J. Agrofor. Environ. 5 (1): 135-138, 2011 ISSN 1995-6983

Effect of cutting materials on regeneration and development of new shoots of jiga (G*aruga pinnata*)

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Abstract: The experiment was conducted to study the regeneration and shoots development on cutting materials of Jiga (Garuga pinnata) at the Agroforestry Farm, Department of Agroforestry, Bangladesh Agricultural University, Mymensingh, during the period from March to September, 2004. The experiment was laid out in Randomized Complete Block Design with three replications. The treatments were three different cutting lengths viz. 50, 25 and 12.5 cm and thickness viz thick stem cuttings of 2.75 cm diameter ranging from 2.5 to 3.0 cm in thickness and thin stem cuttings of 1.5 cm diameter ranging from 1.0 to 2.0 cm in thickness. It was found that regeneration and shoot development leading to forage production, the new bud development was first observed by day 7 and the peak increase in bud number was observed on 21 DAP in 25 cm × thick stem treatment. The treatment of 50 cm × thick stem showed sharp increase in the development of branch number at 90 DAP proving it to be the most effective treatment. The results of comparative study showed that with the increase in number of branches, the number of buds decreased. However, branch development was comparatively slower than that of buds. The length of branch was found increased gradually with the increase in DAP, and it was significantly higher in the longer cuttings than that in shorter ones. Similarity The number of leaf was found to increase gradually with the increase in DAPs and it was significantly higher in longer cutting than that in shorter ones. The interaction effect on the increase in number of leaves also showed almost similar trend as that of number and length of branches.
Key words: Cutting length/ thickness/ regeneration

Introduction

In Bangladesh Jiga (*Garuga pinnata*) is a type of tree that is well suited as living poles along the hedges and can be used for fodder production also. Jiga is a Burseraceae tree species belonging to the genus *Garuga*. It grows very fast and has considerable potential for supplying fodder, live posts and other products. It is a multipurpose tree. It is mostly used as living poles along the fence around the homestead and farm lands by the farmers in our country. It also grows in home garden as timber yielding tree and produces scarcity fodder's for the farmers. The farmers and villagers in our country usually plant very thick and larger stocks/poles/cuttings to serve them as living poles and are selectively kept for growing them as trees for future uses. In this method, they need a huge quantity of plant materials when needed to fence the whole homestead, garden or crop fields. However, although these thick and tall stocks are needed for stronger fencing, it may be unnecessary for the case of fodder production as well as for multiplication of the stems for future uses. Again tall stocks usually branch in upper region. Apart from live posts combination of live fencing and fodder production system is not effectively used at present with *G. pinnata*, unless combined with other species. This problem may be solved using stem cuttings technique in this species, enhancing branching from the whole area of the cuttings. Like many other species, it is thought that *G. pinnata* especially the regenerated plants from cuttings do not grow well in flooding or heavy raining condition. From the above discussion the present study has been taken to study the regeneration and shoots development on cutting materials of Jiga (*Garuga pinnata*).

Materials and Methods

The experiment was conducted to study the regeneration and shoot development on cutting materials of Jiga (*Garuga pinnata*) at the Agroforestry Farm, Department of Agroforestry situated on the central area of agricultural farm of Bangladesh Agricultural University, Mymensingh, during the period from March to September, 2004. The experimental area is located (AEZ-9) at 24.75°N latitude and 90.50°E longitude at a height of 18 m above the sea level (UNDP and FAO 1988). *Garuga pinnata* Roxb. was used for the present study. The experiment was laid out in Randomized Complete Block Design with three replications. The treatments were three different cutting lengths (50, 25 and 12.5 cm) and thickness (thick stem cuttings of 2.75 cm diameter ranging from 2.5 to 3.0 cm in thickness and thin stem cuttings of 1.5 cm diameter ranging from 1.0 to 2.0 cm in thickness). Well decomposed cowdung @ 16 kg/plot of 3.5 m × 4.5 m size were used by mixing to soil as basal dose during final spading and leveling before plantation for the experiment. No chemical fertilizer was used in plot prior to plantation. However, only urea @ 211.64 kg/ha were applied topdressing at mid stage of the study. The recorded parameters were number of buds and branches. The recorded data were analysed statistically to find out variation resulting from experimental treatments using MSTAT package programme (Gomez and Gomez 1984). The mean for all treatments was calculated and analysis of variance under study was performed by F-variance test at 5% level of significance. Duncan's Multiple Range Test (DMRT) separated the means of the parameters.

