



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 11, Issue 5, May 2022

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.118

 9940 572 462

 6381 907 438

 ijirset@gmail.com

 www.ijirset.com

Report on the Propagation of *Bambusa alamii* by Basal Culm Sections

Sangay Dorjee¹, Karma Wangmo¹, Thinley Yangzom¹, Kezang Dema¹, Dorji Lhamo¹, Sangay Khandu¹, Chris Stapleton²

Gyalsung Academy; Samdrup Choling, S/Jongkhar. Gyalsung Infra; Thimphu, Bhutan¹

Bamboo Identification, United Kingdom²

ABSTRACT: The trial investigated simple vegetative propagation of *Bambusa alamii* using basal culm sections planted in polybags and in a nursery bed. A total of 168 cuttings were used, each comprising the lower section of a single culm, all of similar size and age, with similar number of basal rhizomatous nodes. The growth rate was initially faster in polybags, with cuttings starting to shoot much earlier than those in bed planting. However, after six months the height and number of shoots from those planted in the nursery beds were significantly greater and they had a higher survival rate.

KEYWORDS: *Bambusa jaintiana*, bamboo, Bhutan, offset, propagation.

I. INTRODUCTION

Bamboos are an extremely important group of woody grasses but they are probably the least appreciated and understood of all the non-timber forest products. As well as providing constructional, weaving, and fencing materials, animal fodder, and one of the most profitable vegetables that marginal land can sustain, they also offer extremely good protection against surface soil erosion.

In subtropical areas of Bhutan they occur naturally as sub-dominants in a mixed broadleaved forest, and they are also widely planted on private land. In temperate forests, they are often very common in the understorey and provide valuable forest products, harvested systematically for roofing and fencing materials. In alpine pastureland dwarf species can form extensive areas of winter-green grazing. By providing dense evergreen groundcover they are also of great value to wildlife, providing food and breeding grounds for many threatened species (Stapleton, 1997).

Bamboos are multipurpose plants, widely harvested from natural forests and also cultivated. Their uses are dependent upon the characteristics of individual species such as culm strength, flexibility, and size (Stapleton, 1985). In Bhutan, bamboos are mostly used in construction, roofing, weavings, and as implements. As economically and ecologically important plants, they merit serious attempts to manage and plant them, and to conserve their diversity (Stapleton, 1985).

Out of 1718 bamboo species globally, *Bambusa* covers 153 species (Schroder, 2021), and are distributed throughout the lower Himalayan foothills. This particular species has short, straight culms and long internodes with small branches which makes it highly suitable for splitting into weaving strips, and it is particularly useful at lower elevations where the smaller more temperate Himalayan bamboo species commonly used for weaving cannot be grown. Some entrepreneurs in the country use this species to weave into various handicrafts in place of *Neomicrocalamus andropogonifolius* bamboo, which has been declining its population in the wild. In addition, this is one of the species that is frequently used to hoist prayer flags for the deceased in Bhutanese culture. The nomenclature of this species is still under investigation. A similar bamboo had been described from Meghalaya earlier as *Bambusa jaintiana*, and *B. alamii* has been considered a synonym of *B. jaintiana*. However the description of *B. jaintiana* was inadequate for species identification, and the type specimens need to be compared. While *B. alamii* can indeed be seen growing in Meghalaya, a paratype of *B. jaintiana* at Kew differs from *B. alamii* in having hairy culm sheaths and no leaf sheath auricles.

Planting bamboos with entire well-rooted rhizomes and branch-bearing poles (offsets) is the commonest traditional technique used in most countries, and Bhutan is no exception. Direct planting of offsets on site can be slow and unpredictable because of difficulties in protection and watering. Starting plants in nurseries allows better control of



their environment, but movement to the planting site can be problematic. Containerised stock is easier to move and plant, but plants in containers are more liable to desiccation than those with roots in nursery beds. Offsets are the most successful propagules, but they require substantial excavation and they are too large for poly bags. In this trial the basal section of the culms was used instead, including 3-5 compressed nodes, which are rhizomatous in nature, with thickened walls, aerial roots, and large buds.

