

# Selection of Suitable Planting Technique of Gamar (*Gmelina arborea* Roxb.) for Different Sites of Bangladesh.

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## Abstract

Survival percentage and height growth of four types of planting propagules (stumps, poly bag seedling, stumps in poly bag and direct seed sowing) of *Gmelina arborea* were studied at Charaljani, Charkai, Keochia and Lawachara Silvicultural Research Stations located at different regions of Bangladesh. There was no significant differences in the average survival percentage among the polybag raised seedlings, stump planting, stumps in polybag and seeds directly sown in the fields. The average survival percentage was 45% to 91% at four sites at the age of 2 years 4 months at Charaljani, Keochia, Lawachara and 1 year at Charkai Silviculture Research Station. The difference in total height growth of four types of planting propagules was found statistically significant. The highest height growth (263cm) was obtained in polybag raised seedling at Charaljani followed by 105 cm at Keochia, 88 cm at Lawachara at the age of 2 years 4 months and 139 cm at Charkai at the age of 1 year after out planting. However, there was no differences in height growth between the polybag seedlings and stumps in polybag at Lawachara Silviculture Research Station.

## সার সংক্ষেপ

বাংলাদেশের বিভিন্ন অঞ্চলে অবস্থিত চাড়ালজানী, চরকাই, কেউচিয়া এবং লাউয়াছড়া সিলভিকালচার গবেষণা কেন্দ্রে সৃজিত গামার প্রজাতির রোপণকৃত পদ্ধতির বাগানে স্ট্যাম্প, পলিথিন ব্যাগের চারা, পলিথিনব্যাগ সহ স্ট্যাম্প ও সরাসরি বীজ বপন এর মাধ্যমে চারা বেঁচে থাকার ও উচ্চতা বৃদ্ধির হার নিরূপণ করা হয়েছে। এতে পলিথিন ব্যাগের চারা, স্ট্যাম্প, পলিথিন ব্যাগ সহ স্ট্যাম্প ও সরাসরি বীজ বপনের ক্ষেত্রে চারা বেঁচে থাকার হারের কোন পার্থক্য পাওয়া যায়নি। চাড়ালজানী, কেউচিয়া ও লাউয়াছড়া কেন্দ্রে ২ বৎসর ৪ মাস বয়সে এবং চরকাই কেন্দ্রে ১ বৎসর বয়সের চারার বেঁচে থাকার হার গড়ে ৪৫% থেকে ৯১% পাওয়া গিয়েছে। উচ্চতা বৃদ্ধির ক্ষেত্রে ৪ টি প্লান্টিং প্রোপাগিউল এর মধ্যে উল্লেখযোগ্য পার্থক্য পাওয়া গিয়েছে। পলিথিন ব্যাগের চারা রোপণের ক্ষেত্রে সর্বাপেক্ষা বেশী উচ্চতা (২৬৩ সে.মি.) চাড়ালজানীতে এবং নিচক্রমানুসারে কেউচিয়াতে (১০৫সে.মি.), লাউয়াছড়াতে (৮৮ সে.মি.) ২ বৎসর ৪ মাস বয়সে এবং চরকাইতে (১৩৯ সে.মি.) ১ বৎসর বয়সে পাওয়া গিয়েছে। কিন্তু লাউয়াছড়াতে পলিব্যাগের চারা এবং পলিব্যাগসহ স্ট্যাম্প রোপণের বেলায় উচ্চতা বৃদ্ধির ক্ষেত্রে কোন পার্থক্য পাওয়া যায়নি।

**Key words :** *Gmelina arborea*, planting propagules, planting technique, polybag seedlings, stump

## Introduction

Gamar (*Gmelina arborea* Roxb.), a fast growing native of Asia, attains more than 30 m height and 4.5 m diameter at breast height (dbh) in 20 years in natural condition (Troup 1921). Nanagas and Serna (1970) noted that the species attained an average height of 13.2 m and an average clear bole length of 8.22 m 8 years after planting. Latif *et al.* (1995) reported its maximum 12.7 m height and 14.14 cm dbh at the age of 8 years in Bangladesh. Gamar is gaining momentum in plantation of Bangladesh due to its fast-growth, multipurpose uses for pulp wood productions, match sticks, home posts, particle board, boatdecking, door panels, furniture, easy availability of planting propagule and huge market demand as industrial wood. Large scale plantations of gamar is generally done by polybag raised seedlings but it can also be raised by direct seed sowing or stump planting (Lamb, 1968; Zamora and Agpaoa, 1976; Florido and Limsuan, 1977).

