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VEGETATIVE PROPAGATION OF *Adansonia digitata* (L.) USING JUVENILE STEM CUTTINGS, VARIOUS ROOTING MEDIA AND HORMONE CONCENTRATIONS

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ABSTRACT

Adansonia digitata is an important economic tree species which provides varieties of goods and services but despite this importance, the species is threatened with extinction due to its inability to regenerate under natural condition as a result of dormancy, drought, increased human pressure and other environmental factors. As such, some ex-situ conservation methods are necessary in order to preserve and conserve the productivity of the species. This prompted an investigation into the possibility of vegetative propagation of A. digitata as influenced by rooting media and hormone concentrations using juvenile stem cuttings. Double node stem cuttings were obtained from four months old seedlings and treated with indole-3-butyric acid and indole-acetic acid at 0, 50, 100 and 150mg/L. The treated cuttings were planted into three different sets of rooting media (Top soil, River sand and Saw dust) in a completely randomized design and replicated three times. The cuttings were watered twice a day (morning and evening) with knap sac sprayer. Data was collected on percentage survival, number of roots, length of longest root, total root length and number of leaves. Data was analyzed using descriptive statistics and Analysis of Variance. Significantly different means were separated with Duncan multiple Range Tests (P<0.05). The result indicated significant growth differences in the various rooting media and hormone concentrations for the variables assessed. Cuttings dipped in Indole-3-butylic Acid (with a concentration of 150mg/L) planted in sawdust media (SD/IBA/150mg/L) had the best result of all the variables assessed and therefore recommended for vegetative propagation of A. digitata.

Key word: Vegetative propagation, Growth hormone, Rooting media

INTRODUCTION

Adansonia digitata (Baobab tree) is among the most useful trees in the savanna with numerous medicinal and non-medicinal applications in Africa. Every part of it is reported to be useful and it is described as a highly economic tree species (Gebauer, 2002; Rabi'u *et al.,* 2013 and Rabi'u and Murtala, 2013). Despite its economic potentials, the sustained provision of the goods and services by *A. digitata species* is doubtful as it is threatened with extinction due to its e inability to regenerate under natural condition as a result of the increasing human pressure, seed dormancy, drought and other environmental factors which tend to mar its regeneration (Falerama *et al*., 2014). As such, some ex-situ conservation measures are needed to preserve its genetic diversity and maintain a reasonable population of this important plant (Kamatou *et al.* 2011 and Falerama *et al*. 2014). Vegetative propagation of fruit trees through stem cuttings is reported by Sally (2012) to be rapidly increasing and this is vital to tree improvement and establishment of large fruit tree plantations within a short time.

METHODOLOGY

The study was conducted in Aliero; a town located in the southeast of Kebbi State on latitude

12°16′42″N and longitude 4°27′6″E and has a land area of 350km^2 (Olajuyigbe *et al*., 2013). Most inhabitants are agrarian, producing mainly onion and pepper. The study area has a continental type of climate controlled by two air masses (tropical maritime and tropical continental). These air masses blow from the Atlantic Ocean and the Sahara Desert and determine the wet and dry seasons. The wet season is observed from May to September while the dry season lasts from October to April. The study area has a mean annual rainfall of about 800mm and mean annual temperatures of 26^{o}C, even though temperatures can go down to about 21°C during the harmattan and up to 40°C during the months of April to June (Mukhtar, 2016). The natural vegetation of Aliero is Sudan savanna, characterized by the presence of shrubs and scattered trees dominated by grasses.

Double node stem cuttings (8-11mm in diameter) of 4-5cm lengths were obtained from four months old *A. digitata* seedlings and separately treated with indo-3-butyric Acid and indole-acetic acid at 0, 50, 100 or 150 mg/1 concentrations using the quick dip method as described by Akinyele (2007) and Aderounmu (2010). Three cuttings were allocated per auxin concentration and replicated three times in a 2X4X3 factorial experimental design. After dipping, the treated cuttings were immediately planted into three (3) different rooting media (top soil only, river sand and sawdust). The cuttings were arranged in a completely randomized design in a high humidity propagator. The cuttings were watered twice a day (morning and evening) with a Knapsack sprayer. Cuttings were assessed based on percentage survival, number of roots per cutting, length of longest root per-cutting, total root length and number of leaves after 60 days.

