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Survivability of three bamboo species (Giant bamboo- *Dendrocalamus giganteus*, Machiku bamboo- *Dendrocalamus latiflorus* and Spiny bamboo- *Bambusa blumeana*) as influence by the number of nodes

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Key words: Giant bamboo, Spiny bamboo, Machiku bamboo, Nodes, Survival of bamboo.

Abstract

The study was conducted under the protective environment of bamboo nurseries at Cagayan State University Gonzaga Campus from August 2021 until December 2021. The study was conducted to determine the percentage of survival of three species of bamboo (Giant bamboo- *Dendrocalamus giganteus*, Machiku bamboo- *Dendrocalamus latiflorus*, and Spiny bamboo- *Bambusa blumeana*) as influenced by the number of nodes. It aimed to determine the following parameters after three (3) months: average number of shoots, average length (cm) of shoots, the average number of roots, average length (cm) of roots, and the percentage (%) of survival. The study used a Completely Randomized Design (CRD) with a single-factor experiment. There are three treatments in the study which are: T_1- one-node branch cutting; T2- two-node branch cutting; and T3- three-node branch cutting. All species observed were significantly affected by T3, three-node branch cutting in the average number of shoots. It is concluded that three-node cutting leads in all the parameters gathered in giant bamboo while one-node and three-node cutting leads in machiku bamboo. It can be concluded that any of the treatments can be used as planting material. The result may be because node cuttings have a very nil effect in propagating bamboo. Based upon the findings and conclusion of the study, T_3-three node cutting is recommended to use in propagating the spiny bamboo while T_2-two node cutting is recommended in propagating because of its capability to improve survival rate.

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Introduction

For its economic and environmental benefits, bamboo is one of the essential non-timber forest resources that have drawn more attention. It is a superior wood substitute due to its cheap, efficient, and fast-growing characteristics (Yohannes *et al.*, 2019). Bamboos can be used to rehabilitate the country's large tracts of denuded land due to its wide range of adaptability to adverse soil and climatic conditions (ATI-ISD, 2019). It can also be processed to create new products such as food and handicrafts, which can be another income source. Due to bamboo's advantages in the economy and ecology, there is a need for its preservation and the creation of bamboo farms throughout the nation.

It is widely utilized for housing, forestry, agroforestry, agricultural activities, and utensils throughout Africa, Asia, and Latin America and is closely tied with indigenous culture and knowledge. In addition, bamboo received increasing attention (Lobovikov *et al.*, 2007). According to Selvan (2018), more than two billion people rely on bamboo in 2018 to meet their basic needs since it is abundant, renewable, prolific, adaptable, inexpensive, or free, simple to reach, and improves the environment, especially in the villages and countryside of developing countries. Selvan stated that bamboo was being targeted for the creation of livelihoods and the eradication of environmental and social issues. Due to bamboo's growing use in industry and its significance in the Mitigation, Adaptation, and Development (MAD) challenge, most nations have started to develop strategies to invest in bamboo production and processing to lessen the use of wood in industrial production processes. Nearly 4,000 commercial bamboo products are already in use worldwide thanks to technological advancements. In the Philippines, it is the most frequently utilized material - from food to housing components (Bersalona, 2017).

A conventional method of propagation of bamboo is based on seeds (Mudoi *et al.*, 2013). However, the main issues with seed-based propagation methods are generally poor overall seed set and seed consumption by wild animals. Additionally, a seed may only be available seldom, its viability may be poor and transient, there may not be enough facilities for storing seeds, and there may be very varied populations of seedlings (Singh *et al.*, 2013).

Therefore, these approaches cannot be relied upon for the bulk replication of bamboo on a sustainable basis, making it imperative to investigate the viability of vegetative propagation. Vegetative propagation could produce plants that are true to type on a sustainable basis, which is obviously not possible with seeds. However, because of the physiological age of the mother plant, plants grown through vegetative propagation maintain a specific vegetative period before flowering (Ray and Ali, 2017).

Cuttings are readily available for large-scale vegetative replication and cutting-based propagation is one of the vegetative propagation techniques that doesn't harm the mother plant. Alternatively, culm cuttings or branch cuttings could be used to accomplish this (Singh *et al.*, 2013).

However, the supply of bamboo propagules is inadequate to address the need for plantation establishment. Consequently, the need to develop efficient techniques for bamboo propagation on a broad scale is urgent.

To choose the best way for bamboo species, notably *Dendrocalamus giganteus, Dendrocalamus latiflorus,* and *Bambusa blumeana* and their development and survival condition, knowledge of various propagation techniques is essential. Bamboos can be multiplied through tissue culture, seeds, culm cuttings, branch cuttings, or marcotting.

Generally, this study was conducted to determine the percentage of survival of three species of bamboo as influenced by the number of nodes. Specifically, the study determined the following parameters after three months: the average length (cm) of shoots; the average length of roots; the average number of shoots; and the number of nodes to survive per treatment.