Dibbling of seeds and transplanting of nursery stock (both stump planting and polybag raised seedling) were tried in Bangladesh (Nuruzzaman, 1977). Scarce information about the performance of these different planting propagules are not enough to provide a clear understanding, particularly on survival and initial growth performance of the species. Therefore, an endeavor has been made to find out the best planting propagule for reforestation particularly in hills and degraded sal forest areas of Bangladesh.

## Materials and methods

The experiment was established at four Silviculture Research Stations (SRS) of Bangladesh Forest Research Institute (BFRI) viz. Keochia, Lawachara, Charaljani and Charkai located at different dendro-ecological regions of Bangladesh. The description of the sites is given in Table I.

Uniform gamar seeds were collected from Kaptai Seed Orchard Centre of BFRI. Polythene bags of 17.7 x 12.7 cm in size were filled up with a mixture of forest top soil and cow dung in a proportion of 3:1; then one seed was sown directly in each polybag. In July 1999, when the seedlings attained an average height of 75 cm the seedling were transplanted in the field. Among the raised seedlings two types of planting propagules were prepared; 576 numbers of stumps were prepared by keeping a proportion of 15 cm bare root and 5 cm shoot and 576 numbers of stumps in polybags were prepared by keeping only 5 cm shoot with polybag raised seedlings. Other two planting propagules were 576 numbers of polybag seedlings for direct transplantation and a total of 1728 uniform seeds were used for direct seed sowing (3 seeds for each pits) in the experimental plots. So, the four types of planting propagules (Treatments) were stump, polybag raised seedling, stumps in polybag and direct seed sowing. The same trial was set up at all the sites.

**Table 1.** Planting site description at different dendro-ecological regions of Bangladesh (Sterringa 1989).

Site description	Charaljani S.R. Station	Charkai S.R. Station	Keochia S.R. Station	Lawachara S.R. Station
Latitude	24°43'N	25°39'N	22°16'N	24°18'N
Longitude	91°44'E	88°41'E	91°49'E	91°44'E
Altitude	19 m	37 m	6 m	23 m
Topography	Flat to very gently sloping	Flat to very gently sloping	Hilly to flat, medium to gentle slopes	Hilly to flat, medium to gentle slopes
Soils	Deep soils, Clay loam to clay, p <sup>H</sup> 5.0-5.5 Acid soils	Deep soils with good drainage, clay loam and clay, p <sup>H</sup> 5.5-6.0 Almost neutral soils	Deep soils with good drainage; stoniness; small gravel occasionally present, sandy loam to sandy clay loam, p <sup>H</sup> 4.5-5.5, Acid soils	Deep soils with good drainage; stoniness; sandy clay loam, p <sup>H</sup> 4.5-5.5, Acid soils
Mean annual rainfall	2246 mm	1695 mm	2872 mm	2447 mm
Mean annual temperature	25.2°C	25.3°C	25.5°C	24.6°C

The experimental area was completely cleared off weeds by slashing but kept unburned before planting. The experiment was laid out in July, 1999 in a Randomized Complete Block Design (RCBD) with four replications. The plot size was 14 m x 14 m. In each plot 36 pits, each of 30 cm x 30 cm x 30 cm were prepared. Soil was made loosen in the pits by digging . The seeds were directly sown in the pits (3 seeds in each pits) spaced by 15 cm x 15 cm, and all the planting propagules were planted by 2.0 m x 2.0 m spacing. The directly- sown seeds started germination after 15 days and the stumps started producing shoots after 5 days. At the age of one month after germination seed sown in the pits, only one healthy seedling were kept and other seedlings were removed from the pits. The plants in all the plots were maintained by periodic weeding as applied to routine plantations. Data on survival and total height were recorded at the age of 2 year 4 months at Charaljani, Keochia , Lawachara and 1 year at Charkai SRS .

