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Effects of Growth Hormones on Sprouting and Rooting of *Jatropha Curcas* l. Stem Cuttings

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ABSTRACT: This study was conducted to assess the effect of growth hormone on sprouting and rooting ability of *Jatropha curcas* (L). Stem cuttings from mature plants were treated with two types of growth hormones: Naphthalene Acetic Acid and Indole-3-Butyric Acid while the untreated cuttings were used as control. The experiment was laid out as complete randomized design with three treatments replicated three times. The following parameters were evaluated : survival percentage, number of buds that sprouted, bud length, leaf number, and rooting parameters. Results showed that growth hormone application had no significant effect on survival and sprouting behaviour of J. curcas. The untreated cuttings (control) performed better than the hormone treated cuttings. However, in term of rooting behaviours, significant effect of treatment differences were observed at $p < 0.05$. Cuttings treated with IBA were found to root better than those of NAA, the control gave the best performance. @JASEM

Key words : growth hormones, survival, stem cuttings, sprouting and rooting.

Jatropha spp is a drought-resistant, photo-insensitive perennial plant native to Central America and widely distributed in Africa and Asia (Fairless, 2007). Being a plant which has been identified as a potential bio-diesel crop, National and State Governments have drawn ambitious programmes for its large scale cultivation (Kou and Chou, 2007; Mandpe *et al.*, 2005 and Openshaw, 2000). *Jatropha curcas* is usually propagated by seeds which results in lots of genetic variability in terms of growth, biomass and seed yield. However, vegetative propagation or clonal multiplication has shown an advantage of developing true-to-type and disease free clones of great importance both economically and commercially (Kochhar et al, 2008). However, in most vegetatively propagated plant species, there may be need for pre-planting practices to ensure rapid development of the crop. Among such practice is the pre-treatment of clonal materials with growth hormones like Indole-3-Butyric Acid (IBA), Indole-3-Acetic Acid (IAA) and Naphtalene Acetic Acid (NAA) (Kumar and Arumugam, 1980). These growth hormones have been found to affect different aspects of plant growth and development (Davies, 1996). Cline (2000) reported significant influence of IBA and IAA in breaking root apical dominance induced by cytokinins in plants. Kumar and Swankar (2003) reported that rooting and sprouting in *J curcas* was more with IBA than NAA. Similar report was made by Gunes (2000). However, in most of the naturally vegetatively propagated species, adventitious root formation can occur without any need for pretreatment of cuttings with hormones while some other crop species will require growth regulators to root effectively (Syros *et al.,* 2004). However, little or no information was found on the response of the Nigerian varieties of *J curcas* to applied growth hormones. This study therefore aims at evaluating the effect of application of growth hormones on sprouting and rooting behaviour of the Nigerian *Jatropha.*

MATERIALS AND METHODS

Jatropha curcas (J. curcas) stem cuttings were obtained from lateral branches of mature plants. The stems were cut to planting size with one end slanted. Two growth hormones were used for this experiment namely: NAA and IBA. Solutions of NAA and IBA were prepared by dissolving each separately in 10-15ml of ethanol and diluted using distilled water to obtain a crystal clear solution. The basal portion of each stem cutting was dipped in the different hormone formulations and left for 24 hours to enhance the absorption of the hormone by the cuttings before planting. The experiment was laid out as complete randomised design. This includes three treatments which were : the cuttings treated with the two hormones and the untreated control replicated thrice. Manual weed control measures were employed at 3 weeks and 7 weeks intervals after which the plants were assessed.

Data were collected on the following: survival percentage; number of cuttings that sprouted; number of buds / plant, mean bud length/plant and mean leaf number per plant taken between 15 to 75 days after planting. Rooting parameters evaluated include number of cuttings that rooted, percentage rooting per cutting, number of root per cutting and mean root length per cutting.

Data Analysis: Data obtained were subjected to Analysis of Variance using Genstat 5 (Release 3.2) Analytical Model.

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RESULTS AND DISCUSSION

Mean values of survival percentage and sprouting parameters evaluated on the effect of growth hormones on *Jatropha curcas* stem cuttings are presented on table 1.

The survival percentage at 30 days after planting ranged from 42.5 to 49.8%. The control (untreated cuttings) had the highest survival percentage while the least value was recorded for cuttings treated with IBA. No significant treatment difference was observed for this parameter at $p \leq 0.05$. Table 2 presented the mean values for number of buds that sprouted/cutting between 15 and 75 days after planting.