Studies on vegetative propagation of *Bambusa* and *Dendrocalamus* species have shown highly variable success rates between species, with a number of other factors contributing to outcomes. No earlier publications dealing with the propagation of either *B. alamii* or *B. jaintiana* are known. Their small branches suggest that they are not likely to be very successful at producing plants from culm cuttings from higher up the culm without great care or treatment with root-stimulating plant growth regulators, while dormant basal buds are very likely to produce strong well-rooted shoots quite easily. Stapleton (1997) reported that for the most successful propagation of bamboos, the material should be planted just before the buds on it would have started to grow while on the parent plants. The buds on branches usually grow from March onwards while buds on culm bases and rhizomes grow much later, in June or the rainy months so that they can root easily in the following months. Gupta and Pattanath (1976) reported April to be the best month for planting bamboo.

The objective of this trial was to develop a reliable but simple means of establishing a reasonable number of new clumps from a small number of existing clumps in a basic temporary low-altitude forest nursery with limited supervision.

II. METHODOLOGY

As propagation requirements vary substantially between species, the identification of the species used on these trials was undertaken by collecting the culm sheaths and leaves and comparing them with descriptions of the Bhutanese species (Stapleton 1994), and material in the National Herbarium. The distinctive shape of the culm sheath and leaf sheath auricles and ligules, along with the absence of culm sheath hairs support its identification as *Bambusa alamii*. The investigations were conducted for one season with an experimental site located in the Terai of southern foothills at (26°54' N latitude and 91°48' E longitude) at an altitude of 361 meter above mean sea level (figure 1). The region experiences a sub-tropical climate of hot and heavy monsoon with cool winter.

Cuttings from 168 culms of *Bambusa alamii* were selected for the study. Two treatments were used, with 84 cuttings in each treatment, planting into black polybags filled with soil or planting into nursery beds. Basal portions of a single culm having 2 uncompressed internodes and three to five compressed basal nodes were prepared as propagating material, using a saw. The cuttings were collected from native plants growing in healthy clumps in the local area in early April, and only the matured culms (on their second year of growth) were selected. The poly bags of 8"X 12" and nursery beds of 1.2m width with 10m length were furnished with a wooden edging which was filled with normal topsoil as rooting media. The shades made of the green net were constructed to protect the beds from the drying effect of intense sunlight. The cuttings were planted vertically to 10cm depth at a distance of 10cm apart for both treatments. Both the treatments were well monitored on daily basis. The shades made of the green net were constructed to protect the beds from the drying effect of intense sunlight (figure 5). Bamboo does not perform well on waterlogged soils, so the watering of the cuttings were done on the alternate days. Clearing of the competing weeds and other vegetation was carried within a 60 cm around each cuttings. The data on growth rate (shoots) and survival percent after six months were compared using independent-samples t-test and regression analysis.

