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Effect of cutting positions and growth regulators on rooting ability of *Griffonia simplicifolia* (Vahl ex DC.) Baill

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ABSTRACT

The effects of growth hormones and cutting positions on stem cuttings of *Griffonia simplicifolia* were investigated. *The stem cuttings were treated with* IBA and NAA at 0mg/L, 100mg/L and 200mg/L with different cutting positions (top, middle and bottom). Cuttings were assessed for root length, roots number, shoot number and sprout percent weeks after planting. Highest root length (16.69cm) at upper cutting position and highest root number (4.05) at middle nodal position were observed in cuttings with no auxin. For shoot number (2.94) and sprout percentage weeks after planting (15.18), cuttings with no hormone also had the highest mean value.

Introduction

Griffonia simplicifolia also known locally in Nigeria as tapara/alukoko (Gbile, 1984) is a member of the family Fabaceae. It is stout, woody, evergreen climbing shrub with greenish flowers and inflated black pods. **I**n the coastal plains it grows as a shrub to a height of about 2 metres whilst in the forest zones it takes the form of climber around tall trees. The species is found principally in the West African countries following countries; Ghana, Ivory Coast, Togo and Nigeria. The seeds of the plant are used as an herbal supplement for their 5-Hydroxytryptophan content. 5-Hydroxytryptophan extract from seeds has the ability to raise serotonin levels which helps to regulate brain chemistry in the treatment of insomnia, depression, as an aid in weight loss and as well as treatment of stomach and intestinal ailments **(**Pathak *et al.*,2010). The active extract from the leaves is used for people who suffer from a lack of libido because it increases sexual desire and is also used for the treatment of cough and the extract from the stem is used as a laxative in the treatment of constipation. The decoction of the leaves and stems serves as an antiseptic wash for wounds that has pus **(**Pathak *et al.*,2010).

Vegetative propagation via stem cuttings offers true-to-type plants and availability of superior individuals in a short period of time for large scale commercial plantation. Moreover, the use of plant growth regulatory hormones or 'auxins' plays a vital role in influencing the sprouting and survival of stem cuttings. These plant hormones play an essential role in coordination of many growth and behavioural process in the plant life cycle (Delker et al., 2008; Hobbie, 1998). Naphthalene Acetic Acid (NAA) and Indole-3-Butyric Acid (IBA) are typically the principal auxins which are available commercially.

There is a dearth information on the macro-propagation of *G.simplicifolia.* Report has it that propagation by seed gave poor results and different seed treatments (scarification and acid treatment) did not significantly improve germination (Pathak *et al.* 2010).

Due to high medicinal value and economic importance of *G. simplicifolia*, its cultivation could not only play a major role to uplift the socio-economic status of the people, its propagation via stem cuttings would also help in the conservation of this plant. In view of this, an efficient and cost effective investigation was carried out to examine the role of two auxins-indol-3 butyric acid (IBA) and α-naphthalene acetic acid (NAA), for their stimulatory effects on adventitious root formation in stem cuttings of *G simplicifolia*.

Materials and Methods

Location of Study

The experiment was conducted at the Nursery section of the Department of Forest Resources Management, University of Ibadan.

The University of Ibadan campus is located north of Ibadan along Oyo road at approximately latitude $7^0$28'N and longitude $30^0$52'N. It is at an altitude of 277m above sea level (Akinyele, 2010). The climate is the West Africa monsoon with dry and wet seasons. The dry season is usually from November through March and is characterized by dry cold wind of hamattan (Akinyele, 2010). The wet season usually starts from April to October with occasional strong winds and thunderstorms (Akinyele, 2010).

Collection of plant material

Disease free Stem cuttings of *G. simplicifolia* were collected from Botanical Park of Centre for Rural Development (Igbodu, near Epe) Lagos state and were transported to Department of Forest Resources Management, University of Ibadan.

Preparation of leafy stem cuttings and planting medium

Stem cuttings were divided into three equal length representing the upper, middle, and basal cutting positions respectively. The leafy stem cuttings were made from firm stems in slants using secateurs. Thereafter, the leaves were trimmed to half in order to reduce evapo-transpiration.

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The cuttings were treated with indole butyric acid (IBA) and naphthalene acetic acid (NAA) by dipping their basal portions into the different concentrations of 0mg/L, 100mg/L and 200 mg/l using the quick dip method (Oni 1987) and immediately transferred to the rooting medium (sterilised river-sand). Ten stem cuttings were set per tray per treatment and replicated thrice. The treatments were arranged in a 2 x 3 x 3 factorial design in the green house under a high humidity propagator. Watering did not commence instantly as the sterilised river-sand has already been watered. Watering commenced two days after setting up the experiment. The cuttings were assessed for the following parameters after 60 days: Number of roots per cutting, Length of root per cutting, Number of shoots and Sprout percent weeks after planting. Analysis of variance (ANOVA) was carried out on the data collected for the different parameters and least significant difference (LSD) at 5% probability level was used to compare the significantly different means.

