Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2020; 9(4): 515-519
Received: 12-05-2020
Accepted: 13-06-2020

GK Satapathy
College of Forestry, Odisha University of Agriculture and Technology, Bhubaneswar, Odisha, India

TL Mohanty
College of Forestry, Odisha University of Agriculture and Technology, Bhubaneswar, Odisha, India

MC Behera
College of Forestry, Odisha University of Agriculture and Technology, Bhubaneswar, Odisha, India

RK Kar
College of Forestry, Odisha University of Agriculture and Technology, Bhubaneswar, Odisha, India

Corresponding Author:
GK Satapathy
College of Forestry, Odisha University of Agriculture and Technology, Bhubaneswar, Odisha, India

Effect of age, position and type of cuttings on the performance of vegetative propagules in *Bambusa Vulgaris* var. *Striata*

GK Satapathy, TL Mohanty, MC Behera and RK Kar

Abstract
Bambusa vulgaris var. *striata* is a cultivated bamboo species for its versatile uses. The vegetative propagation becomes the only viable alternative for this species because *Bambusa vulgaris* var. *striata* does not set seed after sparse flowering after a long period of time which makes seedling progenies unavailable. A low-cost propagation trial was conducted to explore the clonal propagation techniques for the species with the effect of age, position and cutting types on growth of plant propagules. The planting materials selected were with different ages (1 and 2 year old), different positions (basal, middle and top) and cutting types (single node, double node and branch cuttings). One year old bamboo culm performed better than two year old culm in the following characters eg. Propagules height, collar diameter, no. of nodes, no. of branches/node, no. of sprouts, no. of leaves, no. of roots, root length, leaf area. Propagules from basal portion exhibited significantly higher value than middle and apical portion in height, collar diameter, no. of nodes, no. of branches/node, no. of leaves. Similarly propagules from single node cuttings performed significantly better than double node cuttings and branch cuttings in the following characters, height, collar diameter, no. of nodes, no. of branches/node, no of sprouts, no. of leaves, no. of roots, root length and leaf area. The two year old basal portion single node cutting performed significantly better than all other treatments with respect to quality index.

Keywords: *Bambusa vulgaris* var. *striata*, age position, type of cutting, performance

Introduction
Bamboo belongs to the *Gramineae* family and has about 90 genera with over 1200 species. Bamboo is naturally distributed in the tropical and subtropical belt between approximately 46° North and 47° South latitude, and is commonly found in Africa, Asia and Central and South America. Some species may also grow successfully in mild temperate zones in Europe, North East Asia and North America. Bamboo is an extremely diverse plant, which easily adapts to different climatic and soil conditions.

Bambusa vulgaris var. *striata* is the bamboo species is widely used for various purposes, very little is known about its propagation system. Bamboo flowers rarely and in irregular cycles, which is not yet clearly understood. However, regeneration of this bamboo through seeds is not practical since most of the *B. vulgaris* varieties do not produce viable seeds even after flowering. John and Nadgauda (1993) [9] studied the taxonomy and morphology of *B. vulgaris* var. *vittata* (synonym with *striata*) from India and mentioned that this variety of bamboo flowered irregularly and does not set seeds as the lemma and palea fail to open properly.

Although *B. vulgaris* has been propagated by different vegetative methods like rhizome cutting, offset planting, culm or stem cutting, branch cutting and pre-rooted branch cutting, ground layering, stump sprout, *etc.*, the most common method is rhizome cutting. However, in large-scale plantation programmes, rhizome cutting method is not practised because of high cost and limited availability of material. Also, the bamboo clump loses its regeneration potential if more rhizomes are excavated. Moreover, the survival percentage of rhizome cutting is not always satisfactory. *B. vulgaris* spreads often by rhizomes, culm division and branch cuttings and more rarely by seeds (Francis, 1993; Dransfield and Widjaja, 1995) [7, 4]. This paper described the effect of age, position and type of cuttings on growth and development of quality planting stocks.

Materials and Methods
The experiment was carried out in the College of Forestry, OUAT, Bhubaneswar, Odisha. The experimental site is situated in the College of Forestry Research field which is located at $20^{0}16'$ 35.6” North Latitude and 85^{0} 47’ 25.9” East Longitude with an average altitude of 55 metre (183 feet) above mean sea level (M.S.L.).

The study area falls under the eastern coastal plains of Odisha along the axis of the North-Eastern Ghats mountains. The climate is relatively warm and dry with a typical effect of humid costal belt. Bhubaneswar is located on the coastal plains of Odisha. The average annual rainfall of Bhubaneswar is 1552mm (based on average of preceding 10 years). Most of the rainfall i.e. 85% is received from July to September. The average temperature varies from 14^0 C in winter to 40^0C in summer and relative humidity varies between 49 to 90% from June to December.