Results and Discussion

The regeneration and development of shoots on *G. pinnata* cuttings were measured in term of number of buds and new branches formed, length of branches and number o leaves produced per branch are described under following headings.

Effect on bud development: The swelling of the buds resulting into new bud development was visible from days 5 and counting was started from day 7. It reached to a peak of 3.1, on 21 DAP when affected by cutting lengths (Table 1) and to 1.8 when only cutting thickness (Table 1) was considered, and then the number was reduced gradually. The same trend was resulted in case of interaction between cutting length and cutting thickness as observed in (Fig. 1) However, the peak increase in bud number did not occur on the same time of 21DAP in all the treatments i.e. the peak was also observed on 28DAP in 25Cm × thick stem treatment. On he other hand, the treatments with thick stem always showed higher number of buds than that with thin stems. The sharp increase and decrease (Fig. 1) in bud resulted probably due to opening of buds into the new branch development as is evident from the following discussions.

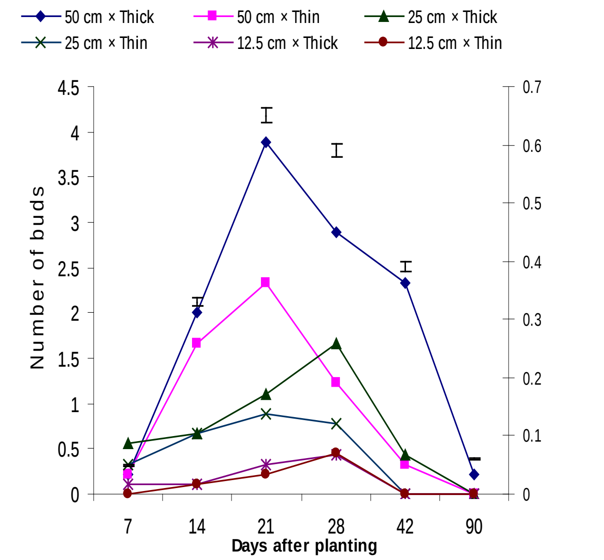

Fig. 1 Interaction effects of cutting length and cutting thickness on the increase and decrease in the numberof buds at different days after planting in Garuga pinnata. Varticle bar represents LSD at 5% level.

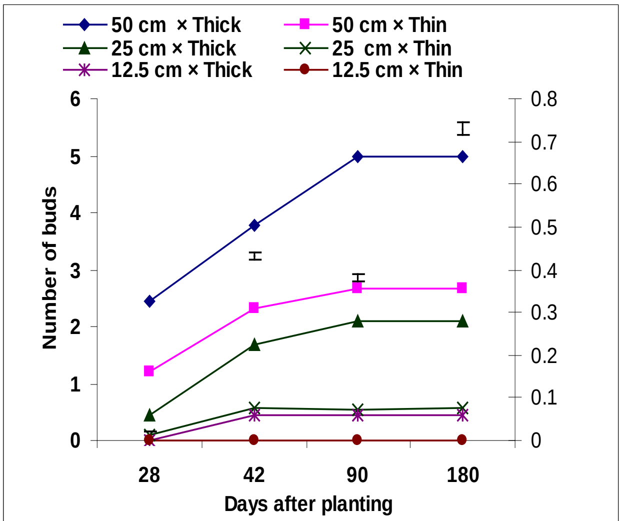

Fig. 2 Interaction effects of cutting length and cutting thickness on the increase in the number of branches at different days after planting in Garguga pinnata. Vartical bars represents LSD at 5 % level of significance

