



EFFECT OF DIFFERENT PROPORTIONS OF AÇAÍ FIBER ON THE INITIAL DEVELOPMENT OF PASSION FRUIT SEEDLINGS

Mariana Sanches Silva¹
Potiára Oliveira Diniz²
Edson Araujo de Amorim³
Edinilson Ferreira Lales⁴
Sadrax Lourran Teixeira Silva⁵
Kalyne Pereira Miranda Nascimento⁶
Anatercia Ferreira Alves⁷
Jossimara Ferreira Damascena⁸
Caylanna Lima Brandão⁹
Carla Beatriz Conceição Silva¹⁰
Fernanda Lima Andrade¹¹
Amália Santos da Silva Veras¹²

ABSTRACT

Introduction: Passion fruit (*Passiflora edulis*) comes from tropical regions, and Brazil is the world's largest producer of this crop today. However, the increase in the cost of seedling production proves the need for alternatives for production, such as açai fiber substrate. The objective of the work was to evaluate the development of passion fruit seedlings in different types of treatments with açai fiber, to determine the best composition of the substrate. The study was conducted at the Center for Agricultural Sciences of the State University of the Tocantina Region of Maranhão, municipality of Imperatriz. The experimental design used was entirely randomized with five treatments T0 (100% soil), T1 (25% açai fiber + 75% soil), T2 (50% açai fiber + 50% soil), T3 (75% açai fiber + 25% soil) and T4 (90% açai fiber + 10% soil), being used 6 repetitions, totaling thirty experimental units. The experiment was conducted for 2 months. Four evaluations were carried out and the variables analyzed were germination, plant height, stem diameter, number of leaves, dry mass of the aerial part and roots. Although they did not present statistical significance for all variables, T2 and T4 treatments showed the best results. T2 stood out

¹ Universidade Estadual da Região Tocantina do Maranhão, Imperatriz, Maranhão, Brasil.

E-mail: marianasanches2712@gmail.com

² Universidade Estadual da Região Tocantina do Maranhão, Imperatriz, Maranhão, Brasil.

E-mail: potiara.diniz@uemasul.edu.br

³ Universidade Estadual de Londrina, Londrina, PR, Brasil.

E-mail: edsonamorins@hotmail.com

⁴ Serviço Ncional de Aprendizagem Rural (SENAR), São Luis, MA, Brasil.

E-mail: agrolales07@gmail.com

⁵ Universidade Estadual da Região Tocantina do Maranhão, Imperatriz, Maranhão, Brasil.

E-mail: sadrax.pessoal@gmail.com

⁶ Universidade Estadual da Região Tocantina do Maranhão, Imperatriz, Maranhão, Brasil.

E-mail: kalyneengenhairaag@gmail.com

⁷ Universidade Estadual da Região Tocantina do Maranhão, Imperatriz, Maranhão, Brasil.

E-mail: anatercia@uemasul.edu.br

⁸ Universidade Estadual de Londrina, Londrina, PR, Brasil.

E-mail: jossimara.pesquisadoraifma@gmail.com

⁹ Universidade Estadual da Região Tocantina do Maranhão, Imperatriz, Maranhão, Brasil.

E-mail: caylannabrandao.20190003888@uemasul.edu.br

¹⁰ Universidade Estadual da Região Tocantina do Maranhão, Imperatriz, Maranhão, Brasil.

E-mail: carlabeatriz387@gmail.com

¹¹ Universidade Estadual da Região Tocantina do Maranhão, Imperatriz, Maranhão, Brasil.

E-mail: fernandal_andrade@hotmail.com

¹² Consultora da Agroveras Consultoria Ltda, Caxias, MA, Brasil.

E-mail: amaliaveras1310@gmail.com



in the height and dry mass of the aerial part, while T4 obtained the highest rates of dry and fresh mass of the roots. These results indicate that the use of açai fiber is a promising and sustainable alternative in the production of passion fruit seedlings.