Superior culms of golden bamboo are collected from college of forestry, OUAT and Silvicultural research station, Bhubaneswar for present research purpose. The first year and second year culms are selected for research purpose. The culms are cut into basal, middle and apical portion. The effect of age, different position of cuttings and type of cutting of bamboo on growth & development parameters are studied in the nursery. Bamboo culms were collected during March. Culms were planted in the field using Randomized Block Design with 2 replications. The plants were planted with a spacing of 1ft x 1ft. All the intercultural operations like hoeing, irrigation, weeding and inter cultural operations were done in time in order to minimize the mortality.

Results and Discussion

The effect of age, position and type of cuttings on different growth parameters are presented in this section. Different alphabets and numbers are used to represent the age, position and type of cuttings as A1 and A2 are 1 year and 2 year old culm, B1, B2 and B3 are basal, middle and top portion of cilm and C1, C2 and C3 are single nodal, bi nodal and branch types of cuttings, respectively.

Number of sprouts

The highest number of sprouts was produced in one year old basal portion single node cutting (2.835) and the lowest number of sprouts was produced in one year old apical portion double node cutting. The reason might be ascribed to the fact that more carbohydrate, hormones and growth regulating substances are found in younger culms than older culms. Manipula *et al.* (1990) [11] observed no of sprouts are more in 6 months old culm compared to one year old culm.

Table 1: No of sprouts of the propagules at 135 DAP

	A_1			A_2		
	B_1	B_2	B_3	B_1	B_2	B_3
C_1	2.835	1.830	2.585	2.665	1.815	2.665
C_2	2.495	1.665	1.500	2.400	1.665	1.730
C_3	2.580	2.330	2.250	2.415	2.750	2.245

Factors	C.D.	SE(d)	SE(m)
Factor(A)	N/S	0.294	0.208
Factor(B)	N/S	0.360	0.255
Factor(C)	N/S	0.360	0.255
Intraction A X B X C	N/S	0.882	0.624

Number of nodes

The highest number of nodes was produced in two year old basal portion single node cutting (10.415) and the lowest number of nodes was produced in one year old apical portion branch cutting (3.995). Tewari *et al.* (2016) [13] reported that no of nodes are more in basal portion as compared to apical portion in *Bambusa vulgaris* which was consistent with present finding.

Table 2: No of Nodes of the propagules at 135 DAP

	A_1			A_2		
	B_1	B_2	B_3	B_1	B_2	B_3
C_1	10.000	5.750	6.680	10.415	5.335	6.415
C_2	5.415	5.130	4.585	4.500	6.500	4.500
C_3	6.815	6.065	3.995	6.415	6.085	4.665

Factors	C.D.	SE(d)	SE(m)
Factor(A)	N/S	0.531	0.375
Factor(B)	1.372	0.650	0.460
Factor(C)	1.372	0.650	0.460
Intraction A X B X C	N/S	1.593	1.126

Number of branches/node

The highest number of branches/node was produced in one year old basal portion single node cutting (2.580) and the lowest number of branches/node was produced in both one year old middle portion double node cutting and one year old middle portion branch cutting (1.830). Elbasheer and Raddad (2013) [5] concluded that juvenile culms are superior to older culms due to presence of more active buds at the nodes which was in tandem with the findings of the present study.

Table 3: No of Branches/node of the propagules at 135 DAP

	A_1			A_2		
	B_1	B_2	B_3	B_1	B_2	B_3
C_1	2.580	1.915	2.080	2.500	2.165	2.065
C_2	1.980	1.830	1.915	2.065	1.915	1.915
C_3	1.980	1.830	1.835	2.080	1.835	1.900

Factors	C.D.	SE(d)	SE(m)
Factor(A)	N/S	0.066	0.047
Factor(B)	0.171	0.081	0.057
Factor(C)	0.171	0.081	0.057
Intraction A X B X C	N/S	0.199	0.140

Number of leaves

The maximum number of leaves was produced in two year old basal portion single node cutting (28.580) and the minimumt number of leaves was produced in one year old apical portion double node cutting (6.500). Chhetri and Kumar (2015) [2] reported more number of leaves in larger culm segments than the smaller one which was similar to the findings of the present study where basal culm segments produced more leaves than the apical portion owing to more basal area and food reserves.