Data analysis: Data was analyzed using analysis of variance and where significant difference existed, the means were separated with Duncan Multiple Range Test using SPSS statistical package (Version 20).

RESULTS

Percentage survival (PS)

The type of rooting media, hormone type and concentrations all interacted significantly (P<0.05) on percentage survival of *A. digitata* cuttings. Table 1 shows the influence of rooting media on the survival of *A. digitata* cuttings where Top Soil (TS) and sawdust (SD) had significantly higher survival (75.01%) compared to River Sand (RS) (48.62%). Seedlings treated with indole-3-butyric acid at a concentration of 150ml/L had significantly a higher percentage survival (70.38%) compared to IBA/100 (40.75%) (Table 2). The interaction of rooting media and hormone concentration also significantly influenced percentage survival of *A. digitata* cuttings after 60 days where cuttings that were not treated with hormone (TS/IBA/0), cuttings treated with IBA at 50ml/L (TS/IBA/50) and cuttings treated with IBA at the concentration of 150ml/L (TS/IBA/150) which were planted in top soil had highest percentage survival (88.90) each and were significantly different with other treatments (Table 3).

Number of root (NR)

The Number of roots was significantly (P<0.05) effected by rooting media, hormone concentration and interaction (Table 1, 2 and 3). Sawdust had the highest mean number of roots (0.17) which significantly (P<0.05) differed with top soil (TS) and river sand (RS). For hormone concentration, seedlings treated with indole-3-butyric acid at a concentration of 150ml/L (IBA/150) had significantly higher mean number of root (0.45) as shown in Table 2. Sawdust media where seedlings were treated with IBA at a concentration of 150ml/L (SD/IBA/150) recorded the highest number of roots formed (1.33) which significantly differed (P<0.05) with other treatment combinations (Table 3).

Length of longest root (LLR)

Rooting media had no significant effect on LLR of *A. digitata* cuttings but hormones concentrations and interaction were significantly (P<0.05) effective on LLR. Top soil had LLR of 1.11cm but was not significantly different from river sand (0.00) (Table 1). Hormone concentration had a significant influence on LLR where seedlings treated with IBA at concentrations of 150ml/L had LLR (1.11cm) that differed significantly from other concentrations which had 0.00 (Table 2). Interaction of rooting media and hormone concentrations had LLR which significantly differed from other treatments (Table 3) where cuttings treated with IBA at the concentration of 150ml/L and raised in sawdust media

(SD/IBA/150) had the only mean LLR recorded (3.33cm) which significantly differed from other treatments (Table 3).

Total root length (TRL)

Rooting media had no effect on TRL but hormone concentrations and their interactions were found significantly more effective in enhancing higher TRL of *A. digitata* cuttings after 60 days (Table 1, 2 and 3). Cuttings raised in Sawdust (SD) media had TRL of 0.81cm but not significantly different from river sand (RS). Cuttings dipped in IBA at a concentration of 150ml/L [IBA/150 (2.17cm)] was the only concentration with TRL and differed significantly from other treatments which had TRL of 0.00 (Table 2). Cuttings dipped in IBA at 150ml/L and planted in sawdust (SD/IBA/150) are the only ones with TRL of 6.50cm and was significantly different with other treatments (0.00) (Table 3).

Number of leaves (NL)

Rooting media significantly influenced the leaf production of *A. digitata* cuttings (Table 1). Top soil recorded the highest number of leaves (2.37). This was significantly different (P>0.05) from river sand (1.00) (Table 1). Cuttings treated with IBA at a concentration of 150ml/L (IBA/150) had the highest NL (3.65). This was significantly higher than IBA/0 (1.59) and other hormone concentrations. The interaction of various hormone concentrations and rooting media also had a significant effect (P<0.05) on NL of *A. digitata* cuttings since SD/IBA/150 and TS/IBA/50 had significantly higher mean NL of 4.00 and 3.94 respectively (Table 3).