Objective: The objective of this study is to investigate the effect of different proportions of açai fiber on the initial development of passion fruit seedlings, in order to determine the best composition of the substrate.

Theoretical Framework: In this topic, the main concepts and theories that underlie the research are presented. The types of substrates that can be used in the production of passion fruit seedlings are highlighted, from Nicoloso (2000) and Saidelles (2009) providing a solid basis for understanding the context of the investigation.

Method: The methodology adopted for this research comprises the experimental design adopted was the entirely randomized, composed of five treatments T0 (100% soil), T1 (25% açai fiber + 75% soil), T2 (50% açai fiber + 50% soil), T3 (75% açai fiber + 25% soil) and T4 (90% açai fiber + 10% soil), being used 6 repetitions, totaling thirty experimental units. Data collection was carried out through weekly analyzes.

Results and Discussion: The results obtained revealed that the açai fiber substrate is efficient in the initial development of passion fruit seedlings, principally in T2 and T4.

Research Implications: The practical and theoretical implications of this research are discussed, providing insights into how the results can be applied or influence practices in the field of [insert field of study]. These implications could encompass [list impacted areas or sectors].

Originality/Value: This study contributes to the literature by [highlighting the originality of the research, whether through the innovative approach, new discoveries or practical contributions]. The relevance and value of this research are evidenced by [explain how the results may impact the area of study or professional practice].

Keywords: Açai Agro-Industrial Waste, Plant Development, Sustainable Cultivation, *Passiflora Edulis*.

EFEITO DE DIFERENTES PROPORÇÕES DE FIBRA DE AÇAÍ NO DESENVOLVIMENTO INICIAL DE MUDAS DE MARACUJÁ

RESUMO

Introdução: O maracujá (*Passiflora edulis*) é oriundo de regiões tropicais, sendo o Brasil o maior produtor mundial dessa cultura atualmente. Todavia, o aumento no custo da produção de mudas, comprova a exigência de alternativas para produção, como o substrato de fibra de açai. O objetivo trabalho foi avaliar o desenvolvimento das mudas de maracujá em diferentes tipos de tratamentos com a fibra de açai, para determinar a melhor composição do substrato. O estudo foi conduzido no Centro de Ciências Agrárias da Universidade Estadual da Região Tocantina do Maranhão, município de Imperatriz. O delineamento experimental utilizado foi o inteiramente casualizado com cinco tratamentos T0 (100% solo), T1 (25% fibra de açai + 75% solo), T2 (50% fibra de açai + 50% solo), T3 (75% fibra de açai + 25% solo) e T4 (90% fibra de açai + 10% solo), sendo utilizadas 6 repetições, totalizando trinta unidades experimentais. O experimento foi conduzido durante 2 meses. Realizou-se quatro avaliações e as variáveis analisadas foram a germinação, altura da planta, diâmetro do coleto, número de folhas, massa seca da parte aérea e das raízes. Apesar de não apresentarem significância estatística para todas as variáveis, os tratamentos T2 e T4 mostraram os melhores resultados. O T2 destacou-se na altura e massa seca da parte aérea, enquanto o T4 obteve os maiores índices de massa seca e fresca das raízes. Esses resultados indicam que o uso de fibra de açai trata-se de uma alternativa promissora e sustentável na produção de mudas de maracujá.

Objetivo: O objetivo deste estudo é investigar o efeito de diferentes proporções de fibra de açai no desenvolvimento inicial de mudas de maracujá, com o intuito de determinar a melhor composição do substrato.

Referencial Teórico: Neste tópico, são apresentados os principais conceitos e teorias que fundamentam a pesquisa. Destacam-se os tipos de substratos que podem ser utilizados na produção de mudas de maracujá, a partir de Nicoloso (2000) e Saidelles (2009) fornecendo uma base sólida para a compreensão do contexto da investigação.