Table 4: No of leaves of the propagules at 135 DAP

	A_1			A_2		
	B_1	B_2	B_3	B_1	B_2	B_3
C_1	23.750	8.500	10.665	28.580	8.585	10.915
C_2	13.080	13.080	6.500	12.745	12.915	7.180
C_3	11.665	14.915	8.995	12.415	15.745	8.080

Factors	C.D.	SE(d)	SE(m)
Factor(A)	N/S	2.148	1.519
Factor(B)	5.550	2.630	1.860
Factor(C)	N/S	2.630	1.860
Intraction A X B X C	N/S	6.443	4.556

Height

The highest plant height was produced in two year old basal portion single node cutting (114.580cm and the lowest plant height was produced in one year old middle portion double node cutting (45.770cm). The maximum height might be due to presence of more no. of nodes in 2nd year old single noded basal cutting which was in line with the findings of Chhetri and Kumar (2015) [2] who observed that the cutting having more number of nodes has propagules with more height compared to propagules raised from less number of nodes in *Bamboosa venrticosa.*

Table 5: Height (cm) of the propagules at 135 DAP

	A1			A2		
	B1	B2	B3	B1	B2	B3
C1	107.335	51.710	50.690	114.580	51.865	51.070
C2	61.500	45.770	46.065	64.620	47.945	45.810
C3	70.415	58.965	47.990	66.330	60.000	47.650

Factors	C.D.	SE(d)	SE(m)
Factor(A)	N/S	5.092	3.600
Factor(B)	13.159	6.236	4.409
Factor(C)	13.159	6.236	4.409
Intraction A X B X C	N/S	15.275	10.801

Collar diameter

The highest plant collar diameter was produced in two year old basal portion single node cutting (12.435mm) and the lowest diameter was observed in one year old apical portion double node cutting (5.460 mm). This might be attributed to the fact that the basal portions are more thicker lead to storage of more amount of food materials compared to middle and apical portions which are comparatively thinner. Tewari *et al.* (2016) [13] reported the collar diameter was more in basal part of the culm compared to middle and apical portion in *Bambusa vulgaris*.

Table 6: Collar diameter (mm) of the propagules at 135 DAP

	A1			A2		
	B1	B2	B3	B1	B2	B3
C1	11.290	6.885	7.325	12.435	6.645	7.940
C2	8.050	7.135	5.460	8.370	7.310	5.940
C3	7.925	7.705	6.505	7.770	8.210	6.345

Factors	C.D.	SE(d)	SE(m)
Factor(A)	N/S	0.928	0.656
Factor(B)	N/S	1.136	0.803
Factor(C)	N/S	1.136	0.803
Intraction A X B X C	N/S	2.783	1.968

Number of roots

The highest number of roots was produced in two year old middle portion single node cutting (33.000) and the lowest number of roots was produced in two year old apical portion branch cutting (17.000). Deb *et al.* (2016) [3] found that no. of roots and sprouts per culm were more in culm segment than in branch cutting in *Bambusa magalandiana* which was in line with the findings of the present study.

Table 7: No of roots of the propagules at 135 DAP

	A1			A2		
	B1	B2	B3	B1	B2	B3
C1	23.000	32.500	28.500	25.000	33.000	24.000
C2	18.000	28.000	30.000	23.000	26.500	23.500
C3	25.000	25.000	22.000	26.000	24.500	17.000

Factors	C.D.	SE(d)	SE(m)
Factor(A)	N/S	1.721	1.217
Factor(B)	N/S	2.108	1.490
Factor(C)	N/S	2.108	1.490
Intraction A X B X C	N/S	5.163	3.651

Root length

The highest root length was produced in both two year old basal portion single node cutting and two year old basal portion branch cutting (24.000 cm) and the lowest root length was produced in one year old middle portion double node cutting (13.500 cm). Jijeesh and Seethalaxmi (2010) [12] observed root length was more in propagules raised from basal portion of culm compared to middle and apical portion in *Bambusa nutans, Bambusa pymurpha and Bambusa vulgaris* which was consistent with the findings of the present study.

Table 8: Root length (cm) of the propagules at 135 DAP

	A1			A2		
	B1	B2	B3	B1	B2	B3
C1	21.000	20.000	17.500	24.000	21.500	16.000
C2	18.500	13.500	19.000	22.000	18.500	22.000
C3	22.000	15.500	14.500	24.000	16.000	16.500

Factors	C.D.	SE(d)	SE(m)
Factor(A)	1.957	0.927	0.656
Factor(B)	2.396	1.136	0.803
Factor(C)	N/S	1.136	0.803
Intraction A X B X C	N/S	2.782	1.967

Leaf area

The highest leaf area was produced in both one year old basal portion branch cutting and two year old basal portion branch cutting (32.875 cm^2) and the lowest leaf area was produced in one year old apical portion branch cutting (18.500 cm^2). Chhetri and Kumar (2015) reported leaf length was maximum in double noded cutting than single noded cutting in *Bambusa ventricosa*.