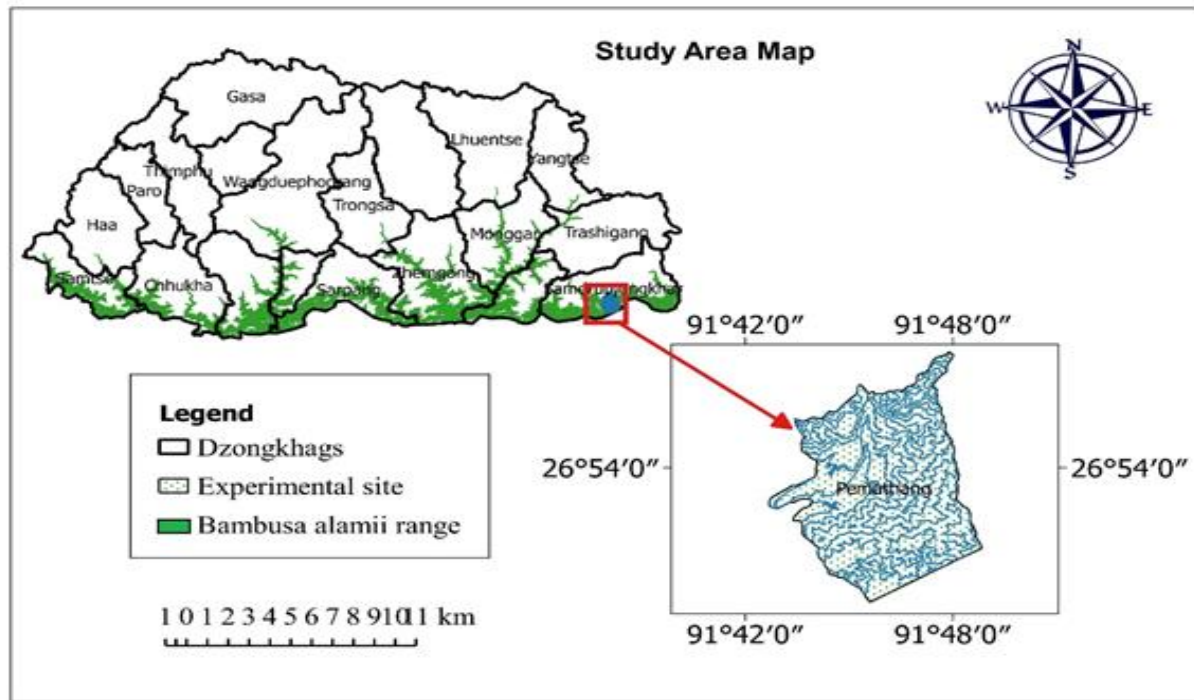


Fig 1. Location Map of the study site

III. EXPERIMENTAL RESULTS

The measurements of the height of shoots and the number of the shoot in each cutting were investigated after six months. Of 84 cuttings in each treatment, 65 survived in nursery bed planting (77%) while only 54 survived in poly bags (64%). The number of shoots for the treatments was found to be 150 and 130 respectively. It was evident that the growth rate was initially better in poly-bags. They started to bud much earlier than in bed planting. An independent-samples t-test was conducted to compare the growth rate of shoots. There was a significant difference in the height of shoots (N=84, M=0.82, SD=0.77) and (N=84, M=1.17, SD=1.10) with a significance value of (P=0.019).

Table 1. Independent-samples t-test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Average height of shoots	Equal variances assumed	11.2	.001	-2.37	166	.019	-.35012	.14723	-.64079	-.05944
	Equal variances not assumed			-2.37	148.76	.019	-.35012	.14723	-.64104	-.05920

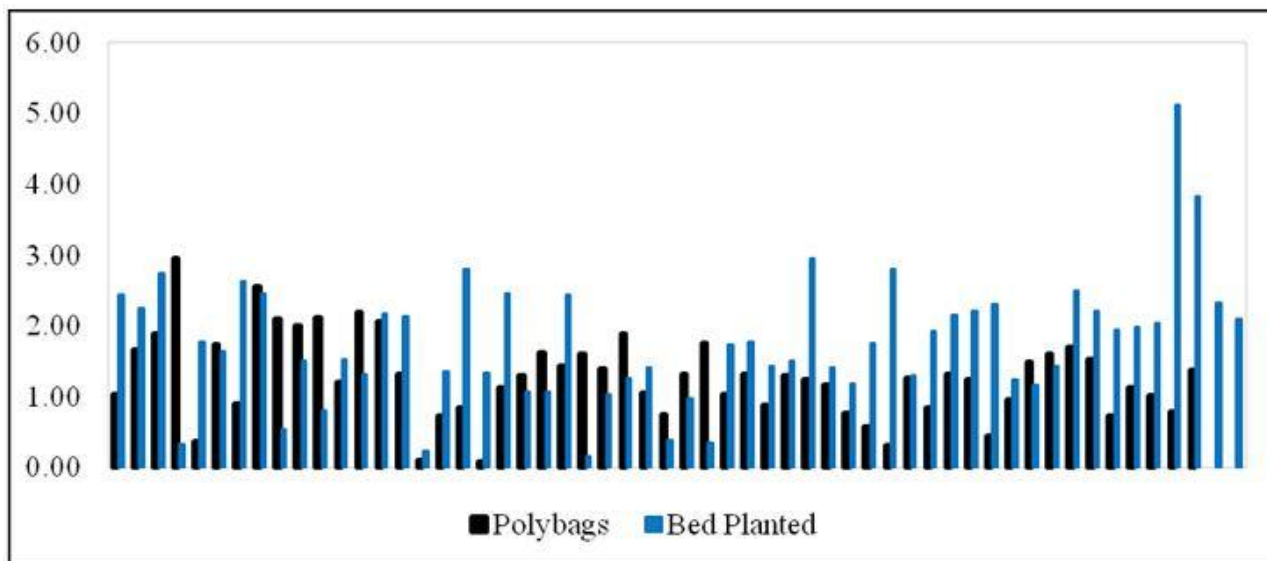
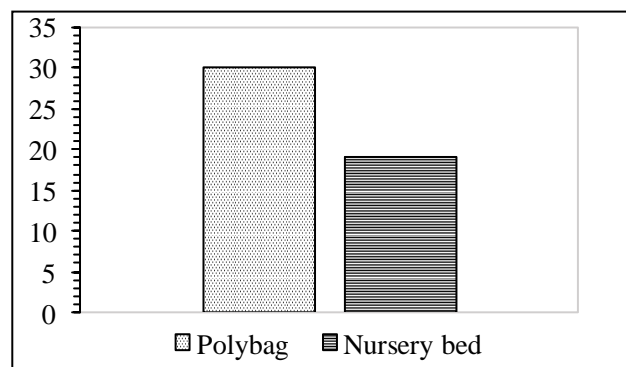
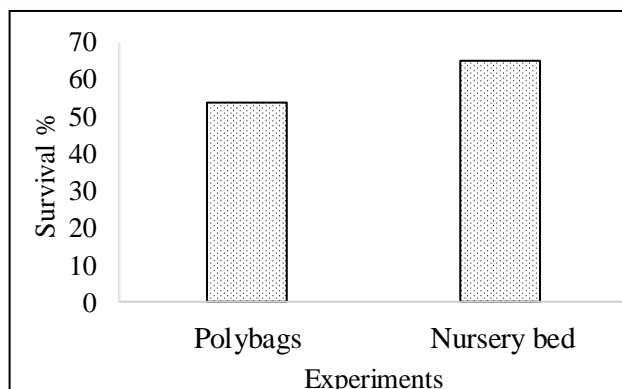