Método: A metodologia adotada para esta pesquisa compreende o delineamento experimental adotado foi o inteiramente casualizado, composto por cinco tratamentos T0 (100% solo), T1 (25% fibra de açai + 75% solo), T2



(50% fibra de açaí + 50% solo), T3 (75% fibra de açaí + 25% solo) e T4 (90% fibra de açaí + 10% solo), sendo utilizadas 6 repetições, totalizando trinta unidades experimentais. A coleta de dados foi realizada por meio de análises semanais.

Resultados e Discussão: Os resultados obtidos revelaram que o substrato da fibra de açaí é eficiente no desenvolvimento inicial de mudas de maracujá, principalmente no T2 e T4.

Implicações da Pesquisa: A pesquisa implica na escolha da proporção do solo juntamente com o substrato de açaí que mais favorece o desenvolvimento de mudas de maracujá. Ela sugere que este tipo de substrato favorece a sustentabilidade e economia.

Originalidade/Valor: Este estudo contribui para a literatura ao ser o pioneiro a evidenciar a eficiência do substrato de fibra de açaí no desenvolvimento inicial de mudas de maracujá.

Palavras-chave: Resíduos Agroindustriais de Açaí, Desenvolvimento Vegetal, Cultivo Sustentável, *Passiflora Edulis*.

EFFECTO DE DIFERENTES PROPORCIONES DE FIBRA DE AÇAÍ EN EL DESARROLLO INICIAL DE PLÁNTULAS DE MARACUYÁ

RESUMEN

Introducción: La fruta de la pasión (*Passiflora edulis*) proviene de regiones tropicales, siendo Brasil el mayor productor mundial de este cultivo en la actualidad. Sin embargo, el aumento en el costo de la producción de plántulas demuestra la necesidad de alternativas para la producción, como el sustrato de fibra de açaí. El objetivo del trabajo fue evaluar el desarrollo de las plántulas de maracujá en diferentes tipos de tratamientos con fibra de açaí, para determinar la mejor composición del sustrato. El estudio fue realizado en el Centro de Ciencias Agrarias de la Universidad Estatal de la Región Tocantina de Maranhão, municipio de Imperatriz. El diseño experimental utilizado fue el totalmente aleatorio con cinco tratamientos T0 (100% solo), T1 (25% fibra de açaí + 75% solo), T2 (50% fibra de açaí + 50% solo), T3 (75% fibra de açaí + 25% solo) y T4 (90% fibra de açaí + 10% solo), siendo utilizadas 6 repeticiones, totalizando treinta unidades experimentales. El experimento se llevó a cabo durante 2 meses. Se realizaron cuatro evaluaciones y las variables analizadas fueron la germinación, la altura de la planta, el diámetro de la cola, el número de hojas, la masa seca de la parte aérea y de las raíces. Aunque no presentan significación estadística para todas las variables, los tratamientos T2 y T4 mostraron los mejores resultados. El T2 se destacó en la altura y la masa seca de la parte aérea, mientras que el T4 obtuvo los índices más altos de masa seca y fresca de las raíces. Estos resultados indican que el uso de fibra de açaí es una alternativa prometedora y sostenible en la producción de plántulas de maracujá.

Objetivo: El objetivo de este estudio es investigar el efecto de diferentes proporciones de fibra de açaí en el desarrollo inicial de plántulas de maracujá, con el fin de determinar la mejor composición del sustrato.

Marco Teórico: En este tema, se presentan los principales conceptos y teorías que fundamentan la investigación. Se destacan los tipos de sustratos que pueden ser utilizados en la producción de plántulas de maracujá, a partir de Nicoloso (2000) y Saidelles (2009), proporcionando una base sólida para la comprensión del contexto de la investigación.

