut

Plate 2: *C pentandra* cuttings grown on river sand

Table 2: Morphological parameters on sprouted cuttings of *Ceiba pentandra* subjected to different sowing media and root growth stimulators

Treatments	TRT	NL	SL	NR	RL
control with top soil	A1B1	1	0.6	1	0.36
50% honey with top soil	A1B2	1	0.7	4	0.4
100% honey with top soil	A1B3	1	1.3	4	0.7
50% IBA with top soil	A1B4	1	0.9	3	0.9
100% IBA with top soil	A1B5	2	1.3	2	1.1
50% coconut with top soil	A1B6	1	1.4	2	0.9
100% coconut with topsoil	A1B7	2	1.3	6	0.9
control with decomposed sawdust	A2B1	1	1	3	0.4
50% honey with decomposed sawdust	A2B2	1	0.7	3	0.5
100% honey with decomposed sawdust	A2B3	1	1.3	5	0.7
50% IBA with decomposed sawdust	A2B4	2	1.4	6	1.2
100% IBA with decomposed sawdust	A2B5	2	1.3	3	0.9
50% coconut with decomposed sawdust	A2B6	2	1.7	6	1.5
100% coconut with decomposed sawdust	A2B7	2	1.9	3	1.7
control with river sand	A3B1	0	0.8	2	0.4
50% honey with river sand	A3B2	1	0.6	2	0.3
100% honey with river sand	A3B3	0	0.8	1	0.3
50% IBA with river sand	A3B4	0	0.5	2	0.4
100% IBA with river sand	A3B5	1	0.5	1	0.4
50% coconut with river sand	A3B6	1	0.7	1	0.4
100% coconut with river sand	A3B7	1	0.8	1	0.4

***KEYS**: Number of Leaves (NL), Shoot Length (SL), Number of roots (NR), Root Length (RL)*

DISCUSSION

The effects of using different soil media on *Ceiba pentandra* cutting were significantly different from one another. Stem cuttings grown through the river sand had the highest number of survived plants, number of leaves and number of roots among others. River sand as a medium for setting stem cuttings of *Ceiba pentandra* have a significant influence for survival as well as growth. The results indicated that successful seedlings production through stem cuttings can be enhanced by the use of sterilized river sand as a growing media. This study corroborates with the findings of De Klerk *et al., (*1999), which states that adventitious root formation is a key step in vegetative propagation of woody species. However, the performance of the stem cuttings in response to the root growth regulators irrespective of the levels of application was not significantly different from one another for the number of leaves produced. This generally shows that shoot growth of the stems has nothing to do with the root growth regulators either it in organic or inorganic origin as the results were not significantly different from one another for all the parameters accessed. The results from this experiment correspond with previous researches which state that asexual propagation through stem cuttings of many plants and fruit trees depends mainly on the physiological stage of the mother plant (Day and Loveys, 1998), the time of planting of the cuttings (Darwesh, 2000) and the type of growth regulators used (Rowezak, 2001).

The longest root was observed in stem cuttings raised with coconut water at 100% and 50% level of application and was not significantly different from one another. This shows that root length and level of penetration into the soil was favorably improved by the use of coconut water as a stimulator. However, the successful rooting rate was very low in top soil and varies significantly with the use of top soil when compared with the other growing media. The results suggested that good aeration and easy movement of the root through a porous sowing medium also contributed immensely to the success of stem cuttings propagation. It was observed in this experiment that cuttings treated with coconut water significantly increase shoot length, shoot girth, number of leaves, wet root weight, dry root weight and root length. Asma*et al.,* (2008) reported that root induction was highly affected by the length of shoots and an appropriate length was pre-requisite for the efficient root formation. The use of coconut water also indirectly affected the in-vitro roots induction since during shoot multiplication; the addition of coconut water to the culture media resulted in maximum shoot length (7.2 ± 0.16) and hence facilitating the efficient root formation. Also, Gupta *et al.*, (2002) reported that treatment of Bougainvillea cuttings with 1000 ppm IBA showed maximum rooting (100%) with higher number of roots in soaking method but its availability and cost of procuring it by the peasant nursery men made it of utmost importance to study and look for local and accessible alternatives which brought about the usage of coconut water and honey as the best alternatives in raising seedling through stem cuttings (Okunlola, 2016).

CONCLUSION

Natural root growth regulators such as coconut water and natural honey with sterilized river sand performed excellently for root initiation of *C. pentandra* cuttings. For successful propagation of *C. pentandra*s eedlings from cuttings, natural root growth stimulators such as coconut water and honey with sterilized river sand as a medium works better. This is cheaper and safer to use compared to synthetic hormones. These root growth stimulators come highly recommended for propagation for cuttings when seeds of the species are not readily available due to season and over exploitation.

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