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Growth Response of Bago *(Gnetum gnemon)* Cuttings to Various Rooting Agents

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Abstract - Domestication of forest-based floral resources like *Gnetum gnemon*, with young leaves and immature flowers are popularly eaten, promote *ex-situ* conservation of the species. *G. gnemon* is an excellent source of Vitamins A and C. However, the species remain largely forest-based and unresponsive to natural cutting propagation. The seeds remain dormant for 5 months to 1 year. This study determined the growth response of bago cuttings soaked for an hour in the following rooting agents : ANAA (1 tbsp/li of water); IBA (500 ppm); pure coconut water and plain tap water. Results showed T-2 (ANAA) and T4 seedlings (control) had the highest survival of 75% and 67% respectively. On leaf production, T4 (control) was significantly higher than the other treatments. Treatment 1 (IBA) produced the highest average number of roots. The study concluded that bago or *Gnetum gnemon* can be successfully propagated through cuttings with the use of rooting enhancers. However, care should be taken in the selection of the cuttings. Highest survival was observed with the greenish cuttings containing only a few brownish pigmentation and containing two nodes. Mortality was higher in the more mature or too young cuttings and those with one node only.

Keywords - Growth, *Gnetum gnenom*, Rooting agents, Cuttings

INTRODUCTION

Harnessing and exploring the potentials of local resources to reduce the dependency on commercial food and medicines is an urgent and very practical call for many impoverished communities in the country and around the world. Domestication of forest-based floral resources like *Gnetum gnemon*, which young leaves and immature flowers are popularly eaten, would not only enhance household economy and nutrition but also promote **ex-situ** conservation of the species. *G. gnemon* is an excellent source of Vitamins A and C. However the species remain largely forest-based and unresponsive to natural cutting propagation. *Gnetum gnemon* is an important agroforest species in Southeast Asia and Melanesia (Thaman 2000).

Bago seeds remain dormant for 5 months to one year and have low germination percentage. The branches or twigs do not respond to ordinary cutting propagation. Meanwhile, the advent of cloning technology utilizing rooting hormones pose a bright potential in the successful production of bago planting materials. Cloning has some successes with forest trees like the dipterocarps (white lauan, yakal etc.)

Indole Butyric Acid (IBA) is an auxin and the leading plant hormone used to promote the formation of roots in plants and to generate new roots in the cloning of plants through cuttings. Recommended concentration: herbaceous cuttings 1000PPM; softwood: 2000 to 3000 PPM, semi-hardwood 2000 to 4000 PPM and hardwood, 3000 to 6000 PPM (http://www.super-grow.biz/IndoleButiricAcidPlantRootingHormone.jsp). A concentration of 6000 PPM was tried for kiwi rooting. Many types of olive did well with 3000 PPM quick dip. A study on teak cloning found that combining Indole Butyric Acid with Thiamine (vitamin B-1) improved cloning success. In this study a 1000 PPM IBA and 3800 PPM thiamine was used. (Carmichael 1996).

Oxygenated water can be an alternative to root promotion agents for adventitious rooting of chrysanthemum cuttings (Park et al. 2004). Soaking cuttings in running waters high in oxygen content has

potential for improving early growth and survival of willow cuttings planted on eroded stream banks (Pezeshi 2003).

The success of plantation establishment using hardwood cuttings depends to a large extent on the ability of the cuttings to develop early and vigorous root systems (Petersen and Phipps 2001).

OBJECTIVES OF THE STUDY

The study primarily aimed to determine the growth response of bago *(Gnetum gnemon*) cuttings to different rooting agents. Specifically it seeks to find out the rooting agent that would give the earliest positive response, the highest average number of leaves and roots.

MATERIALS AND METHODS

A. Construction of the Improvised Raised Bed

The planted cuttings were housed in a raised bed made of bamboo slats which was constructed in a partially shaded area for a cooler microclimate. It was constructed one meter above ground. This is to prevent stray animals from trampling or destroying the experiment set-up. Transparent plastic was used for roofing. The roof was necessary to prevent rain splashing during a heavy downpour. The sides were covered with mist nets to control wind movement and also to keep away insects, birds and other flying animals from disturbing the plants.

B. Preparation of the Planting Media

The planting medium consisted of rich top soil, coir dust and river sand in equal proportion or in 1:1:1 ratio. These were thoroughly mixed and sterilized by cooking over fire using a big iron vat. Sterilization is necessary to do away with fungi that might attack the cuttings, damaging it before they can produce roots. The sterilized media was poured into the individual potting bags or cloning cups and arranged on the trays.