Table 9: leaf area (cm2) of the propagules at 135 DAP

	A1			A2		
	B1	B2	B3	B1	B2	B3
C1	30.875	31.875	32.375	31.075	30.875	32.500
C2	22.625	22.125	27.375	24.750	23.500	28.875
C3	32.875	31.000	18.500	32.875	31.125	19.875

Factors	C.D.	SE(d)	SE(m)
Factor(A)	N/S	3.013	2.131
Factor(B)	N/S	3.691	2.610
Factor(C)	N/S	3.691	2.610
Intraction A X B X C	N/S	9.040	6.392

Biomass

A. Fresh Shoot Biomass

The highest Fresh shoot biomass was produced in two year old top portion single node cutting (145.425 gm) and the lowest fresh shoot biomass was produced in one year old basal portion double node cutting (69.145 gm). The above ground biomass was higher in juvenile culms due to more height collar diameter, no of branches, leaves and sprouts compared to propagules raised from older culms which was in line with the findings of Elbasheer and Raddad (2013) [5].

Table 10: Fresh shoot biomass (gm) of the propagules at 135 DAP

	A1			A2		
	B1	B2	B3	B1	B2	B3
C1	124.965	76.870	123.770	128.095	124.665	145.425
C2	69.145	83.820	90.285	91.735	109.255	79.880
C3	89.280	124.280	107.155	100.030	117.885	113.210

Factors	C.D.	SE(d)	SE(m)
Factor(A)	N/S	12.390	8.761
Factor(B)	N/S	15.174	10.730
Factor(C)	N/S	15.174	10.730
Intraction A X B X C	N/S	37.169	26.283

B. Dry Shoot Biomass

Dry shoot biomass was produced in two year old top portion single node cutting (113.175 gm) and the lowest dry shoot biomass was produced in one year old basal portion double node cutting (52.175 gm). The findings were in line with the observations made by Raveendran *et al.* (2010) [12] in *Dendrocalamus giganteus*.

Table 11: Dry shoot biomass (gm) of the propagules at 135 DAP

	A_1			A_2		
	B_1	B_2	B_3	B_1	B_2	B_3
C_1	98.075	58.370	97.005	91.455	92.670	113.175
C_2	52.175	61.850	66.615	67.720	82.910	57.205
C_3	68.870	95.260	79.560	77.225	93.620	82.385

Factors	C.D.	SE(d)	SE(m)
Factor(A)	N/S	9.842	6.959
Factor(B)	N/S	12.054	8.523
Factor(C)	N/S	12.054	8.523
Intraction A X B X C	N/S	29.525	20.878

C. Fresh Root Biomass

Fresh root biomass was produced in two year old middle portion single node cutting (21.770 gm) and the lowest Fresh root biomass was produced in two year old top portion double node cutting (9.020 gm). Deb *et al*. (2016) [3] reported no. of roots was more in culm segment than branch cuttings which contributed for higher biomass in *Bambusa magalandiana*.

Table 12: Fresh root biomass (gm) of the propagules at 135 DAP

	A_1			A_2		
	B_1	B_2	B_3	B_1	B_2	B_3
C_1	19.000	18.495	16.270	19.030	21.770	14.390
C_2	10.175	14.840	10.640	12.475	15.555	9.020
C_3	16.470	15.540	15.230	16.210	16.840	14.390

Factors	C.D.	SE(d)	SE(m)
Factor(A)	N/S	2.475	1.750
Factor(B)	N/S	3.031	2.143
Factor(C)	N/S	3.031	2.143
Intraction A X B X C	N/S	7.425	5.250

D. Dry root biomass

Dry root biomass was produced in two year old middle portion single node cutting (13.815 gm) and the lowest Dry root biomass was produced in two year old top portion double node cutting (5.560 gm). Carpenter *et al*. (2008) [1] reported positive effect of cuttings size on the shoot and root biomass may be associated with the carbohydrate pool for the allocation to roots and shoots.