Materials and methods

Research Design

The experiment was conducted in a single-factor experiment in a Completely Randomized Design (CRD). Each bamboo species was treated separately because they have different physiological characteristics. The treatments to be used are as follows:

T1- one node

T2- two nodes

T3- three nodes

Total enumeration was made in the collection of data except for the length of roots each treatment consisted of 20 propagated cuttings that were duplicated three times for a total of 60 cuttings. A total of 180 cuttings from each species were planted, with a total of 540 propagules from the three species.

Locale of the Study

The study was conducted at the bamboo nursery of the Cagayan State University- Gonzaga Campus.

Preparation of Soil Media

Potting medium was prepared before collecting propagules to avoid dehydration. Soil media is a mixture of one (1) part alluvial soil, one (1) part organic fertilizer, and two (2) parts of Carbonized Rice Hull (CRH) making a ratio of 1:1:2. The soil medium was mixed thoroughly and packed in a polyethylene bag.

Selection and Gathering of Planting Stock

Branch cuttings were gathered in a 1-2-year-old culm and cut with the use of a sharp bolo, chisel, or hacksaw reduced to 2-3 node cuttings.

Planting

The cuttings were planted in previously prepared media. It is planted vertically at the center of polyethylene bags. The base or lower node was covered with soil and was pressed gently at the base of the plant. To allow the soil to settle, watering was done immediately.

Care and Management

The propagules were propagated in a partially shaded area to retain their moisture for a longer time. The moisture of the soil was maintained by watering once or twice a day as the need arose. To maintain its cleanliness and avoid completion of nutrients and water, weeding was done every time a weed was observed.

Data Analysis

Statistical Tool for Agricultural Research (STAR) was used in analyzing the tabulated data (ANOVA) on a Completely Randomized Design (CRD) in a single-factor experiment.

Results and discussions

Average Survival Rate (%)

The results (Table 1) showed the highest percentage of survival of spiny bamboo was obtained by T_3, three (3) node cuttings and T_2, two (2) node cuttings propagated in one-part alluvial soil, one part vermicompost and one part of Carbonized Rice Hull (CRH) with a mean of 66.67% while T_1, one part alluvial soil, one part vermicompost and one part of Raw Rice Hull (RRH) garnered the lowest survival rate (Table 1). In the results of the study of Ray and Ali (2017), two- or one-nodal cutting was found better than whole-culm cuttings for high rooting and survival of *B. blumeana*.

On the other hand, giant bamboo as shown in Table 2, T_2 garnered the highest percentage of survival having a mean of 66.67%. This was followed by T3 with a mean of 53.33%, T_1 obtained the lowest percentage of survival having a mean of 28.89%.

Meanwhile, Table 3 shows the survivability performance of machiku bamboo. The highest survival of machiku bamboo was obtained by T_1 with a mean of 95.56% followed by T_2 with a mean of 91.11%. T_3 has the lowest survival rate with a mean of 86.67%.

The result showed that the survival of every species depends on different style of cuttings. In the erratic temperature of Cagayan State University-Gonzaga Campus, handling from planting stock to the management of propagules must consider attaining a higher survival rate. The higher percentage of survival means more propagules to plant.

Average number of shoots

Spiny bamboo produced the greatest number of shoots in T_3, three node cuttings with a mean of 3.18. This was followed by T_2, two node cuttings with a mean of 3.12 while T_1, one node cuttings obtained the least number of shoots produced with a mean of 2.17.

Table 2 shows the performance of giant bamboo. T_3, three node cuttings gained the highest number of shoots with a mean of 4.96, followed by T_2, two node cuttings with a mean of 3.19. T_1, one node cuttings have the least number of shoots having a mean of 1.63. On the other hand, Table 3 shows that machiku bamboo propagated in treatment T_3, three node cuttings produce the highest number of shoots with a mean of 4.58 followed again by T_2, two node cuttings that produce a mean of 2.79. Treatment 1 obtained the least number of shoots with a mean of 1.64. The experiment detects a significant difference between the treatments and all the species tested in the study. In giant bamboo, 3 nodes are not significantly different from 2 nodes while one node is not significantly different from 2 nodes but shows significantly different in treatments one and three.

This finding supports Ms. Klarissa Camile Halili's DOST PCAARD report that the optimal planting material for gigantic bamboo growth is two- to three-node branch cuttings with active buds. After being potted, these branch cuttings take seven to ten days to grow. After at least three to four months of good upkeep, it will be ready for out-planting.

Average length (cm) of shoots

After three months, T1, one node cuttings of spiny bamboo had shoots that were, on average, 100.89 inches long. T2, with a mean of 97.59, came in second place, and T3, with a mean of 88.56, acquired the shoots with the shortest lengths after three months (Table 1). According to Table 2, T1 produced the longest shoots for giant bamboo, averaging 85.42, followed by T3, three nodes, averaging 79.24. T2 produced the shoots with the smallest average length, 72.93.

Table 3 presents that machiku bamboo in T_1 reached the longest shoots with a mean of 81.08 followed by T_2 with a mean of 78.16 while T_3 has the shortest with a mean of 72.58.

