



VEGETATIVE PROPAGATION OF *Plumeria pudica* SUBJECTED TO DIFFERENT PROPORTIONS OF DECOMPOSED BABASSU STEM

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ABSTRACT

Objective: The objective of this study was to evaluate the viability of the decomposed babassu stem in the vegetative propagation of bridal bouquets.

Theoretical Framework: The bridal bouquet (*Plumeria pudica*) is a perennial shrub of the Apocynaceae family, native to Venezuela and Panama, which can reach four meters in height. Studies have shown that the substrate of decomposed stems of babassu tree (*Attalea speciosa* Mart.) stands out for the production of flowering seedlings in the northeast region, being very abundant in the Maranhão region and low cost.

Method: The research was carried out in a greenhouse with 70% light interception, at the Chapadinha Center of the Federal University of Maranhão. A completely randomized design was adopted, delimiting six substrate treatments based on decomposed babassu tree (CDB) added to soil in the proportions of 0, 20, 40, 60, 80, 100% of CDB. The variables analyzed were number of leaves (NF) and number of shoots (NB), leaf area (AF), length of the largest shoot (CMB) and root length (CR), fresh mass of the root system (MFSR), dry mass of the aerial part (MSPA), dry mass of the root system (MSSR) and percentage of survival (PS). For statistical analyses, InfoStat® was used.

Results and Discussion: The data obtained were subjected to analysis of variance, using the “F” test, to diagnose significant effects between the different substrates and comparison of means using the Tukey test at 5% probability. Given that the best proportion for this experiment was 100% CDB, which provided good conditions for the bridal bouquet seedlings.

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Research Implications: *Plumeria pudica* is a common species in eastern Maranhão, where decomposed babassu substrate is frequently used. The evaluation of different substrates for seedling production is essential to optimize cultivation and enable the commercialization of the plants.

Originality/Value: The decomposed babassu substrate has not yet been tested for *Plumeria pudica*. In this sense, its evaluation may bring new possibilities for the propagation and commercialization of the species.

Keywords: Apocynaceae, Vegetative, Propagation, Regional Substrates.

PROPAGAÇÃO VEGETATIVA DE *Plumeria pudica* SUBMETIDA DIFERENTES PROPORÇÕES DE CAULE DECOMPOSTO DE BABAÇUZEIRO

RESUMO

Objetivo: O objetivo do presente trabalho foi avaliar a viabilidade do caule decomposto de babaçuzeiro na propagação vegetativa de buquê de noiva.

Referencial Teórico: O buquê de noiva (*Plumeria pudica*) é um arbusto da família Apocynaceae, nativa da Venezuela e do Panamá, perene, que chega a quatro metros de altura. Foi comprovado através de estudos que o substrato de caule decomposto de babaçuzeiro (*Attalea speciosa* Mart.) se destaca para produção de mudas floríferas na região nordeste, sendo muito abundante na região maranhense e de baixo custo.

Método: A pesquisa foi realizada em casa de vegetação com 70% de interceptação luminosa, no Centro de Chapadinha da Universidade Federal do Maranhão. Adotou-se o delineamento inteiramente casualizado, delimitando-se em seis tratamentos de substratos a base de caule decomposto de babaçuzeiro (CDB) acrescidas de solo nas proporções de 0, 20, 40, 60, 80, 100% de CDB. As variáveis analisadas foram número de folhas (NF) e número de brotos (NB), área foliar (AF), comprimento do maior broto (CMB) e comprimento radicular (CR), massa fresca do sistema radicular (MFSR), massa seca da parte aérea (MSPA), massa seca do sistema radicular (MSSR) e porcentagem de sobrevivência (PS). Para as análises estatísticas foi utilizado o InfoStat®.

Resultado e Discussão: Os dados obtidos foram submetidos à análise de variância, pelo Teste “F”, para diagnóstico de efeitos significativos entre os diferentes substratos e comparação de médias pelo teste de Tukey a 5% de probabilidade, visto isso a melhor proporção para esse experimento foi 100% CDB, na qual proporcionou boas condições as mudas de buquê de noiva.

Implicações da Pesquisa: A *Plumeria pudica* é uma espécie comum no leste maranhense, onde o substrato decomposto de babaçu é frequentemente utilizado. A avaliação de diferentes substratos para a produção de mudas é essencial para otimizar o cultivo e possibilitar a comercialização das plantas.

Originalidade/Valor: O substrato decomposto de babaçu ainda não foi testado para *Plumeria pudica*. Nesse sentido, sua avaliação pode trazer novas possibilidades para a propagação e comercialização da espécie.