Table 13: Dry root biomass (gm) of the propagules at 135 DAP

	A_1			A_2		
	B_1	B_2	B_3	B_1	B_2	B_3
C_1	12.750	13.495	10.120	12.525	13.815	8.680
C_2	6.625	10.340	7.110	7.005	10.530	5.560
C_3	10.770	11.160	11.070	11.150	11.510	9.985

Factors	C.D.	SE(d)	SE(m)
Factor(A)	N/S	1.871	1.323
Factor(B)	N/S	2.291	1.620
Factor(C)	N/S	2.291	1.620
Intraction A X B X C	N/S	5.613	3.969

Quality index of the propagules of different treatments

The average quality index in propagules ranged from 3.445 to 7.505 (table 10). The highest quality index was produced in two year old basal portion single node cutting (7.505) followed by two year old middle portion branch cutting (6.655) and one year old middle portion branch cutting (6.510). The lowest quality index was produced in two year old apical portion double node cutting (3.445). Johnson and Cline (1991) [10] quality index is consider as a promising integrated measure of morphological traits. Fonseca *et. al.* (2002) [6] emphasized not to select individual parameters for seedling quality in *Trema micrantha* (L.).

Table 14: Quality index of the propagules of different treatments at 135 DAP

	A_1			A_2		
	B_1	B_2	B_3	B_1	B_2	B_3
C_1	6.470	6.145	6.485	7.505	6.045	6.255
C_2	3.745	5.745	4.105	4.065	6.480	3.445
C_3	5.185	6.510	6.195	5.715	6.655	5.975

Factors	C.D.	SE(d)	SE(m)
Factor(A)	N/S	0.974	0.689
Factor(B)	N/S	1.193	0.843
Factor(C)	N/S	1.193	0.843
Intraction A X B X C	N/S	2.922	2.066

Conclusion

Our results suggested that vegetative propagation is the best way to cultivate *Bambusa vulgaris* var *striata*. In most of the growth parameters two year old basal portion single noded cutting showed the higher value and also recorded highest quality index (7.505). Overall, it was concluded that propagules raised from basal portion showed better performance.

References

1. Carpenter LT, Pezeshki SR, Shields FDJ. Response of non-structural carbohydrates to shoot removal and soil moisture treatments in *Salix nigra* trees. Trees. 2008; 22: 5.
2. Chhetri S, Kumar H. Effect of planting position on rhizogenesis in buddha belly bamboo (Bambusa ventricosa) under nursery condition. Journal of international academic research for multidisciplinary. 2015; 2(12):283-289.
3. Deb C, Lirolasangtam T, Jamir NS. International journal of conservation Science. 2016; **7**(1):147-154.
4. Dransfield S, Widjaja EA. *Bambusa vulgaris* Schrader ex Wendland. Record from Proseabase. Bogor, Indonesia: PROSEA (Plant Resources of South-East Asia) Foundation, 1995.
5. Elbasheer YHA, Raddad EAY. Vegetative propagation of *Oxytenentheraabyssinica*by culmcuttings. Jr. of Natural resources environmental studies. 2013; 1(3):1-5.
6. Fonseca EP, Valeri SV, Miglioranza E, Fonseca Nan, Couto L. Target seddlings of *Trema micrantha* (L.) Blume grown under different periods of shading. Revista Arvore. Vicosa. 2002; 26(4):515-523.

7. Francis JK. *Bambusa vulgaris* Schrad ex Wendl. [Publication SO-IITF-SM-65], 1993.
8. Jijesh CM, Seethalakshmi KK. Effect of position on root no. and root length in *Bambusa vulgaris* and bambusa polimorpha. Green Farming. 2010; 3(1):23-28.
9. John K, Nadgauda RS. On the monocarpic flowering of bamboos. Curr. Sci. 1993; 65:665-666.
10. Johonson JD, Cline MC. seedling quality of southern *pines* in Duryea ML. Dougherty P.M. (Eds). Forest regeneration manual. Netherlands: kumar Academic, 1991, 143-162.
11. Manipula BM, Gianan NSO, Virtucio FD. Survival and growth of culm cutting and whole culm of *Gigantochlo aatter* as affected by age and culm portion. Paper presented at the Second National Bamboo R & D Symposium held at the ERDB Auditorium, College, Laguna December, 1990, 14.
12. Raveendran VP, Seethalakshmi KK, Jijeesh CM. Effect of season, position of node and growth regulating substances on adventitious root induction in Giant Bamboo, *Dendrocalamus giganteus* (Wall) Munro.Ad. Plant Sci. 2010; 23(1):125-127.
13. Tewari RK, Asha Ram, Inder Dev, Sridhar KB, Singh R. Farmer friendly technique for multiplication of bamboo (*Bambusa vulgaris*). ICAR – Central Agroforestry Research Institute, Jhansi-284003, India. Current science, Merit. Similarly length at 95 DAS, number of nodes at 95 DAS, number of branches at 45 DAS were the good general combiners. 2016; 111(5).