In all the treatments observed, T_1, one node cutting obtained the longest shoots from all the species observed. This may be due to its focus while growing. One-node cuttings only focus on one node that presents longer shoots compared to cuttings with three nodes that focus on more nodes and fulfill their higher needs. There was an insignificant difference among treatment means but it does not prove that all treatments are the same.

The average number of roots

Table 1 shows that spiny bamboo in T_2; two node cuttings obtained the greatest number of roots with a mean of 27.25. T_3, three node cuttings follow with a mean of 25.42. T_1, one node cuttings had the least average number of roots with a mean of 20.67.

On the other hand, Table 2 shows that giant bamboo in T_3, three node cuttings had the highest number of roots with a mean of 51.75 followed by T_2, two node cuttings with a mean of 43.75. T_1, one-node cuttings garnered the lowest number of roots with a mean of 42.17. Meanwhile, machiku bamboo produces the highest number of roots in T_3, three node cuttings with a mean of 46.67. T_2, two node cuttings follow with a mean of 45.25. T_1, one-node cuttings produce the least number of roots with a mean of 39.67.

Machiku and giant bamboo react the same with all the treatments used, T_3, three-node cuttings are the best planting material while spiny bamboo is in favor of two-node cuttings. The data reveals insignificant effects may be due to its very nil differences in treatments used.

The average length of roots

Spiny bamboo obtained the longest length of roots in T_2, two node cuttings with a mean of 57.03. T_3, three node cuttings follow with a mean of 50.48. T_1, one-node cuttings obtained the shortest length of roots after three months with a mean of 46.46 (Table 1). Table 2 shows that giant bamboo obtained the longest

roots from T_3, three node cuttings with a mean of 41.83 followed by T_1, one node cuttings with a mean of 40.68. T_2 garnered the shortest roots with a mean of 29.21. In T2, two nodes of the machiku bamboo reached the roots that were the longest, with a mean length of 78.31, followed by T3 with a mean length of 49.77, and T1 with the roots that were the smallest, with a mean length of 44.37 (Table 3).

Table 1. Parameters obtain of spiny bamboo using a different number of nodes after three (3) months.

Treatments	Parameters				
	Average Survival rate (%)	Average number of shoots	Average length (cm) of shoots	Average number of roots	Average root length (cm)
T1-one node	46.67	2.47	100.89	20.67	46.46
T2- two nodes	48.89	3.12	97.59	27.25	57.03
T3-three nodes	53.33	3.18	88.56	25.42	50.48
Anova Results	ns	*	ns	ns	ns
C.V. (%)	34.97	30.61	9.72	36.88	15.71

Table 2. Parameters obtain of giant bamboo using a different number of nodes after three (3) months.

Treatments	Parameters				
	Average Survival rate (%)	Average number of shoots	Average length (cm) of shoots	Average number of roots	Average root length(cm)
T1-one node	91.11	1.63	85.42	42.17	40.68
T2- two nodes	93.33	3.19	72.93	43.75	29.21
T3-three nodes	86.66	4.96	79.24	51.75	41.83
ANOVA RESULTS	ns	*	ns	ns	ns
C.V. (%)	4.92	28.28	11.67	43.93	31.20

Table 3. Parameters obtain of machiku bamboo using different number of nodes after three (3) months).

Treatments	Parameters				
	Average Survival rate (%)	Average number of shoots	Average length (cm) of shoots	Average number of roots	Average root length (cm)
T1-one node	95.56	1.64	81.08	39.67	44.37
T2- two nodes	91.11	2.79	78.16	45.25	78.31
T3-three nodes	86.67	4.58	72.58	46.67	49.77
ANOVA RESULTS	ns	*	ns	ns	ns
C.V. (%)	16.18	26.44	23.46	41.93	68.74

Conclusions and recommendations

In spiny bamboo, after three (3) days of planting, only T_2 has a sign of growth (breaks eye-buds and partially appearing new shoots). On the other hand, in giant bamboo after six (6) days of planting only T_2 observed to have signs of growth (breaks eye-buds and partially appearing new shoots). Meanwhile, in machiku bamboo, after five (5) days of planting only T_3 was observed to have signs of growth (breaks eye-buds and partially appearing new shoots). It is further observed that during this month (July-September), it gives a higher numeral percentage of survival compared to other studies. The occurrence of pests and diseases was not observed in the study. The treatments used derive different influences in each species. It was concluded that two (2) to three (3) node cuttings are the best in the four parameters obtained in spiny bamboo. Using one node as a cutting obtained the highest mean in average length of shoots but the time of planting should consider.

Three-node cutting leads in all the parameters gathered in giant bamboo while one-node and three-node cutting lead in machiku bamboo. It can be concluded that any of the treatments can be used as planting material. The result may be because node cuttings have a very nil effect in propagating bamboo. Based upon the findings and conclusion of the study, T_3-three node cutting is recommended to use in propagating the spiny bamboo while T_2-two node cutting is recommended in propagating because of its capability to improve survival rate.

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