INNSPUB

Journal of Biodiversity and Environmental Sciences (JBES)
ISSN: 2220-6663 (Print) 2222-3045 (Online)
Vol. 25, No. 5, p. 35-41, 2024
http://www.innspub.net

RESEARCH PAPER OPEN ACCESS

The effect of different rooting hormones on the survival of three species of bamboo species giant bamboo-*Dendrocalamus giganteus*, machiku-*Dendrocalamus latiflorus* and spiny bamboo-*Bambusa blumeana*)

Froilan A. Pacris Jr., Jona L. Asuncion, Marvin V. Baloloy, Mylene R. Ermitanio*

Cagayan State University Gonzaga Campus, Gonzaga, Cagayan, Philippines

Article published on November 06, 2024

Key words: Giant bamboo, Spiny bamboo, Machiku bamboo, Alpha Naphthalene Acetic Acid (ANAA), Gibberellic Acid (GA3) and Indole Acetic Acid (Auxin)

Abstract

The study was conducted under protective environment of bamboo nurseries at Cagayan State University Gonzaga Campus. The study was conducted to determine the effect of Different Rooting Hormones on the Survival of Three Species of Bamboo- Giant Bamboo (*Dendrocalamus giganteus*), Machiku (*Dendrocalamus latiflorus),* and Spiny bamboo (*Bambusa blumeana).*It aimed to determine the average number of shoots after three (3) months, average length (cm) of shoots after three (3) months, average number of roots after three (3) months, average length (cm) of roots after 3 months, and the percentage (%) of survival. The study was conducted in a single factor experiment under Completely Randomized Design (CRD).There are four treatments in the study which are: T_0- control, T_1- Alpha Naphthalene Acetic Acid (ANAA); T2- Gibberellic Acid (GA3); and T3- Indole Acetic Acid (Auxin).

***Corresponding Author:** Mylene R. Ermitanio ✉ ermitaniomylene@csu.edu.ph

Introduction

Bamboo is a perennial giant grass that has an excellent role to our environment, economy and culture. It is also a crucial element in the balance of oxygen and carbon dioxide in the atmosphere. It is a great way to reduce carbon footprint and help fight global warming. It is a viable replacement for wood and it can also use for construction, furniture, food, cooking and etc.

Bamboo is known to be the flagship commodity of our campus, Cagayan State University Gonzaga, Philippines, 3513. The campus propagated different species of bamboo and has also areas as plantation sites for collection of cuttings as planting materials. The school provide cuttings for plantation of different agencies and private farms as environmental restoration or any purposes that may serve them.

Furthermore, there is a need to meet the demand of the farmers and satisfy the planting materials required for extension program as a way of mitigating climate change. One of the major problems of the campus on propagating was a very low survival. While monitoring the different species propagated, three species of bamboo; spiny (30%), giant (11%) and Machiku (11%) bamboo has the lowest rate of survival among them all. The use of ANAA as rooting hormone was implemented to boost the survival rate of the commodity. This is commonly used as plant regulator that has an ability to promote root formation and elongation. On the other hand, other kind of rooting hormones should be tried to prove the best not only for root formation but also responsible for promoting growth and elongation of plants.

Auxin is the most important hormone involved in rooting. In the early 1900's, Fritz Went and a number of other researchers showed that these effects could be induced by plant extracts that were subsequently shown to contain the plant hormone indole acetic acid (IAA). Kelpak is a product that contains auxin produced from seaweed extract and it was considered as organic rooting hormones. The other hormone that will be used will be Gibberilic Acid. As cited by Rachel Weinstein, Gibberilic Acid (GA) is known to induce seed germination, promote shoot growth and internode elongation, determine the sex expression of a plant, and it involved in promoting the flowering of plants.

The three hormones should be test to see the differences in its effect to the growth and survival of the three species.

Generally, this study was conducted to determine the effect of different rooting hormone in percentage of survival of three species of bamboo (Giant Bamboo- *Dendrocalamus giganteus*, Machiku- *Dendrocalamus latiflorus*, and Spiny Bamboo- *Bambusa blumeana)*

Specifically, it aimed to determine the following:

1. Average number of shoots after three months,
2. Average length (cm) of shoots after three months,
3. Average number of roots after three months,
4. Average length (cm) of roots after three months,
5. Percentage of survival after three months.