Table 1: Effect of rooting media on percentage survival, root and leaf development on juvenile stem cuttings of *A. digitata*

Treatment	PS%	NR	LLR(cm)	TRL(cm)	NL
Top soil	75.01[a]	0.00[b]	0.00	0.00	2.37[a]
River sand	33.33[c]	0.00[b]	0.00	0.00	1.00[b]
Saw dust	48.62[b]	0.17[a]	0.42	0.81	2.44[a]
S.E	5.009	0.048	0.173	0.382	0.332
Significance	*	*	*ns*	*ns*	*

Means followed by the same letter(s) within a column are not significantly different (P>0.05)

PS: Percentage survival, NR: Number of root, LLR: Length of longest root, TRL: Total root length, NL: Number of leaves and *= significant

Table 2: Effect of hormone concentration on percentage survival, root and leaf development in juvenile stem cuttings of *A. digitata*

Treatment	PS	NR	LLR (cm)	T RL(cm)	NL
IBA/0	51.86[ab]	0.00[b]	0.00[b]	0.00[b]	1.59[b]
IBA/50	44.45[ab]	0.00[b]	0.00[b]	0.00[b]	1.93[b]
IBA/100	40.75[b]	0.00[b]	0.00[b]	0.00[b]	0.89[b]
IBA/150	70.38[a]	0.45[a]	1.11[a]	2.17[a]	3.65[a]
IAA/0	62.97[ab]	0.00[b]	0.00[b]	0.00[b]	1.95[b]
IAA/50	48.15[ab]	0.00[b]	0.00[b]	0.00[b]	2.00[b]
IAA/100	51.86[ab]	0.00[b]	0.00[b]	0.00[b]	1.89[b]
IAA/150	48.16[ab]	0.00[b]	0.00[b]	0.00[b]	1.61[b]
S.E	8.180	0.079	0.283	0.625	0.543
Significance	*	*	*	*	*

Means followed by the same letter(s) within a column are not significantly different (P>0.05)

Table 3: Effect of rooting media and hormone concentrations on percentage survival, root and leaf development in juvenile stem cuttings of *A. Digitata*

Treatment	PS	NR	LLR (cm)	TRL (cm)	NL
TS/IBA/0	88.90^{a}	0.00^{b}	0.00^{b}	0.00^{b}	1.93^{abc}
TS/IBA/50	88.90^{a}	0.00^{b}	0.00^{b}	0.00^{b}	3.94^{a}
TS/IBA/100	55.56^{abcd}	0.00^{b}	0.00^{b}	0.00^{b}	1.67^{abc}
TS/IBA/150	88.90^{a}	0.00^{b}	0.00^{b}	0.00^{b}	3.44^{ab}
TS/IAA/0	88.90^{a}	0.00^{b}	0.00^{b}	0.00^{b}	2.50^{abc}
TS/IAA/50	77.80^{ab}	0.00^{b}	0.00^{b}	0.00^{b}	2.16^{abc}
TS/IAA/100	77.80^{ab}	0.00^{b}	0.00^{b}	0.00^{b}	2.00^{abc}
TS/IAA/150	33.33^{bcd}	0.00^{b}	0.00^{b}	0.00^{b}	1.33^{abc}
RS/IBA/0	11.10^{d}	0.00^{b}	0.00^{b}	0.00^{b}	0.67^{bc}
RS/IBA/50	11.10^{d}	0.00^{b}	0.00^{b}	0.00^{b}	0.00^{c}
RS/IBA/100	33.33^{bcd}	0.00^{b}	0.00^{b}	0.00^{b}	0.00^{c}
RS/IBA/150	66.67^{abc}	0.00^{b}	0.00^{b}	0.00^{b}	3.50^{ab}
RS/IAA/0	55.57^{abcd}	0.00^{b}	0.00^{b}	0.00^{b}	0.33^{bc}
RS/IAA/50	22.20^{cd}	0.00^{b}	0.00^{b}	0.00^{b}	0.67^{bc}
RS/IAA/100	22.20^{cd}	0.00^{b}	0.00^{b}	0.00^{b}	1.33^{abc}
RS/IAA/150	44.43^{abcd}	0.00^{b}	0.00^{b}	0.00^{b}	1.50^{abc}
SD/IBA/0	55.57^{abcd}	0.00^{b}	0.00^{b}	0.00^{b}	2.17^{abc}
SD/IBA/50	33.33^{bcd}	0.00^{b}	0.00^{b}	0.00^{b}	1.83^{abc}
SD/IBA/100	33.33^{bcd}	0.00^{b}	0.00^{b}	0.00^{b}	1.00^{abc}
SD/IBA/150	55.57^{abcd}	1.33^{a}	3.33^{a}	6.50^{a}	4.00^{a}
SD/IAA/0	44.43^{abcd}	0.00^{b}	0.00^{b}	0.00^{b}	3.00^{abc}
SD/IAA/50	44.43^{abcd}	0.00^{b}	0.00^{b}	0.00^{b}	3.17^{abc}
SD/IAA/100	55.57^{abcd}	0.00^{b}	0.00^{b}	0.00^{b}	2.33^{abc}
SD/IAA/150	66.70^{abc}	0.00^{b}	0.00^{b}	0.00^{b}	2.00^{abc}
S.E	14.168	0.136	0.491	1.082	0.940
Significance	*	*	*	*	*