Método: La metodología adoptada para esta investigación comprende el delineamiento experimental adoptado fue el totalmente aleatorio, compuesto por cinco tratamientos T0 (100% suelo), T1 (25% fibra de açaí + 75% suelo), T2 (50% fibra de açaí + 50% suelo), T3 (75% fibra de açaí + 25% suelo) y T4 (90% fibra de açaí + 10% suelo), siendo utilizadas 6 repeticiones, totalizando treinta unidades experimentales. La recopilación de datos se realizó a través de análisis semanales.

Resultados y Discusión: Los resultados obtenidos revelaron que el sustrato de la fibra de açaí es eficiente en el desarrollo inicial de plántulas de maracujá, principalmente en T2 y T4.

Implicaciones de la investigación: La investigación implica la elección de la proporción del suelo junto con el sustrato de açaí que más favorece el desarrollo de plántulas de maracujá. Ella sugiere que este tipo de sustrato favorece la sostenibilidad y la economía.



Originalidad/Valor: Este estudio contribuye a la literatura al ser el pionero en evidenciar la eficiencia del sustrato de fibra de açáí en el desarrollo inicial de plántulas de maracuyá.

Palabras clave: Residuos Agroindustriales de Açáí, Desarrollo Vegetal, Cultivo Sostenible, *Passiflora edulis*.

RGSA adota a Licença de Atribuição CC BY do Creative Commons (<https://creativecommons.org/licenses/by/4.0/>).



1 INTRODUCTION

Passion fruit (*Passiflora edulis*) is native to tropical regions, and it is estimated that about 150 species are native to Brazil (Fernandes et al., 2015), however, only three cultivars are the main: yellow passion fruit (*Passiflora edulis f. flavicarpa*), purple passion fruit (*Passiflora edulis Sims*) and sweet passion fruit (*Passiflora alata*). Of these, the yellow passion fruit fits as the most important. The plant can have a wide use, they are: fruits for fresh consumption that are called sweet passion fruit, flowers for ornamentation, pulp for the manufacture of juices and nectars and stems and leaves for the production of raw material for industries of various sectors (EMBRAPA, 2022).

According to the Brazilian Institute of Geography and Statistics (IBGE, 2021), Brazil is the largest producer of passion fruit worldwide, with a production of about 600 thousand tons, with an average yield of 15,259 kg per hectare. Among the states that produce the most are Ceará and Bahia, making the Northeast stand out with 64.5% of the country's production. The production of passion fruit in the state of Maranhão has been gaining great prominence, especially in the region of Amarante do Maranhão, which fits as the largest pole of the state. This advancement of fruit growing is due to climatic conditions and passion fruit is one of the crops with enormous potential, and contributes to the generation of employment and income, especially in small properties (Caldas, 2022; Meletti *et al.*, 2012).

Because it is a typical plant of hot regions, passion fruit can adapt to dry climate regions, but adequate irrigation is necessary. In addition, it can develop in different types of soils, since they are fertile and have good drainage (EMBRAPA, 1996). Exposure to light is also a factor that affects the production of passion fruit, since light increases its pollination time. Thus, hot regions that are close to the equator, where there is a greater uniformity of sunlight, produce almost the whole year. As for the pollination of this plant, we have the bumblebees (*Xylocopa spp.*) as the main form, due to its size proportional to the flower structure (Corbert; Willimer, 1980). Manual pollination can also be used as a mechanism to complement natural pollination.



And the form of propagation is through seeds and seedlings, which must come from certified healthy plants (Ribeiro *et al.* 2005).

The production of passion fruit seedlings is a fundamental step for the success of the cultivation, being widely practised both in Brazil and in other countries. In Brazil, production is highlighted by the search for high quality seedlings, from certified seeds or techniques such as cloning to ensure uniformity and resistance to pests and diseases (Pasqual *et al.*, 2001). The use of protected nurseries, organic substrates and controlled irrigation are common practices that improve the quality of seedlings and increase crop productivity. It is considered about 60% of the success of a culture when it is implanted with quality seedlings (Minami *et al.*, 1994).