Effect on branch development: Unlike bud development, which started to develop in very early periods of the experiment, branch formation could be recorded first on around day 28 (Table 1). Then the numbers of branch development increased to a peak at 90 DAP in both cases of the effects of cutting length and cutting thickness when considered separately. It was found that the highest (3.835) number of branch was found from 50 cm cutting length at 180 DAP and the lowest (0.000) was recorded at 28 DAP. Significantly the highest (2.517) number of branch was found from thick (2.75 cm) cutting at 180 DAP and the lowest (0.443) was recorded at 28 DAP.

The interaction effects between the cutting lengths and cutting thickness showed that the number of branches produced was increased until day 42, followed by a slow increase until 90 DAP except in the treatment of 50 cm × thick stem. The highest (5.00) number of branch was found from 50 cm × thick stem and the lowest (0.000) was recorded from 12.5cm × thin stem at 180 DAP (Fig. 2).

This treatment showed sharp increase in the development of branch number until 90 DAP. This treatment also showed significantly highest number of branches than that of others at all DAP, proving it to be the most effective treatment (Table 2 and Fig.2).

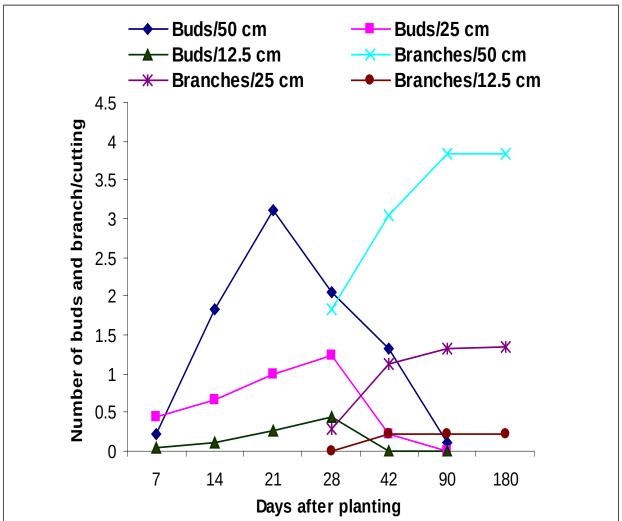

Fig. 3 Comparative development of buds and branches at different days after planting on the cuttings of Garuga pinnata

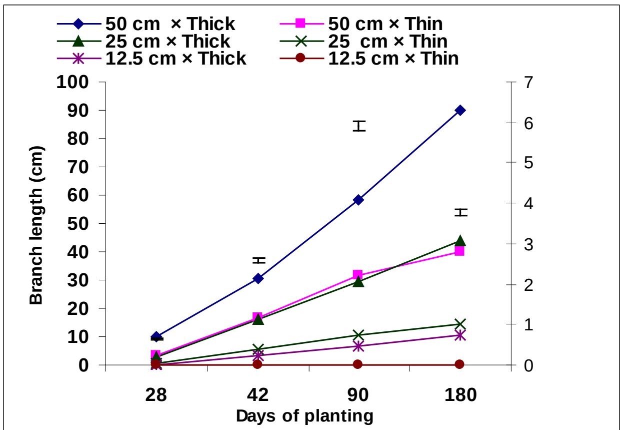

Fig.4 Interaction effects of cutting length and cutting thickness on the increase in length of branches produced at different days after planting in Garuga pinnata. Vertical bars represents LSD at 5% level

Comparative development of buds and branches on the cuttings: The results of comparative study (Fig. 3) showed that with the increase in number of branches, the number of buds decreased. This is obviously because that the buds were opened into new branches. However, the turning of buds into branches was not exact in all cases, because some buds might remain suppressed of damaged. This also indicates that there are chances of more branch development in the situation more bud formation.