Results

Length of root

Hormone Concentration (HC) and Cutting Position (NP) had significant effect on root length at 0.05 probability level. 0mg/L had significant different on the root length with a mean of 16.69cm (Fig 2), while the 100mg/L and 200mg/L are not significantly different. Cuttings from the Upper position had the highest root length (11.26cm) while those obtained from Middle and Basal positions had 11.09cm and 5.21cm respectively (Fig. 2). Hormone type had no significant effect on root length.

Table 1: **Effects of Concentration on length of root, Number of root, Number of shoot and Percent Sprout**.

Treatment	Length of root	Number of root	Number of shoot	Percent sprout
0mg/L	16.69	4.05	2.94	15.19
100mg/l	6.77	1.38	2.88	13.33
200mg/L	4.10	0.88	2.11	6.85

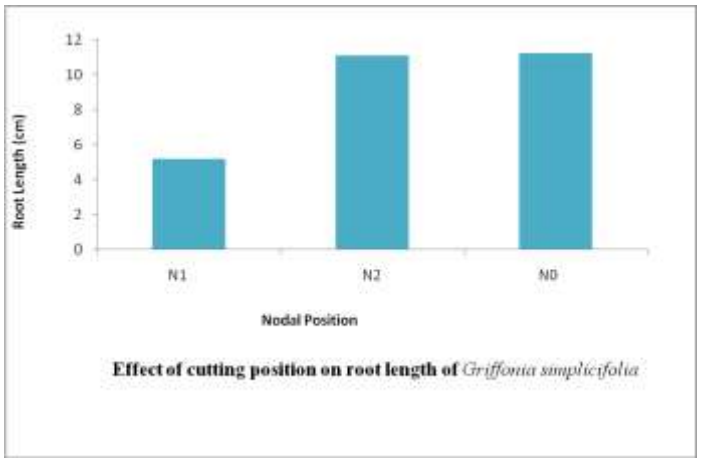

Fig 1: Effect of Cutting position on root length of *G. simplicifolia*

Analysis of variance showed that hormone concentration had significant effect on number of shoots at 0.05 probability level. Hormone type and cutting position does not have significant effect. However, there was significant effect between the interaction of Hormone Concentration and Hormone type on the number of shoot.

0mg/L and 100mg/L had the same effect on number of shoot with 2.94 and 2.88 as mean number of shoot respectively (Fig. 5). Interaction effects of Hormone Concentration and Hormone type are not significantly different from each other except for 200mg/L NAA (1.11).

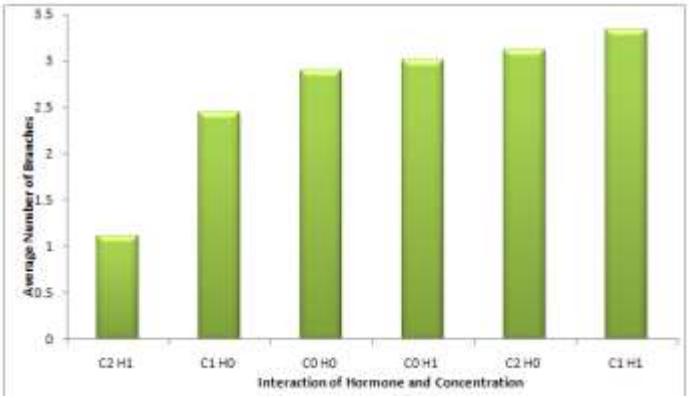

Fig 2: Average number of shoot under the interaction effects of hormones and concentrations

Sprout Percent Weeks after Planting of *G. Simplicifolia*

The result shows that Hormone Concentration, Weeks after Planting (WAP) and interaction between Hormone Concentration and cutting position all had significant effects on the percentage of sprout of *G. simplicifolia*.

0mg/L had the most significant effect of percentage sprout with mean percentage sprout of 15.19% (Fig.7).

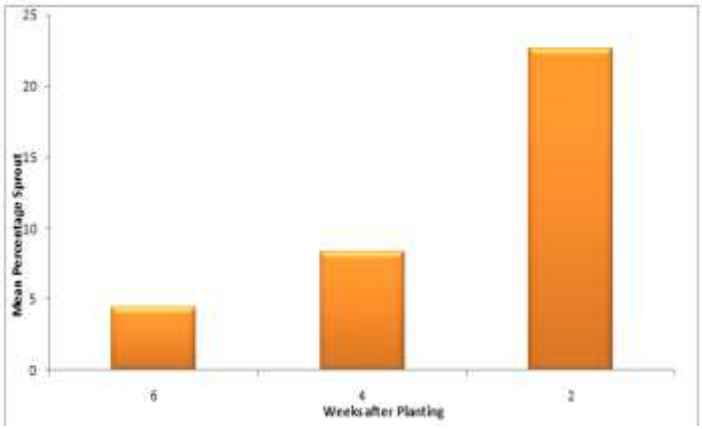

Fig 3: Mean percentage sprout across the weeks after planting

At two weeks after planting result reveal that number of sprout had the highest mean percentage sprout of 22.59% (Fig.8)

While interaction between hormone concentration (0mg/L) and top cutting position and interaction between hormone concentration (0mg/L) and middle cutting position had the most significant effect on percentage sprout with mean percentage sprout of 20.55% and15.55% respectively.