Table 1: Effect of application of growth hormones on survival percentage of *Jatropha curcas*

Treatments	Survival % (30 DAP)
NAA	44.
IBA	42.5
Control	49.8
S.E.D	n.s

ns --- not significant at $p \leq 0.05$; DAP --- Days after planting

Table 2: Effect of application of growth hormones on number of buds that sprouted per cutting at 2 weeks interval

Treatment	15 DAP	30 DAP	45 DAP	60 DAP	75 DAP
NAA	3.0	7.0	7.0	8.0	9.0
IBA	3.0	7.0	7.0	9.0	9.0
Control	3.0	8.0	8.0	9.0	10,0
S.E.D	n.s	n.s	n.s	n.s	n.s

ns---- not significant at $P \leq 0.05$; DAP---- Days after planting

Mean number of buds per plant ranged from 3.0 to 10.0. The highest mean value at 75 DAP was found in the control. However, no significant effect of treatment differences was observed for this parameter at $p \leq 0.05$. The mean bud length/plant (table 3) ranged from 1.9 to 2.1cm at 15DAP and from 26.3cm to 30.0cm at 75 days after planting. The highest bud length (30.0cm) was however recorded for the controls. No significant difference was observed for this parameter at $P \leq 0.05$. Mean number of leaves (table 4) ranged from 61 to 69 with the least value (61) recorded for cuttings treated with IBA while NAA-treated cuttings produced 64 leaves at 75 days after planting. However, the highest mean leaf number (69) was recorded for the controls. No significant difference was observed among the treatments at $P \leq 0.05$ for this parameter.

The better performance of the untreated cuttings over the hormone treated ones showed that the growth hormones used had no significant effect on the sprouting behaviour of the Nigerian species of *J. curcas*. This probably implies that vegetative propagation of *J. curcas* is possible without the use of growth hormones as previously reported by Narin and Watna (1983) and supported by Aminul-Islam *et al.* (2010).

Table 3: Effect of application of growth hormone on mean bud length per cutting at 2 weeks Interval

Treatment	15 DAP	30 DAP	45 DAP	60 DAP	75 DAP
NAA	2.1	13.4	19.3	24.9	28.3
IBA	1.9	12.7	18.5.	24.3	26.3
Control	2.0	14.3	21.3	27.7	30,0
S.E.D	n.s	n.s	n.s	n.s	n.s

ns---- not significant at $P \leq 0.05$; DAP---- Days after planting

Table 5 showed the mean values of parameters evaluated to assess rooting behaviours of *J. curcas* stem cuttings. The percentage of cuttings that rooted ranged from 58.3% to 83.5%. Cuttings treated with IBA had higher rooting percentage (59.7%) than cuttings treated with NAA (58.3%). The highest value (83.5%) was however recorded for the untreated cuttings (control).

Table 4: Effect of application of growth hormones on mean number of leaves per cutting at 2 weeks interval

Treatment	15 DAP	30 DAP	45 DAP	60 DAP	75 DAP
NAA	5.0	23.0	39.0	61.0	61.0
IBA	4.0	23.0	39.0.	58.0	64.0
Control	4.0	28.0	45.0	66.0	69,0
S.E.D	n.s	n.s	n.s	n.s	n.s

ns---- not significant at $P \leq 0.05$; DAP---- Days after planting

Table 5: Effect of application of growth hormones on rooting behaviour of *Jatropha curcas cuttings* at 8 weeks after planting

Treatment	Rooting %	Mean No. of roots/cutting	Mean length of roots /cutting	Quality of roots formed
NAA	58.3^{b*}	13.0^{b}	12.4^{b}*	Fair
IBA	59.7^{b}	16.0^{a}	14.3^{a}	Vigorous
Control	83.5^{a}	15.0^{a}	15.2^{a}	Vigorous
S.E.D	0.9	1.0	0.8	

ns---- not significant at $p < 0.05$; * Means followed by different letters within a column are significantly different at $p \leq 0.05$.

This is an indication that IBA enhanced rooting better in *J. curcas* stem cuttings than NAA. Cuttings treated with IBA had the highest mean number of roots (16.0) than cuttings treated with NAA treated cuttings having 13.0 (being the least) while the controls (untreated cuttings) had a mean value of 15.0. These were found to be significantly different at $P \leq 0.05$. Mean root length ranged from 12.4cm to 15.2cm. Significant effect of treatment differences was observed for this parameter at $p \leq 0.05$. The least root length (12.4cm) was recorded for cuttings treated with NAA while cuttings treated with IBA had a mean value of 14.3cm. The highest mean value (15.2cm) was however observed among the control. In terms of root quality, both the untreated cuttings and cuttings treated with IBA had more vigorous root growth than cuttings treated with NAA. The better peformance of IBA over NAA treated cuttings could be due to the fact that IBA enhanced rooting better in *J. curcas* than NAA as reported by Kumar and Swarnkar (2003). The ability of IBA to enhance rooting in *J. curcas* has also been previously reported by Osborne and McManus (2005), Kochhar *et al* (2008) and Gunes (2000). Gunes (2000) observed that *there is* slight selective response of *Jatropha* species to growth hormone application. However, that the untreated stem cuttings had the best performance in terms of rooting of *J. curcas,* could be due to the fact that growth hormones may not necessarily be the major factor influencing root induction in *J. curcas*. Rooting of cuttings may be influenced more by the other factors such as physiological age of the cuttings and status of rooting media in terms of aeration and drainage properties as stated by Narin and Watna (1983).

Conclusion: Results showed that there were no significant treatment differences on survival percentage and sprouting behaviour of J. curcas. Slight selective response to growth hormones application was observed in terms of rooting behaviour, as IBA treated cuttings rooted better than the NAA treated cuttings. However, the untreated cuttings gave the best performance for all the parameters assessed on sprouting and rooting ability of J. curcas. Hence, the untreated cuttings could be used for massive production of *Jatropha* as they are good propagating materials.

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