However, branch development is comparatively slower than that of buds. The figure also shows that branch development in terms of increasing number was mostly completed by day 42in 12 in 12.5 cm cuttings in all others by day 90, compared to bud development by day 21 and 28.

Table 1. Single effect of cutting length and thickness on the number of bud development at different days after planting (DAP) in *G. pinnata*

Treatments	Number of buds per cutting					
	7 DAP	14 DAP	21 DAP	28 DAP	42 DAP	90 DAP
Cutting length						
50 cm	0.220 b	1.835 a	3.105 a	2.055 a	1.330 a	0.110 a
25 cm	0.445 a	0.670 b	1.000 b	1.225 b	0.220 b	0.000 b
12.5 cm	0.055 c	0.110 c	0.275 c	0.446 c	0.000 b	0.000 b
Level of significance	0.01	0.01	0.01	0.01	0.01	0.01
LSD (0.05)	0.040	0.237	0.463	0.420	0.275	0.040
CV (%)	10.01	11.05	14.66	12.95	14.53	15.29
Thickness						
Thick (2.75 cm)	0.297	0.927	1.773	1.667	0.923	0.073
Thin (1.5 cm)	0.183	0.817	1.147	0.816	0.110	0.000
Level of significance	0.01	NS	0.01	0.01	0.01	0.01
LSD (0.05)	0.033	0.194	0.379	0.344	0.225	0.033
CV (%)	10.01	11.05	14.66	12.95	14.53	15.29

Table 2. Single effect of cutting length and thickness on the number of branch development at different days after planting (DAP) in *G. pinnata*

Treatments	Number of branch per cutting			
	28 DAP	42 DAP	90 DAP	180 DAP
Cutting length				
50 cm	1.830 a	3.055 a	3.835 a	3.835 a
25 cm	0.280 b	1.115 b	1.330 b	1.335 b
12.5 cm	0.000 c	0.220 c	0.220 c	0.220 c
Level of significance	0.01	0.01	0.01	0.01
LSD (0.05)	0.013	0.301	0.266	0.513
CV (%)	4.9	16.03	11.55	14.19
Thickness				
Thick (2.75 cm)	0.963 a	1.963 a	2.517 a	2.517 a
Thin (1.5 cm)	0.443 b	0.963 b	1.073 b	1.077 b
Level of significance	0.01	0.01	0.01	0.01
LSD (0.05)	0.011	0.246	0.218	0.419
CV (%)	4.9	16.03	11.55	14.19

In a column figures having similar letter(s) do not differ significantly whereas figures with dissimilar letter(s) differ significantly as per DMRT at 5% level of significance

Table 3. Effect of cutting lengths and thickness on the increase in length of branches at different days after planting (DAP) in *G. pinnata*

Cutting length	Average branch length (cm)			
	28 DAP	42 DAP	90 DAP	180 DAP
50 cm	6.720 a	23.610 a	45.055 a	65.000 a
25 cm	1.560 b	10.780 b	20.055 b	29.170 b
12.5 cm	0.000 c	1.725 c	3.220 c	5.330 c
Level of significance	0.01	0.01	0.01	0.01
LSD (0.05)	0.4493	1.822	4.176	2.657
CV (%)	12.64	11.77	14.25	6.23
Thickness				
Thick (2.75 cm)	4.150 a	16.633 a	31.440 a	48.073 a
Thin (1.5 cm)	1.370 b	7.443 b	14.113 b	18.260 b
Level of significance	0.01	0.01	0.01	0.01
LSD (0.05)	0.351	1.488	5.218	2.170
CV (%)	12.64	11.77	14.25	6.23

Effect on the increase in branch length: The lengths of branches increased gradually with the increase in DAPs and it was significantly higher in the longer cuttings than that in shorter ones. The highest (65.00 cm) average branch length was found from 50 cm cutting length and the lowest (5.330 cm) was recorded from 12.5cm at 180 DAP (Table 3). The same trend in increase in branch length was noticed when only stem thickness was considered (Table 3).