## Results and discussion

The mean survival percentages of four planting propagules, viz stump, polybag seedling, stumps in polybag and direct seed sowing of *Gmelina arborea* at four sites are shown in Table 2 . Analysis of variance showed no significant differences among the planting propagules for survival. Stump planting had higher survival percentage (69%) followed by polybag seedling (60 %) at Charaljani whereas polybag seedling had higher survival (91 %) followed by stumps in polybag (87%) at Charkai but polybag seedling (66%) and stump planting (80%) had higher survival percentage at Keochia and Lawachara SRS respectively . In the case of propagation by direct seeding, Sabado and Asuncion (1970) observed 71.9% survival while Caleda (1966) reported 90.8%. Sabado and Valiente (1972) observed 80.0% survival of the species propagated by stem cuttings. Sabado (1972) also observed that the method (centre hole

and dibble) with which the stumps were planted and the root length of the stumps did not affect their survival and height growth . Florido and Limsuan (1977) reported that there was no significant differences in the rate of survival of cuttings planted and seeds directly sown in this field. *Gmelina arborea* stumps planted in May and June gave the best height growth rates; survival percentage was best attained with the May-July plantings (Zamora and Agpaoa 1976).

The mean height (cm) of all the four planting propagules of *Gmelina arborea* planted at four sites are shown in Table 3. The analysis of variance showed significant differences ( $P > 0.05$ ) among the planting propagules and direct seed sown for total height growth at the age of 2 years 4 months at Charaljani, Keochia , Lawachara and 1 year at Charkai SRS . Mean height of the polybag seedlings showed significantly highest growth (263 cm) followed by stump planting (239 cm) while the stumps in polybag and direct seed sown propagules attained the same height growth at Charaljani . Mean height of the polybag seedlings showed significantly highest growth (139 cm) followed by stump planting (93 cm) and stumps in polybag (93 cm) at Charkai . Mean height of the polybag seedlings showed significantly highest growth (105 cm) followed by stump planting (73 cm) and stumps in polybag at Keochia. Similarly, the mean height of the polybag seedling (88 cm) and stump in polybag (80 cm) showed significantly highest growth followed by stump planting (69 cm) at Lawachara. The present findings are in accordance with Zamora and Agpaoa (1976) that the average survival percent of *Gmelina* stumps at the age of 11 months after planting was 73.97 cm.. Latif *et al* (1995) reported that at the age of 2 years the initial height growth of *Gmelina* were 220 cm when plantation raised with polybag seedlings . The findings of Zamora and Agpaoa (1976) and Latif *et al*. (1995) support the results of this experiment.

**Table 2.** Mean survival percentage of four planting propagules of *Gmelina arborea* at the stage of 2 years 4 months at Charaljani, Keochia and Lawachara and 1 year at Charkai S. R. Station.

Location	Survival of planting propagules (%)			
	Stump planting	Polybag seedling	Stumps in polybag	Direct seed sowing
Charaljani,	69	60	45	47
Charkai	67	91	87	76
Keochia,	61	66	63	62
Lawachara	80	74	74	68

**Table 3.** Height growth of four planting propagules of *Gmelina arborea* at the age of 2 years 4 months at Charaljani, Keochia, Lawachara and 1 year at Charkai S.R Station.

Location	Height of planting propagules (cm)*			
	Stump planting	Polybag seedling	Stumps in polybag	Direct seed sowing
Charaljani,	239 ab	263 a	202 b	199 b
Charkai	93 ab	139 a	93 ab	60 b
Keochia,	73 b	105 a	74 b	27 c
Lawachara	69 ab	88 a	80 a	57 b

\* Figures denoted by the same letters are not significantly different at  $P>0.05$ , based on Duncun's New Multiple Range Test.

## Conclusion

Based on the present findings, the survival percent showed no significant differences but the height growth differences is highly significant. Though highest height growth found in the polybag raised seedlings, considering the cost, easy carrying

and to avoid polybag for seedlings raising, direct seed sown of *Gmelina arborea* could be given preference for plantation forestry of Bangladesh. But, before going to large-scale plantation programmes, with direct seed sowing more growth data from these studies as well as pilot testing is needed to come to a conclusion.

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