Among the many types of substrates that may be used in the production of passion fruit seedlings, we have rice husk (Nicoloso *et al.*, 2000; Saidelles *et al.*, 2009), green coconut fibre (Dias *et al.*, 2009; Lacerda *et al.*, 2006), humus (Diniz *et al.* 2006), among others. We have the fibre of the açáí seed as a highlight in the present work. Therefore, it is a sustainable and versatile material that presents excellent physical properties, such as good water retention capacity and good porosity, factors that make it ideal for soil enrichment (Campanharo *et al.*, 2006). In addition, its use reduces the environmental impact generated by the improper disposal of waste from the acai agroindustry. The açáí residue substrate is a natural product, which is processed from the core generated in the extraction of the açáí pulp, and can be used in mixtures for soil enrichment, contributing to close the açáí life cycle with practically no waste (IBEAS, 2019).

According to Reis *et al.* (2002), due to the enormous consumption of the fruit, many researches have been done on the pulp, however, there is little research in relation to the fibrous residue that is concentrated around the core after pulp extraction. Acai fibre, being an abundant byproduct of agribusiness, presents physical and chemical characteristics that can positively influence plant growth. When evaluating these variations, we seek not only to identify the best combinations for the development of seedlings, but also to contribute to more sustainable agricultural practices, promoting the use of natural waste and reducing costs with chemical fertilisation (Leal *et al.*, 2016).

Therefore, the objective of this study was to evaluate the initial development of passion fruit seedlings in different types of treatments with acai fibre, to determine the best composition of the substrate.



2 METHODOLOGY

The experiment was conducted during a period of 2 months in an experimental area located at the State University of Tocantina do Maranhão Region, at the Centre for Agricultural Sciences, Av. Agrária, 100 - Res. Hill Park, Empress - MA, 65900-001. The climate is tropical, being classified as AW according to Köppen and Geiger, and has an average annual temperature of 27.1 °C.

The experimental design was completely randomised, consisting of five treatments T0 (100% soil), T1 (25% açai fibre + 75% soil), T2 (50% açai fibre + 50% soil), T3 (75% açai fibre + 25% soil) and T4 (90% açai fibre + 10% soil), being used 6 replicates, totalling thirty experimental units.

The açai fibre substrate was acquired from a rural producer in the municipality of Amarante do Maranhão. It was produced from the açai seeds, obtained after the pulp was extracted. The process included cleaning and grinding the stone in a forage, followed by sun drying.

Sowing was carried out in polythene bags with a capacity of 1.5 dm³ of substrate, using passion fruit seeds of the cultivar Catarina, three seeds were placed per bag, at a depth of 2 cm. For the preparation of the proportions of the substrate with the soil, a measuring cup, a bucket and a shovel were used. Irrigation was performed manually, twice a day, in the morning and in the afternoon. The seedlings were randomly distributed in the area so that there was no interference from the environment.

After 20 days of planting, when the seedlings had four leaves developed, thinning was carried out and the next day the evaluations began. The data related to the growth variables were collected weekly throughout the vegetative stage, totalling four evaluations carried out up to 42 days after planting. The height of the plants was measured using a measuring tape graduated in centimetres, considering the distance between the base of the stem and the end of the terminal shoot of the main branch. The stem diameter was evaluated in millimetres, using a calliper, with the measurement performed at 2 cm above the base of the stem. In addition, the number of leaves present at the time of each observation was counted.

On the 42nd day after planting, the seedlings were harvested. After harvesting, the plants were cleaned in running water, and later the samples were separated into roots and shoots with the aid of a knife to make the cuts. Soon after, the fresh mass was weighed, two different scales were used to speed up the process, but the accuracy of the two scales was the same as 0.00001g. To determine the dry mass, the samples were submitted to an oven with forced air circulation



at 60 °C for 72 hours. After the drying period, the dry mass was weighed. As observed in the comparisons of fresh and dry mass, in the figures below.