The interaction effect on the increase in branch length also showed almost similar trend as mentioned above. Thus gradual increase in branch length occurred in *G. pinnata* cutting with increase in all DAPs (Fig. 4). The treatment of stock plants with 50 cm length and thick stem again showed significantly higher lengths of branches from those of others. The higher effectiveness in longer cuttings might be due to more reserve materials present in cuttings, which resulted faster growth of new shoots.

The similarity between the results in treatments of 50 cm × thin and 25 cm× thick as well as in 25cm× thin and 12.5× thick indicate that thick stem always had superiority over thin irrespective of lengths of cuttings (Fig. 4). Thus, the treatment 50cm× thick always proved to be the best among all the treatments tested.

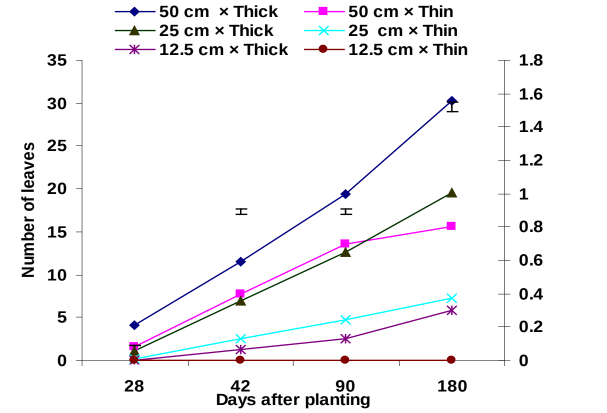

Fig. 5 Interaction effects of cutting length and cutting thickness on the increase in number of leaves produced at different days after planting inGaruga pinnata. Vertical bars represents LSD at 5% level.

Effect on leaf development: The number of leaves was found to increase gradually with the increase in DAPs and it was significantly higher in the longer cutting than that in shorter ones. The highest (23.005) number of leaves was found from 50 cm cutting length and the lowest (2.890) was recorded from 12.5cm at 180 DAP (Table 4). Significantly the highest (18.557) number of leaves was found from thick stem (2.75 cm) and the lowest (7.63) was recorded from thin stem (1.5 cm) at 180 DAP (Table 4).

The interaction effect on the increase in number of leaves also showed almost similar trend as above. Thus gradual increase in number occurred in *G. pinnata* cuttings with the increase in DAPs (Fig. 5). The treatment of stock plants of 50cm length and thick stem again showed significantly higher number of leaves compared to other treatments. As stated previously, the higher effectiveness in longer cuttings might be due to more reserve materials present in the cuttings, which resulted faster growth of new shoots.

The similarity between the results in the treatment of 50 cm× thin and 25 cm× thick as well as in 25cm× thin and 12.5cm×thick further indicated that thick stem always had superiority over thin irrespective of length of cuttings (Fig.5). Thus, the treatment 50cm × thick always proved to be the best among all the treatment tested.

Forest, Mexico. Number and height of shoots on each cutting were measured monthly for a year. Analysis indicated a slight (34.80%) correlation between number of shoots per cutting and height of shoots in the present study an increased number of branches and leaves were observed in cuttings with longer length than these of shorter ones. Adejumo (1991) studied the effects of length and girth of planting materials on DM yield of G. *sepium.* plots of G. *sepium*established form cutting of 3 different girths (5, 10 and 15 cm) and 4 lengths (25,50,75 and 100cm) were harvested every 8weeks over 48 weeks. The DM Yield of G. *Sepium* increased with increasing length and girth of cutting. According to Hong (1989) plant height, stem and LAI increased with increasing the number of branches while stem diameter decreased. These are in good conformity with the results of present study.

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