Materials and methods

Research design

The experiment was conducted in a single factor experiment in Completely Randomized Design (CRD). It consists of three (3) rooting hormones; these are the following:

T_0- control
T1- Alpha Napthalene Acetic Acid (ANAA)
T2- Gibberilic Acid (GA3)
T3- Indole Acetic Acid (Auxin)-Kelpak

Locale of the study

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

Potting

The soil media that was used was a mixture of two parts Carbonized Rice Hull (CRH), one-part alluvial soil and one-part organic fertilizer having a ratio of 2:1:1. The soil medium was mixed thoroughly and packed in a polyethylene bags (Fig. 1).

Fig. 1. Preparation and processing of potting media

Selection of planting materials

A more or less two years of age were selected as healthy branches and used as propagules. Bamboo branches were reduced for at least two nodes using a sharp bolo or hacksaw. Proper care was observed when cutting to protect live buds specially the base having prominent roots (Fig. 2).

Fig. 2. Preparation of planting materials, distribution of cuttings according to size and number of nodes and soaking using different hormones

Preparation of rooting medium and soaking

All collected cuttings were soaked immediately at prepared solution of three (3) kinds of rooting hormones. The recommended solution from the manufacturer was followed and soaked for twenty minutes only before planting. The solution used was 4 tbsp for 16 liter of water.

Fig. 3. Planting and watering immediately after planting

Planting

The propagules were planted vertically and the first node should be covered with soil. Cares in cutting of the propagules were observed to make sure the propagules don't have any injury/crack especially to its base to ensure high percentage of survival. The prepared solution was used to irrigate the propagules for better absorption of the treatments (Fig. 3).

Care and management

All propagules were watered equally once a day or as need arise to avoid excessive loss of moisture. Weeding was done immediately as the weeds appear to maintain its cleanliness and avoid competition of water and nutrient (Fig. 4).

Fig. 4. Care and management

Data collection

The data was collected from ten (10) sample plants on each treatment. There were ten (10) cuttings that were propagated per treatments and were replicated three (3) times. Sixty (30) cuttings were planted per treatment with a total of 120 propagules per species (Fig. 5).

Fig. 5. Data gathering after three months

Analysis of the data

Statistical Tool for Agricultural Research (STAR 2.0.0 version) was used in analyzing the tabulated data (ANOVA) on a Completely Randomized Design (CRD) in a single-factor experiment.

Results and discussion

As shown in Table 1, different parameters were obtained by Spiny bamboo such as survival rate, number of shoots, length (cm) of shoots, number of roots, and root length.

Average survival rate (%)

Highest percentage of survival of spiny bamboo was achieved by T_1, cuttings soaked in ANAA with a mean of 88.89% followed by T_3, cuttings soaked in IAA-Kelpak with a mean of 64.44%. T_0, control gained 57.78 mean in its survival rate. T_2, cuttings soaked with GA garnered the lowest survival rate with a mean of 55.56%.

The result showed that survival of this species was highly influenced by T_1, cuttings soaked in ANAA but the ANOVA result shows insignificant result among the treatments. In erratic temperature of Cagayan State University-Gonzaga Campus, handling from planting stock to management of propagules must consider.

Average number of shoots

Table 1 shows insignificant result in the average number of shoots, spiny bamboo produced the greatest number of shoots in T_0, which means control produced the highest number of shoots having a mean of 2.95 shoots followed by T_3, cuttings soaked in IAA-Kelpak with a mean of 2.84. Third was achieved by T_1, cuttings soaked in ANAA with a mean of 2.62 while T_2, cuttings soaked with GA obtained the least number of shoots produced with a mean of 2.33. The treatments also showed insignificant result and also presents very small differences in terms of shoot quantity produced per treatments.

Table 1. Parameters obtain of spiny bamboo using different rooting hormone 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)
T_0-control	57.78	2.95	95.06^{b}	21.33^{b}	45.51^{ab}
T_1-ANAA	88.89	2.62	139.45^{a}	55.58^{a}	62.90^{a}
T_2- GA	55.56	2.33	80.21^{b}	21.92^{b}	31.20^{b}
T_3-IAA-Kelpak	64.44	2.84	78.84^{b}	22.25^{b}	36.03^{b}
ANOVA RESULTS	ns	ns	**	**	**
C.V. (%)	20.81	28.00	13.37	23.14	24.28

Means with the same letter are not significantly different

Average length (cm) of shoots

Among the treatments, T_1, cuttings soaked in ANAA shows highly significant result in with a mean of 139.45cm and obtained the longest length of shoots after three months. This was followed by T_0, control with a mean of 95.06cm and then T_2, cuttings soaked with GA with a mean of 80.21cm while T_3, cuttings soaked in IAA-Kelpak obtained the shortest length of shoots after three months with a mean of 78.84cm.