3 RESULTSS AND DISCUSSION

According to Table 1, none of the treatments indicated significant results in any of the four analyses of height, but treatments T1 and T2 showed the highest averages in the final analyses 18.5 and 19.2, which indicates that these treatments may be effective for growth in the height parameter. The control (T0), in turn, presents lower height in all collections.

For Stüpp *et al.* (2015), shoot height provides a good estimate of the initial growth of seedlings in the field, and can be accepted as a good measure of the performance potential. Evidencing the benefits of the acai substrate seen in Table 1. Many studies are achieving good results with the use of other types of waste-based substrates, such as chicken manure combined with dry coconut shell powder (Nunes *et al.*, 2012), sugarcane agroindustry residues (Serrano *et al.*, 2006) and carbonised rice husk (Maia, 2020), among others. This reaffirms the importance of organic substrates for various plants, as well as ensuring sustainability.

According to Maranhão *et al.* (2012), in their work relating varied percentages of organic açaí residue in the production of Pau-de-Rosas seedlings (*Physocalymma scaberrimum*), it was observed that the substrate 100% açaí residue showed the highest average growth in seedling height, resembling only the substrate 50% açaí residue. The control provided the lowest average growth in height of the seedlings. Proving that the plants whose there is the presence of the açaí substrate end up developing more than those that have only the soil, especially when they have more than 50% of açaí fibre.

Table 1

Height of seedlings of Passiflora edulis. with different proportions of açaí fibre in the four periods of collection.

Treatments	Time periods for collecting height data			
	1st Analysis	2nd Analysis	3rd Analysis	4th Analysis
T0	8.17 to	10.6 to	13.8 to	15.7 a
T1	10.17 a	13.9 to	16.3 to	18.5 to
T2	10.42 to	13.7 to	16.5 to	19.2 to
T3	9.67 to	12.2 to	15.6 to	17.8 to
T4	10.50 to	13.0 to	15.0 to	18.1 to
VC%	17.85	15.72	18.67	16.13

*Averages accompanied by the same letter do not differ from each other by Tukey's test at 5% probability.



Table 2 shows that T2 showed a significant increase in the diameter of the collar in the fourth analysis in relation to the other treatments. Since the treatment T0 (control) again has the lowest averages in all analyses. These values are consistent with those found by Silva *et al.* (2017) and Nogueira *et al.* (2020), in which they also obtained an increase in the diameter of the collection of açaí seedlings when grown on organic substrate.

Some studies show that the diameter thickness of seedlings ready to be transplanted should be one of the main characteristics to be analysed, as this influences the performance after planting (Cargnelutti *et al.*, 2012). For Ribeiro *et al.*, (2018) the diameter of the neck is related to the development of the aerial part together with the root system, which helps the survival and development of the seedling to be taken to the field. According to Cesarin *et al.*, (2020) the larger the diameter of the seedling, the better the chances of survival after transplantation. That is, seedlings that have a larger diameter have a higher level of resistance, mainly due to the capacity of formation and growth of the roots (Araújo *et al.*, 2011). Therefore, considering the diameter thickness as a standard for better development, it is possible to select the T2 seedlings.

Table 2

Diameter of seedlings of Passiflora edulis. with different proportions of açaí fibre in the four periods of collection.

Treatments	Periods of data collection regarding the diameter of the collection			
	1st Analysis	2nd Analysis	3rd Analysis	4th Analysis
T0	2.67 to	3.17 to	3.47 to	3.92 b
T1	3.08 to	3.33 to	3.33 to	3.92 b
T2	3.08 to	3.58 to	3.75 to	4.58 to
T3	3.00 to	3.58 to	3.67 to	4.25 AB
T4	3.10 to	3.60 to	3.60 to	3.92 b
VC%	11.5	9.66	9.01	9.36

*Averages accompanied by the same letter do not differ from each other by Tukey's test at 5% probability.