Palavras-chave: Apocynaceae, Propagação, Vegetativa, Substratos Regionais.

PROPAGACIÓN VEGETATIVA DE *Plumeria pudica* SOMETIDA A DIFERENTES PROPORCIONES DE TALLO DE BABASÚ DESCOMPUESTO

RESUMEN

Objetivo: El objetivo de este estudio fue evaluar la viabilidad del tallo descompuesto de babasú en la propagación vegetativa de ramos de novia.

Referencia Teórica: El ramo de novia (*Plumeria pudica*) es un arbusto de la familia Apocynaceae, originario de Venezuela y Panamá, perenne, que alcanza los cuatro metros de altura. Se ha comprobado a través de estudios que el sustrato de tallo descompuesto de babasú (*Attalea speciosa* Mart.) se destaca para la producción de plántulas floridas en la región nordeste, siendo muy abundante en la región de Maranhão y de bajo costo.



Método: La investigación se realizó en un invernadero con 70% de interceptación de luz, en el Centro Chapadinha de la Universidad Federal de Maranhão. Se adoptó un diseño completamente aleatorizado, delimitando seis tratamientos de sustrato a base de tallo de babasú descompuesto (CDB) adicionado al suelo en proporciones de 0, 20, 40, 60, 80, 100% de CDB. Las variables analizadas fueron número de hojas (NF) y número de brotes (NB), área foliar (AF), longitud del brote mayor (CMB) y longitud de la raíz (CR), masa fresca del sistema radical (MFSR), masa seca de la parte aérea (MSPA), masa seca del sistema radical (MSSR) y porcentaje de supervivencia (PS). Para el análisis estadístico se utilizó InfoStat®.

Resultados y discusión: Los datos obtenidos se sometieron a un análisis de varianza mediante la prueba F para diagnosticar efectos significativos entre los diferentes sustratos, y se compararon medias mediante la prueba de Tukey con una probabilidad del 5%. Dado que la mejor proporción para este experimento fue 100% CDB, lo que proporcionó buenas condiciones para las plántulas de ramo de novia.

Implicaciones de la investigación: *Plumeria pudica* es una especie común en el este de Maranhão, donde con frecuencia se utiliza sustrato de babasú descompuesto. La evaluación de diferentes sustratos para la producción de plántulas es esencial para optimizar el cultivo y posibilitar la comercialización de las plantas.

Originalidad/Valor: El sustrato de babasú descompuesto aún no ha sido probado para *Plumeria pudica*. En este sentido, su evaluación puede traer nuevas posibilidades para la propagación y comercialización de la especie.

Palabras clave: Apocynaceae, Propagación, Vegetativa, Sustratos Regionales.

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1 INTRODUCTION

The bridal bouquet (*Plumeria Pudica*) is a shrub from the Apocynaceae family, native to Venezuela and Panama, perennial, which reaches 4 meters in height, widely used in landscaping, isolated or forming rows. Its bouquet-shaped flowers, white with a slightly yellowish touch, provide an aesthetic pleasure that acts on the psyche of those who observe them (Nascimento & Coelho, 2016). It is a plant found abundantly in northeastern Brazil due to the plant's ease of climatic adaptation (Fernandes et al., 2015).

The use of cuttings in the formation of seedlings is an advantage of vegetative propagation, as it ensures the anticipation of the reproductive period, contributing to the economic exploitation and maintenance of the characteristics of the mother plant in the descendants, providing homogeneity in cultivation (Sasso et al., 2010).

The bridal bouquet is a very resistant plant, but for good vegetative propagation it is necessary to use a substrate that can meet all the nutritional demands of the plant at this stage of development. According to Cordeiro et. al. (2019), the decomposed babassu stem (CDB) has high natural fertility, with high levels of N, P, K, S, Ca and Mg. In addition, it is highly available in the northeast region and can be purchased at a low cost. The babassu palm is native to the



Amazon and Atlantic Forest regions of Brazil and grows with periodic deforestation and successive fires (Sluszz & Machado, 2016).

Aiming at the importance of the substrate in seedling production, the present work was developed with the objective of evaluating the viability of the decomposed babassu stem (CDB) in the vegetative propagation of *Plumeria pudica*.