Average number of roots

Among the treatments observed, T_1, cuttings soaked in ANAA shows highly significant result in spiny bamboo that obtained the greatest number of roots with a mean of 55.58. T_3, cuttings soaked in IAA-Kelpak follows with a mean of 22.25. T_2, cuttings soaked with GA with a mean of 21.92 and T_0, control had the least average number of roots with a mean of 21.33.

Average length (cm) of roots

Results showed significant result in spiny bamboo that obtained the longest length of roots in T_1, cuttings soaked in ANAA with a mean of 62.90cm followed by T_0, control, with a mean of 45.51cm. T_3, cuttings soaked in IAA-Kelpak follows with a mean of 36.03cm and T_2, cuttings soaked with GA obtained the shortest length of roots after three months with a mean of 31.20cm.

Table 2. Parameters obtain of Giant bamboo using different rooting hormone 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)
T_0-control	88.89	2.19 [b]	78.96[b]	45.75[b]	44.48
T_1-ANAA	86.67	3.28 [ab]	99.94 [a]	79.42 [a]	42.73
T_2- GA	66.67	2.27 [b]	77.97 [b]	38.42 [b]	34.49
T_3-IAA-Kelpak	82.22	2.66 [a]	77.74 [b]	35.08 [b]	27.40
ANOVA RESULTS	ns	*	**	*	ns
C.V. (%)	12.78	22.66	7.64	24.45	34.47

Means with the same letter are not significantly different

As shown in Table 2, different parameters were obtained by Giant bamboo such as survival rate, number of shoots, length (cm) of shoots, number of roots, and root length.

Average survival rate (%)

Table 2 presents the results of different parameters achieved by Giant bamboo as shows insignificant result of different treatments. T_0, control reached the highest survival rate with a mean of 88.89% followed by T_1, cuttings soaked in ANAA with a mean of 86.67% also followed by T_3, cuttings soaked in IAA-Kelpak with a mean of 82.22%. T_2, cuttings soaked with GA garnered the lowest survival rate with a mean of 66.67%.

Average number of shoots

Table 2 shows significant result of giant bamboo. T_1, cuttings soaked in ANAA gained the highest number of shoots with a mean of 3.28, followed by T_3, cuttings soaked in IAA-Kelpak with a mean of 2.66. followed also with T_2, cuttings soaked with GA with a mean of 2.27. T_0, control have the least number of shoots having a mean of 2.19.

Average length (cm) of shoots

Giant bamboo shows highly significant result in T_1, cuttings soaked in ANAA and obtained the longest shoots with a mean of 99.94cm followed by T_0, control with a mean of 78.96cm. T_2, cuttings soaked with GA reached a length with a mean of 77.97cm. T_3, cuttings soaked in IAA-Kelpak garnered the shortest shoots with a mean of 77.74cm.

Average number of roots

Table 2 shows highly significant result in giant bamboo that reached the most number of roots with a mean of 79.42 in T_1, cuttings soaked in ANAA followed by T_0, control with a mean of 45.75. T_2, cuttings soaked with GA also reached a mean of 38.42 and T_3, cuttings soaked in IAA-Kelpak garnered the lowest number of roots with a mean of 35.08.

Average length (cm) of roots

Table 2 presents that the treatments used insignificantly affect Giant bamboo. It obtained the longest roots from T_0, control with a mean of 44.48. T_1, cuttings soaked in ANAA was next with a mean of 42.73 followed by T_2, cuttings soaked with GA with a mean of 34.49. T_3, cuttings soaked in IAA-Kelpak garnered the shortest roots with a mean of 27.40cm.

Average survival rate (%)

The survivability performance of machiku bamboo presents insignificant result among treatments. The highest survival was obtained d by T_1, cuttings soaked in ANAA with a mean of 93.33% followed by T_3, cuttings soaked in IAA-Kelpak with a mean of 88.89% T_0, control also reached a mean of 83.22. T_2, cuttings soaked with GA garnered the lowest survival rate with a mean of 75.56%.