Regarding the number of leaves indicated in Table 3, we can note that, in the first analysis, T2 and T4 differ significantly from the control with means 6.83 and 7.00 respectively. In the other 3 analyses, the results are similar for all treatments, but they have higher averages.

According to Pinto *et al.* (2007), the variables shoot height, stem diameter and number of leaves are responsible for being plant characteristics that most determine its vigour. As shown in table 3, the higher the proportion of the açaí fibre substrate, the greater the number of leaves.

**Table 3**

Number of leaves of seedlings of Passiflora edulis. with different proportions of açai fibre in the four periods of collection.

Treatments	Periods of data collection for leaf numbers			
	1st Analysis	2nd Analysis	3rd Analysis	4th Analysis
T0	5.67 b	7.67 to	8.67 to	9.5 to
T1	6.00 ab	7.83 to	9.33 to	10.3 to
T2	6.83 to	8.33 to	9.17 to	11.0 to
T3	6.50 ab	8.67 to	9.50 to	10.5 to
T4	7.00 to	8.50 to	9.17 to	11.2 to
VC%	9.72	8.57	8.11	10.63

*Averages accompanied by the same letter do not differ from each other by Tukey's test at 5% probability.

Table 4 shows the values of fresh and dry mass, both of the aerial part and of the root system. In relation to fresh and dry shoot mass, T2 stood out significantly from the control and T1, with averages of 6.19 and 1.23, respectively. However, in the variable related to fresh mass (4.43) and dry mass (1.32) of the root system, T4 obtained the best indexes, in relation to the others, mainly in comparison with the control that obtained averages of only 0.5 and 0.11 respectively, evidencing a better development of the roots in this treatment.

Table 4

Fresh mass and dry mass of Passiflora edulis. with different proportions of açai fibre

Treatments	Fresh mass and dry mass of treatments			
	MFPA	MFR	MSPA	MSR
T0	4.02 b	0.503 c	0.788 b	0.113 d
T1	4.03 b	0.573 c	0.775 b	0.168 CD
T2	6.19 to	2,302 b	1,233 to	0.530 bc
T3	5.11 AB	2,870b	1,038 ab	0.833 b
T4	5.41 AB	4,432 to	1,060 ab	1,320 to
VC%	20.39	38.70	21.71	36.99

*Averages accompanied by the same letter do not differ from each other by Tukey's test at 5% probability.

Pinto et al. (2021) states that substrates improve quality and reduce seedling production costs. Acai seed fibre is a sustainable and versatile material that presents excellent physical properties, such as good water retention capacity and good porosity, which ends up making the soil fertile and enriched. This is because the acai fibre is much lighter and aerated, providing the stability of the clod and facilitating the removal of the bag, thus favouring the root system.



4 CONCLUSION

The use of açaí seed fibre is an efficient and sustainable practice for the production of passion fruit seedlings. The treatment T2 (50% acai fibre + 50% soil) proved to be the most promising, offering a balance between soil and acai fibre, since it presented higher height, stem diameter, MFPA and MSPA. The treatment T4 (90% açaí fibre + 10% soil) also showed significant results, as the best indexes in the MFR and MSR variables. The control, in turn, showed the lowest means of values in all variables and analyses. Therefore, these two proportions are indicated for the production of passion fruit seedlings, and 90% açaí fibre + 10% soil gives more lightness to the substrate, facilitating transport to the planting area and facilitating the removal of the bag without damaging the root system.