2 MATERIAL AND METHODS

The research was carried out in a greenhouse with 75% light interception, in the experimental area of the Maranhão Fruit Research Group (FRUTIMA), located at the Center for Agricultural and Environmental Sciences, Federal University of Maranhão, in Chapadinha-MA . Whose coordinates are 3° 44'30" S, 43° 21'37" W. The climate, according to the Koppen -Geiger classification, is of the Aw tropical climate type with a dry season in winter. The climate of the region is classified as humid tropical, with average annual rainfall totals of 1613.2 mm and average annual temperature above 27 °C (Passos et al., 2016).

randomized design (CRD) was used for this study , with 6 treatments based on CDB plus soil, in the following proportions: T1: 100% soil; T2: 20% CDB + 80% soil; T3: 40% CDB + 60% soil; T4: 60% CDB + 40% soil; T5: 80% CDB + 20% soil; T6: 100% CDB, with 4 replicates containing 2 seedlings in each replicate, totaling 8 experimental units per treatment. The cuttings were selected in such a way as to obtain only subwoody cuttings, cut to 20 cm in length, with 4 pairs of leaves in formation, and were placed in trays of 35 cells containing a volume of 90 cm ³ per cell. A chemical analysis of the substrates was previously performed (Table 1).

**Table 1**

Values of pH, electrical conductivity (EC) and total levels of nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg) and sulfur (S) of substrates based on decomposed babassu stem (CDB).

Substrates	pH dS m ⁻¹	EC g kg ⁻¹	N g kg ⁻¹	P mg kg ⁻¹	K	Here ----- cmolc kg ⁻¹ -----	Mg	S
T1	5.06	0,1	0,63	13	0,07	0,8	0,3	1,5
T2	4,88	0,61	1,23	14	0,67	1,6	1	3,8
T3	5,11	1,36	1,46	13	1,82	3,2	1,7	7,6
T4	4,83	1,79	2,02	13	2,35	4,4	2,8	10,8
T5	5.16	3	3.47	27	6.17	10.9	4.6	24.6
T6	5.32	4.34	5.88	33	3.63	20.6	15.2	41.5

T1: 100% only; T2: 20% CDB + 80% only; T3: 40% CDB + 60% only; T4: 60% CDB + 40% only; T5: 80% CDB + 20% only; T6: 100% CDB.

The experiment was evaluated in a laboratory. The variables analyzed were: i) number of leaves (NF) and number of shoots (NB): obtained by counting the leaves and shoots of each plant; ii) leaf area (AF): obtained through the ImagemJ[®] program ; length of the largest shoot (CMB) and root length (CR): determined with the aid of a millimeter ruler; dry mass of the aerial part (MSPA) and dry mass of the root system (MSSR) obtained by the drying method in an oven with forced air circulation at 60°C; survival percentage (PS), fresh mass of the root system (MFSR) obtained by weighing on a scale with an accuracy of 0.01 g.

InfoStat[®] computer program was used . The data obtained were subjected to analysis of variance, using the “F” test, to diagnose significant effects between the different substrates. The means of the variables were compared using the Tukey test at 5% probability.

3 RESULTS AND DISCUSSION

Through the Tukey and “F” statistical tests, it was possible to observe that the variables: leaf area (AF), number of leaves (NF), percentage of survival (PS) and fresh mass of the root system (MFSR) showed a significant effect with the use of the substrate (CDB) while the variables: length of the largest shoot (CMB), dry mass of the aerial part (MSPA), number of shoots (NB), root length (CR) and dry mass of the root system (MSSR) did not show a significant response.

Regarding the number of leaves and leaf area (Table 2), the substrates that contained CDB presented better results, statistically differentiating them from T1 with 100% soil. Considering NF, the same result was obtained by Andrade et al. (2017) in their biometric study of tomato seedlings produced in substrates based on decomposed babassu stem.



According to Figueiredo et al. (2010), AF is widely known for being an excellent indicator of phytomass productivity and the economic life of the crop. It is possible to see that there is a relationship between the number of leaves and leaf area (Table 2), achieving this success due to the use of CBD, which is a substrate consisting of a high nutrient content that influences the shape, development and growth of both the roots and the aerial part of the plant (Macedo, 2011).

CMB and MSPA did not show significant effects regarding the use of the substrate, but showed a greater tendency to respond in T6 (Table 2). Regarding MSPA in the work of Andrade et al. (2017), in the 'Crimson Sweet' watermelon crop, it was found that T6 also showed a numerical increase in dry matter compared to other treatments containing CDB, despite not showing differences like the work above.

Table 2

Summary of analysis of variance of leaf area (AF), number of leaves (NR), length of the largest shoot (CMB) and dry mass of the aerial part (MSPA) of bridal bouquet cuttings as a function of different substrates based on decomposed babassu stem (CDB) and soil.