Discussion

The use of external hormone in stimulating root growth or length is not necessary in this species. This is in line with the finding of Ofori *et al* (1996) that auxin had no significant effect on the final rooting percentage although values declined with successive increase in IBA concentration above 0.2% when the effect of different IBA concentrations on rooting ability of leafy stem cuttings of *Milicea excelsa* were investigated. The results therefore imply that endogenous hormone concentration in

Griffonia simplicifolia is higher to be able to activate root initiation.

Table 3: Interaction Effects of Concentration and Cutting positions

Interactions	Percent sprout
0mg/L x Top	20.55
0mg/L x Middle	15.55
0mg/L x Basal	9.44
100mg/L x Top	12.22
100mg/L x Middle	13.88
100mg/L x Basal	13.88

The species therefore might not really require application of more exogenous hormone to boost the level of endogenous hormone in order to promote rooting through cell division. The type of hormone used did not have any effect on the cuttings either in the production of massive or long roots. However, the result presented from cutting position indicates that upper nodal cuttings and middle cutting position gave the best root length and number of root respectively out of the other cuttings position. This may be attributed to the level of auxin present at the meri-stem which is more than that found in other parts of the plants (Kurakawa *et al*., 2007). In most tree species rooting ability of cuttings has been reported to increase from apical to basal part of the crown/shoots which has been attributed to accumulation of carbohydrates at the base of shoot (Hartmann et al. 1997).

Fiona, (1997) also finds out that all top cutting positions of *C. mitchellii* gave a higher root length. Ngenoh *et al.,* (2013) also reported that cuttings of *Strychnos henningsii* from the top cutting position had the highest root length. Result was also obtained from *Tectonia grandis* indicating that cuttings originating from the middle position displayed higher root number (Husen and Pal., 2007) and *Dalbergia sissoo* (Husen, 2004). Therefore, it is evident from these findings that optimal cutting positions for the best rooting vary with the plant species. The result from the interaction effect of hormone type and nodal position indicated that middle cutting positions again also had the highest number of roots when treated with NAA. On the contrary, a report investigated by Husen and Pal., (2007) indicated that NAA treatment had an inhibitory effect in cuttings taken from the middle position while IBA treatment maximally promoted rooting for cuttings, which were taken from the middle position while it was less effective in cuttings taken from the other positions. NAA was more effective for increasing the number of roots at the middle cutting position. Also, hormone concentration significantly increase number of shoot as hormone concentration increases from 0mg/L to 100mg/L (NAA). Additional increase in the hormone concentration above 100mg/L resulted to reduction in the number of sprouted cuttings. Similar results obtained from this study have been reported by Mamo *et al* (2013) who emphasized that a further increase in concentration of NAA had a pronounced inhibitory effect on shoot number in *Prunus africana* and *Syzygium guineense.* Similarly, NAA treatment was found to be generally inhibitory on *Tectonia grandis* stem cuttings. (Husen and Pal; 2007). Generally, among hormone treatments, application of IBA to stem cuttings maximally promote sprouting (Husen and Pal; 2007). However, there was a great increase in shoot number as hormone concentration IBA increased to 200mg/L. These results also agree with Sally (2012) who observed that number of shoot was highest in stem cuttings of *Treculia africana* treated with higher concentration of IBA. However, from the investigation of Husen and Pal; (2007) treatment with higher concentration of IBA resulted into increased number sprout but yet, NAA hormone performed better according to the findings of Tiwari and Das (2010) who found out that NAA is more superior on cuttings of *E. tsjariam.* There was a great increase in sprouted cuttings treated with no hormone at first assessment (2 WAP) which eventually decreases from the fourth week (4WAP) to the sixth week (6 WAP). It can be deduced from the presented results that the storage of nutrients reserved was not sufficient (i.e. it had been depleted) to arrive at optimum sprouting. The findings from this study is similar to results reported by Mamo, *et al* (2013), who emphasized that there was a significant increase in the number of sprouted cuttings of *Prunus africana* treated with no hormone although, when IBA and NAA concentration were increased, there was an inhibitory effect.

Conclusion

The root ability of this species without hormone treatment is found to be encouraging when the cost and the availability of the hormones are considered. It can be concluded that the problem of seeds of *Griffonia simplicifolia* can be mitigated by rooting cuttings. Other factors controlling the rooting ability of these species are deemed necessary

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