Fig 2. Height of the investigated shoots

Significant differences in growth and development parameters were found for both treatments. Based on survival, height (figure 2), and shoot production, the result of the present study showed promising growth performance of *Bambusa alamii* in direct planting (nursery bed) techniques (figure 3). Though the initial growth was good in poly bags, there was a low survival rate (30 cuttings died out of 84) after six months (figure 3 b). It could be due to the congested space, loss of soil fertility over time, and less water holding capacity of the soil in the pot (figure.6).

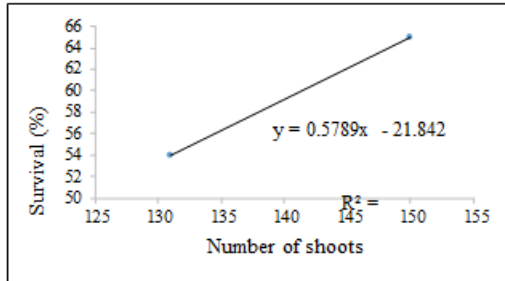


(a)

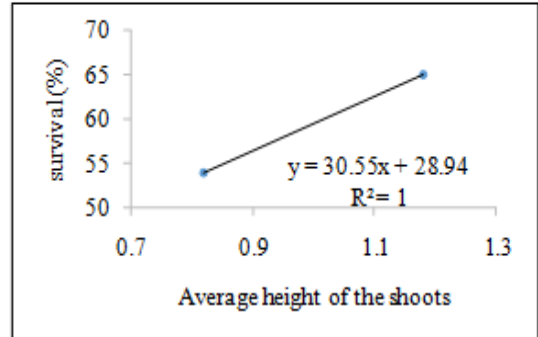
(b)

Fig 3. a) Cuttings Survival percent, and b) Number of cuttings died.

The seedling morphology was also found significantly correlated with survival and/or growth after out-planting (Baley & Kietka, 1997). The same is also evident from the relationship between survival and the number of shoots to an average height of the shoots which is found to be positively correlated (figure 4). Higher survival and more number of shoots found in direct planting (nursery bed) showed effective growth of cuttings in an open field than polybags.