C. Collection and Preparation of Bago Cuttings

Bago cuttings were collected from healthy mother plants in Kanapnapan, Corella, Bohol.The optimum maturity of the twigs was carefully considered. They were not too young neither old. Selected twigs were cut leaving at least two (2) nodes. The cuttings were immediately placed in a pail partially filled with water to avoid wilting or desiccation while in transport to the planting area.

The cuttings were placed on a cutting board where clean, neat, and forty-five degree cut was made at the base using a sharp bolo. It was important not to damage the branch while handling. A crushed or bruised stem would have a reduced chance of rooting. The final cuttings had two nodes.

Then, the cuttings were soaked for an hour in a fungicide solution. Afterwards the portion above the cut, about one centimeter, was scraped to further enhance rooting. Finally the cuttings were soaked into the various treatments for an hour.

D. The Various Treatments

A total of 60 bago cuttings were used and distributed equally to four (4) treatments. The cuttings will be simultaneously soaked in the following various treatments:

a. Treatment 1 (IBA): The base of the cuttings was soaked for one hour in a 500-ppm solution of indole butyric acid or IBA.

b. Treatment 2 (ANAA): The base of the cuttings was soaked for one hour in ANAA solution. The solution was made by 1 tablespoon of ANAA diluted in 1 liter of water.

c. Treatment 3 (Coconut Water): The base of the cuttings was soaked for an hour in pure coconut water taken from just-matured coconuts (still green with a few scattered brownish spots on the external husk).

d. Treatment 4 (Tap Water): The base of the cuttings was soaked for an hour in plain tap water at ordinary temperature.

E. Research Design

A modified Completely Randomized Design (CRD) was employed in the study. Instead of randomly arranging the individual pots, these were arranged in trays by treatment. The potted cuttings had to be in trays to have them enclosed, air tight, to control the humidity.

F. Planting

Right after soaking, the cuttings were planted simultaneously within an hour in the sterilized growing media. The growing media was thoroughly watered with sterile water before setting in the cuttings. The cloning cups were punched with holes on the sides and bottom and were arranged in four trays appropriately labeled by treatment. The trays, provided with a wire-ensemble as roof structure, were placed inside a transparent plastic or cellophane. The loose end was tied tightly with a rubber band. The purpose was to control the humidity and have the immediate atmosphere around the cuttings moist. Fresh air was allowed into the enclosure after the first two weeks when the cuttings had to be watered for the first time by misting.

G. Care and Maintenance

Misting was done every week or once every two weeks depending on the weather condition. Cuttings that showed molding or fungal wilting were removed immediately from the set-up so as not to infect the rest. Sanitation was maintained within the raised bed and its immediate surroundings.

H. Data Collection

The initial signs of rooting success were noted. This was indicated by erectness of the leaves within the first 24 hours and the stems remaining alive during the first week. Leaf production was noted weekly after the first 3 weeks or when it started to bear leaves. At the end of the study period the following data were collected per plant in each treatment:

a. Survival Rate
b. Number of leaves
c. Number of roots

I. Data Treatment and Analysis

The data gathered were analyzed using Analysis of Variance (ANOVA) and further subjected to Duncan's Multiple range Test (DMRT) of the Statistical Program for Social Studies (SPSS) software to determine whether the results were significant or not.

RESULTS AND DISCUSSION

Data on the cloning response of bago (*Gnetum gnemon*) applied with various rooting agents- IBA, ANAA, coconut water and tap water are presented here and analyzed.

Table 1. Survival Rate of the Bago Cuttings Applied with Various Rooting Agents

Treatment	Number of Seedlings Survived	Percent Survival
T1- IBA	8	53.33%
T2- ANAA	11	73.33%
T3- Coconut Water	1	1%
T4- Control	10	66.67%
TOTAL	30	50%

Table 1 above shows T-2 (ANAA) seedlings with the highest % survival of 73.33% followed by T-4 (control), 66.6%; T-1 (IBA), 53.3% and T-3 (coconut water), 1%. It was observed that the cuttings that died were mostly those without leaves when planted or were too young or too old than the rest. It was also observed that cuttings applied with coconut water had a lot of fungal growth in the growing media. The coconut water itself may have caused it being sweet and palatable for

the soil organisms. Since the coconut water was not sterilized, it may have been infected with fungi during the soaking.

B. Early Growth Response

The cuttings in T4 (control) gave the earliest response in terms of leaf bud production on the 20th day of the observation period. This was followed by T2 (ANAA) on the 24th day; T1 (IBA) on the 25th day. The rest of the leaves came out on 5th week.