Means followed by the same letter(s) within a column are not significantly different (P>0.05)

DISCUSSION

Rooting media, hormone concentration and interaction of these treatments significantly influenced survival, rooting and growth of *A. digitata* stem cuttings. Cuttings treated in IBA at the concentration of 150ml/L and planted in sawdust (SD/IBA/150) were the only cuttings that rooted. All other hormone concentration and rooting media did not enhance roots development. The inability of cuttings to roots appears to be in consonance with the findings of Manjulata (2011) who reported that plant growth hormones had adverse effect on the growth of *Aspergillus umbrosus*. It could also be due to the fact that the cuttings of *A. digitata* used in this experiment had no leaves. The presence of leaves of *Garcinia kola* cuttings without any hormone application probably positively enhanced the success of rooting of the cuttings (Oboho and Iyadi 2013). It could be that the stored photosynthate in leaved stem cuttings were essential for the physiological functioning and survival of cuttings (Oboho and Iyadi, 2013). It was also reported that root forming substances are manufactured in the leaves and move downwards to the stem where they promote root formation (Kroin, 2009). The significant differences herein recorded in rooting media and growth hormone concentration disagrees with the result of Akinyele (2010) who recorded no significant differences between rooting media and hormones concentrations in influencing root production of *Bucholzia coreacea* cuttings. This has to do with the characteristics of the species as *B. coreacea* was reported to be propagated with or without growth hormone unlike *A. digitata*. Akinyele (2010) also reported that retention of leaves on cuttings seemed to be necessary for cuttings of *B. coreacea* as they do not have photosynthate reserves and that, the ability of cuttings to survive and produce long massive roots

is very important. This could be another reason for the poor result obtained even though Sally (2012) observed no significant difference in leaf size or area of *Treculia africana* cuttings. The better performance of sawdust (SD) and top soil (TS) over river sand (RS) might be due to the later being too porous and could not keep enough moisture required by the cuttings. The presence of sufficient nutrient in sawdust and top soil over the river sand could have produced the observed significant differences (Akinyele, 2010). The findings therefore suggest that *A. digitata* cuttings should be treated with IBA/150mg/L and planted in sawdust (SD) for vegetative propagation (SD/IBA/150mg/L).

CONCLUSION

Cuttings of *A. digitata* rooted better when quickly dipped in IBA (at 150mg/L concentration) and planted in sawdust or topsoil media. Rooting media and hormone concentration significantly influenced the survival, rooting and vegetative growth of juvenile stem cuttings of *A. digitata*

RECOMMENDATIONS

1. SD/IBA/150mg/L was recommended for vegetative propagation of *A. digitata*

2. Further research on rooting of leafy cuttings is required on *A.digitata*

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