Substrates	AF — cm ² —	NF — —	CMB — cm —	MSPA — g —
F	2.64 *	4.28 *	0.91 ^{ns}	1.45 ^{ns}
T1	16.25b	7.00b	5.55	0.24
T2	49.91ab	7.75ab	5.87	0.27
T3	22,25ab	14,25ab	6,84	0,06
T4	46,25ab	14,25ab	5,51	0,21
T5	53,64ab	12,75ab	5,92	0,21
T6	132,76a	17,00a	6,31	0,56
DMS	115,35	8,614	-	-
C.V.	95,93	31,51	17,71	106,67

* Significant at the 5% probability level, by F test; ns : not significant. T1: 100% soil; T2: 20% CBD + 80% soil; T3: 40% CBD + 60% soil; T4: 60% CBD + 40% soil; T5: 80% CBD + 20% soil; T6- 100% CBD; LSD: least significant difference; CV: coefficient of variation.

For PS, there was a significant difference between the concentrations of substrates tested, being an important variable, as it demonstrates a higher level of cuttings utilization (Table 3).

In the NB variable, the treatment that stood out statistically compared to the others was the 80% CBD + 20% soil treatment (Table 3), with an average of 2.75, this result can be considered positive when compared to Cruz (2017) in his work with *Bougainvillea cuttings spectabilis* Willd., in which he obtained an average of 2.79 for NB per cutting. The answer is due to the material's ability to develop with a high carbon/nitrogen ratio.


Table 3

Summary of the analysis of survival rate (PS) and number of shoots (NB) of bridal bouquet cuttings (*Plumeria pudica* sp.) as a function of different substrates based on decomposed babassu stem (*Attalea* sp.).

Substrates	YOU —— % ——	NB
F	7,20*	2,69 ^{ns}
T1	62,50b	2,50
T2	50,00b	1,25
T3	50,00b	1,50
T4	62,50b	1,88
T5	50,00b	2,75
T6	100,00a	2,13
DMS	32,43568	1,01828
C.V.	23,09	35,11

*Significant at the 5% probability level, by F test; T1: 100% soil; T2: 20% CBD + 80% soil; T3: 40% CBD + 60% soil; T4: 60% CBD + 40% soil; T5: 80% CBD + 20% soil; T6: 100% CBD; LSD: least significant difference; CV: coefficient of variation.

For plants to adapt and survive in adverse conditions, root development is a fundamental requirement (Dantas, 2010). However, even though the root length (RL) variable did not show any difference between treatments, it stood out with an average of 3.80 in T5 (Table 3). This is proven by Oliveira Neto (2017), who worked with pomegranate cuttings, which obtained the best results for the root system in a substrate of 80% CDB + 20% S, believing that efficiency is related to porosity, which allows the roots to develop freely.

Table 4

Summary of analysis of variance of root length (CR), fresh mass of the root system (MFSR) and dry mass of the root system (MSSR) of bridal bouquet cuttings (*Plumeria púdica* sp.) as a function of different substrates based on decomposed stem of babassu (*Attalea* sp.).

Treatments	MFSR —— cm ³ ——	CR —— cm ——	MSSR —— g ——
F	3.54 *	2.06 ^{ns}	0.51 ^{ns}
T1	0.43ab	1,80	0,13
T2	0,19b	1,98	0,12
T3	0,05b	1,10	0,16
T4	0,22ab	1,70	0,16
T5	0,22ab	3,80	0,10
T6	1,15 ^a	5,15	0,13
DMS	0,952	-	-
C.V.	112,61	83,55	47,07

* Significant at the 5% probability level, by F test; ns : not significant. T1: 100% soil; T2: 20% CBD + 80% soil; T3: 40% CBD + 60% soil; T4: 60% CBD + 40% soil; T5: 80% CBD + 20% soil; T6- 100% CBD; LSD: least significant difference; CV: coefficient of variation.



In analyzing the data (Table 4), it can be seen that the tested proportions do not differ from each other in relation to MSSR. According to Santana et al. (2019), the substrates formulated with decomposed babassu stems present satisfactory physical and chemical characteristics for the development of seedlings. In their work with purple ipê variable MFSR, a relevant difference was found between the treatments, with 60% CDB + 40% S being the best treatment.

4 CONCLUSION

Promising results were obtained, since the CBD is made up of a high nutrient content that characterizes the substrate, influencing the structure and growth of both the roots and the aerial part. Therefore, they provide good conditions for vegetative propagation and the development of bridal bouquet seedlings. It is recommended to formulate the substrate with 100% CBD. However, to make the use of this substrate viable for this ornamental plant, further studies are necessary.

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