(a)



(b)

Figure 4. Relationship between the survival percent a) number of shoots, and b) average height of the shoots

IV. CONCLUSION

Basal culm sections were found to offer a good success rate and to produce sufficient vigorous plants of good size for planting out in the same year after they were raised using both polybags and nursery beds. Cuttings grown in nursery beds had a higher survival rate than those in polybags (77% vs 64%). It was evident that the cuttings planted directly in the bed eventually produced more shoots (150) and while slower to start growing, had a better growth rate once they had caught up. The result showed there were significant differences ($P=0.019$) in the average height of shoots between the two treatments, but the plants were very variable in size and many from both treatments were not large enough to be planted out on site after 6 months. However, the containerised plants will be easier to transport and plant, and more likely to survive after planting. The earlier growth but lower survival of plants raised in poly bags could both have been caused by higher temperatures in containers compared to nursery beds, stimulating earlier bud break, but also a higher chance of the soil and young roots drying out. Inspection of failed cuttings gave some support to death through desiccation, but it is possible that substantial insect attack of buds and new shoots could also have occurred.



(a)



(b)



(c)



(d)

Fig 1. Two treatments of Bambusa alamii; a) polybag b) nursery bed, c) new shoot in polybag after few weeks and d) beds and shading in July.

V. ACKNOWLEDGEMENT

Authors are indebted to the Project Head Office, Gyalsung Infra, Thimphu, Project Management; GA-Pemathang, Project staff, and Mr. Dendup Tshering, for the guidance and support during the field preparation.



REFERENCES

- (1) Ashiul ISK, Abdul MD, Ahsan HMD, Golam RMD, "Growth of *Bambusa vulgaris* schrad.Ex Wendl. Planted in the coastal homestead of Bangladesh", Bangladesh Forestry Research Institute. J.Asiat.Soc. Bangladesh, Sci. 41(2): 123-129, 2015.
- (2) Dorjee S, "Bamboos of South-Eastern, Samdrup Jongkhar, Bhutan", NeBIO 10(1): 12-16, 2019.
- (3) Dzongkhag Profile, "Dzongkhag Administration Samdrup Jongkhar, Eastern Bhutan", Retrieved on 18th April, 2022, from <http://www.samdrupjongkhar.gov.bt/district-profile>, 2022.
- (4) Gupta BN, Pattanath PG, "Variation in stored nutrients in culms of *Dendrocalamus strictus* and their effect on rooting of culm cuttings as influenced by their method of planting", Indian forester 102 (4) 235-241, 1976.
- (5) Kaushal R, Gaulabrao YA, Tewari SK, Chaturvedi S, Chaturvedi OP, "Rooting behaviour and survival of bamboo species propagated through branch cuttings", Indian Journal of Soil Conservation 39 (2):171-175, 2011.
- (6) Ray SS, Ali MN, "Factors affecting Macro-propagation of bamboo with special reference to culm cuttings: a review update", *N.Z. j. of For. Sci.* 47, 17, 2017.
- (7) Stapleton CMA, "Studies on vegetative propagation of *Bambusa* and *Dendrocalamus* species by culm cuttings in Nepal: Proceedings of IDRC Bamboo workshop, Hangzhou China", 1985.
- (8) Stapleton CMA, Tamrakar SM, Planting of large bamboo 'Bans' by the traditional method. Nepal Forestry Technical Bulletin 9: 15-17, 1983.
- (9) Stapleton CMA "The bamboos of Nepal and Bhutan Part I: *Bambusa*, *Dendrocalamus*, *Melocanna*, *Cephalostachyum*, *Teinostachyum*, and *Pseudostachyum* (Gramineae: Poaceae, Bambusoideae)", *Edinburgh J. Bot.* 51(1): 1-32, 1994.
- (10) Stapleton CMA, Bamboos of Bhutan, an illustrated guide. Royal Government of Bhutan, Thimphu, 1994.
- (11) Stapleton CMA., Barrow, S. and Pradhan, R, "Bamboo and Cane Study of Zhemgang Dzongkhag", Ministry of Agriculture; Royal Government of Bhutan, Thimphu, 1997.
- (12) Schroder S, "Guadua Bamboo", Retrieved on 5th November 2021 from https://www.guaduabamboo.com/genera/bamboogenera?fbclid=IwAR2_tsgJ8Ffhx6CnIsuJIZMLA0bKJzCTzYZ_CIVqN78z9rbADK9A6UgxEO, 2021.



INNO SPACE
SJIF Scientific Journal Impact Factor
Impact Factor: 8.118



ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 **9940 572 462**  **6381 907 438**  **ijirset@gmail.com**



www.ijirset.com

Scan to save the contact details