C. Leaf Production of the Bago Cuttings

Table 2 shows the descriptive comparisons of the various treatments through the computed mean, standard deviation and degree of confidence at 5% level or interval. Data indicated that T4 (Tap Water) produced the most number of leaves with a mean of 7.50, followed by T2 (ANAA) with 2.91, T1 (IBA) with 2.88. Only treatments 1, 2 and 4 were compared. Treatment 3 was discarded for having only 1 sample (or 1 replicate). Results showed T4 (control with the highest degree of confidence.

Table 2. Number of Leaves

Descriptives

No. of Leaves

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
1	8	2.88	3.182	1.125	.21	5.54	0	10
2	11	2.91	3.081	.929	.84	4.98	0	11
4	10	7.50	3.375	1.067	5.09	9.91	3	13
Total	29	4.48	3.814	.708	3.03	5.93	0	13

Table 3. Analysis of Variance (ANOVA) for Number of Leaves

No. of Leaves

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	138.957	2	69.479	6.733	.004
Within Groups	268.284	26	10.319		
Total	407.241	28			

Table 3 presents the analysis of variance on the number of leaves produced on bago cuttings applied with IBA, ANAA, coconut water and tap water. Statistical test revealed that the computed F has bigger value at 5% level meaning there was a significant difference on the number of leaves produced by bago cuttings applied with different rooting hormones. This finding further indicated that the rooting ability of the different rooting hormones differs from each other.

D. Root Development of Bago Cuttings

Table 4 below shows the descriptive comparisons of the various treatments through the computed mean, standard deviation and degree of confidence at 5% level or interval. Only treatments 1, 2 and 4 were compared. Treatment 3 was discarded for having only 1 sample (or 1 replicate).

Table 4. Descriptives for Number of Roots

Descriptives

No. of Roots

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
1	8	2.88	3.357	1.187	.07	5.68	0	10
2	11	2.27	1.902	.574	.99	3.55	0	5
4	10	1.50	1.841	.582	.18	2.82	0	5
Total	29	2.17	2.346	.436	1.28	3.06	0	10

Table 5. Analysis of Variance (ANOVA) of Number of Roots

ANOVA

No. of Roots

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	8.581	2	4.291	.766	.475
Within Groups	145.557	26	5.598		
Total	154.138	28			

Table 5 below shows the analysis of variance for number of roots of the bago cuttings. The result was significant between treatments. It means that treatments were significant with each other.

CONCLUSION AND RECOMMENDATION

From the result of this study, it can be concluded that the vegetable tree, bago (*Gnetum gnemon*), can be successfully propagated by cuttings even without the use of rooting chemicals. Treatment 2 (ANAA) gave the highest survival of bago plants. Treatment 4 (Control) gave the earliest positive response in cottage propagation of bago. Treatment 4 (Control) produced the highest average number of leaves while Treatment 1 (IBA) produced the highest average number of roots. The number of leaves in cuttings soaked in water was significantly higher than the rest there was significant difference in the number of rooted cuttings among treatments.

It is hereby highly recommended for people to grow "bago" in their home lots by soaking the cuttings in sterile water for an hour. Similar studies should be made increasing the concentration of ANAA and IBA but within the bounds of tried dosages from previous studies involving other species. Other rooting hormones can also be tried like Hormex. It is further recommended that the right age of the cuttings be strictly observed for successful rooting and leaf production.

Excess non-reusable chemicals should be safely disposed. Those that can still be used must be safely stored in a cool place. Other cuttings which are hard to root, whether for timber, ornamental or food production purposes may also be tested with the rooting agents used in this study. The potting media, cuttings and other materials used should be completely sterilized to insure non-contamination of fungus and other pathogens.

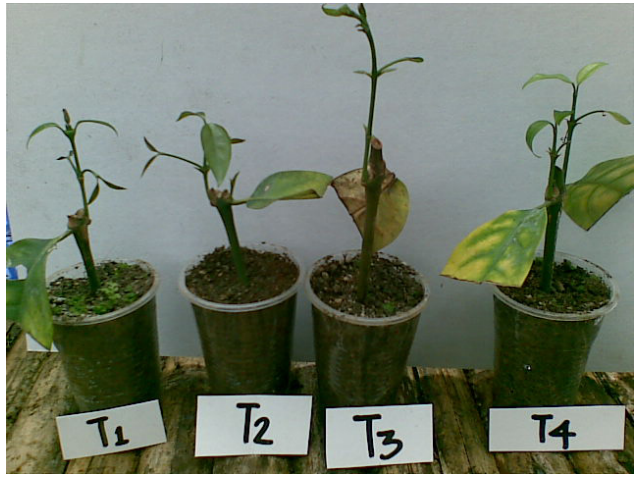

Fig. 1. Representative samples of successfully propagated bago plants.

Fig. 2. Representative samples of rooted bago cuttings.

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