Average number of shoots

On the other hand, Table 3 shows highly significant result from Machiku bamboo propagated in treatment T_3, cuttings soaked in IAA-Kelpak produces the highest number of shoots with a mean

of 4.67 followed by T_1, cuttings soaked in ANAA that produce a mean of 3.88 also followed by T_0, control with a mean of 2.96 shoots. T_2, cuttings soaked with GA obtained the least number of shoots with a mean of 2.84.

Average length (cm) of shoots

Table 3 presents not significant result in Machiku bamboo in T_1, cuttings soaked in ANAA reached the longest shoots with a mean of 111.75cm followed by T_2, cuttings soaked with GA with a mean of 99.24cm while T_3, cuttings soaked in IAA-Kelpak reached a mean of 96.78cm. T_0, control has the shortest shoot with a mean of 74.08cm

Average number of roots

Meanwhile, significant result shows in Machiku bamboo that produces the highest number of roots in T_0, control having 51.25 number of roots produced. This was followed by T_3, cuttings soaked in IAA-Kelpak with mean of 37.67. T_1, cuttings soaked in ANAA follows with a mean of 36.25. T_2, cuttings soaked with GA produces the least number of roots with a mean of 20.17.

Table 3. Parameters obtain of Machiku bamboo using different rooting hormone 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)
T_0-control	83.22	2.96[b]	74.08	51.25[a]	34.90
T_1-ANAA	93.33	3.88 [ab]	111.75	36.25 [ab]	39.34
T_2- GA	75.56	2.84 [b]	99.24	20.17 [b]	32.08
T_3-IAA-Kelpak	88.89	4.67 [a]	96.78	37.67 [ab]	41.87
ANOVA RESULTS	ns	*	ns	*	ns
C.V. (%)	15.82	20.33	16.50	17.35	29.28

Means with the same letter are not significantly different

Average length (cm) of roots

Table 3 presents that Machiku bamboo in T_3, cuttings soaked in IAA-Kelpak reached the longest roots with a mean of 41.87 followed by T_1, cuttings soaked in ANAA with a mean of 39.34cm next is the T_0, control having 34.90cm in root length while T_2, cuttings soaked with GA had the shortest roots with a mean of 32.08cm. It shows insignificant effects among the treatments used.

The study is very specific to Cagayan State University-Gonzaga Campus, and the findings may not be directly applicable to other regions with different environmental conditions.

Conclusion

The treatments used derived different influence in each species. It was concluded that T_1, cuttings soaked in ANAA is the best treatment use for the three species of bamboo which garnered nine (9) parameters out of 15.

It was observed that T_0, control also shows as the highest in some parameters or 4 parameters out of 15. These results also prefer that not soaking to rooting hormones can be done by indigent bamboo grower for lesser expenses.

For commercial bamboo cultivation or projects with tight timelines, using ANAA as a means of propagating bamboo is better for faster establishment of bamboo plants.

Recommandations

Based upon the findings and conclusion of the study, T_1, cuttings soaked in ANAA is recommended to use in propagating the three species of bamboo because of its capability to improve survival rate.

Acknowledgements

The authors were very thankful to Cagayan State University for funding and contributing towards the success of the book.

References

Banik RL. 1995. A manual for vegetative propagation of bamboos. International Network for Bamboo and Rattan. Retrieved from https://www.inbar.int/wp-content/uploads/2020/05/1489457006.pdf

Bareja GB. 2013. Bamboo production and propagation methods. Online. Retrieved from https://www.doc-developpement-durable.org/file/Culture/Arbres-Bois-de-Rapport-Reforestation/FICHES_ARBRES/bambou/bambooproduction-and-propagationmethods.pdf

Halili KC. 2015. DOST-PCAARRD S&T Media Service. Bamboo propagation via branch cuttings to assist farmers in production. Retrieved from http://www.pcaarrd.dost.gov.ph/home/portal/index.php/quick-information-dispatch/2600-bamboo-propagation-via-branch-cuttings-to-assist-farmers-in-production

Ray SS, Ali MN. 2017. Factors affecting macropropagation of bamboo with special reference to culm cuttings: a review update. N.Z. J. For. Sci. 47, 17. https://doi.org/10.1186/s40490-017-0097-z