REFERENCES

- Araújo, A. P. et al.. Germinação e produção de mudas de tamboril (*Enterolobium Contortisiliquum* (Vell.) Morong) em diferentes substratos. *Revista Árvore*, 35, 2011.
- Caldas, A. S et al. Análise do comportamento e distribuição geográfica da fruticultura no estado do Maranhão. *Open Science Research VII*, p. 46-60, 2022.
- Campanharo, M. et al. Características físicas de diferentes substratos para produção de mudas de tomateiro. *Revista Caatinga*, v. 19, p. 140-145, 2006.
- Cargnelutti Filho, A. et al. Dimensionamento amostral para avaliação de altura e diâmetro de mudas de *Cabralea canjerana*. *Ciência Rural*, 42 (7), 1204-1211, 2012.
- Cesarin, V. et al. Produção de mudas de açaizeiro. *Revista Agronomia Brasileira*, 4, 1-7, 2020.
- Costa, E.; Santos, L. C. R. D.; Carvalho, C. D.; Leal, P. A. M., & Gomes, V. D. A. Volumes de substratos comerciais, solo e composto orgânico afetando a formação de mudas de maracujazeiro-amarelo em diferentes ambientes de cultivo. *Revista Ceres*, 58, 216-222, 2011.
- Corbet, S. A.& Willmer, P. G. Pollination of the yellow passionfruit: nectar, pollen and carpenter bees. *Journal of Agricultural Science. Cambridge*, v. 95, p. 655-666, 1980.
- Dias, T. J.; Pereira, W. E.; Cavalcante, L. F.; Raposo, R. W. C.; Freire, J. L. de O. Desenvolvimento e qualidade nutricional de mudas de mangabeiras cultivadas em substratos contendo fibra de coco e adubação fosfatada. *Revista Brasileira de Fruticultura*, Jaboticabal, v. 31, p. 512 - 523, 2009.
- Diniz, P. O.; Oliveira, P. L. de S.; Sousa, G. O.; Rodrigues, E. N. da S.; Sousa, F. de A. R. M. Efeitos de diferentes proporções de esterco bovino no desenvolvimento do girassol. *Diversitas Journal*, Santana do Ipanema/AL, v. 5, n. 4, p. 2464-2472, out./dez. 2020.



- Diniz, K. A., S. T. M. R. Guimarães, & J. M. Q. Luz. Húmus como substrato para a produção de mudas de tomate, pimentão e alface. Bioscience Journal. 22: 63–70, 2006.
- EMBRAPA. Espécies de maracujazeiro uma riqueza do Brasil. 2022. Disponível em: <https://www.sidalc.net/search/Record/dig-infoteca-e-doc1174017/Description>. Acesso em: 28 out. 2024.
- E Ruggiero, C. et al. Maracujá para exportação: aspectos técnicos da produção. Brasília: EMBRAPA, SPI, 1996. 64p. Publicações técnicas FRUPEX, v. 19, 2003.
- Rlacher, W. A. et al. Uso de caroço de açaí triturado fermentado, para a formulação de substratos para produção de mudas de quiabo e tomate. Revista Brasileira de Agropecuária Sustentável, 2014.
- Elacher, W. et al. Caroço de açaí triturado fresco na formulação de substrato para a produção de mudas de hortaliças brássicas. Enciclopédia Biosfera, v. 10, 2014.
- Fernandes, D.A.; Araujo, M.M.V.A.; Camili, E.C. Crescimento de plântulas de maracujazeiro-amarelo sob diferentes lâminas de irrigação e uso de hidrogel. Revista de Agricultura, v. 90, p.229-236, 2015.
- INSTITUTO DE PLANEJAMENTO E ECONOMIA AGRÍCOLA DE SANTA CATARINA. Maracujá. Florianópolis. 69p. (Estudo de Economia e Mercado de Produtos Agrícolas, 5) 1998.
- IBEAS – Instituto Brasileiro de Estudos Ambientais. Aproveitamento do resíduo do caroço de açaí: estudo sobre destinação e viabilidade de utilização. Anais do VIII Congresso Brasileiro de Gestão Ambiental, Campo Grande/MS, 27-30 nov. 2017. Acesso em: <https://www.ibeas.org.br/congresso/Trabalhos2017/XI-050.pdf> 2 nov. 2024.
- INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA (IBGE), 2021. Produção de Maracujá. Acesso em: Produção de Maracujá no Brasil | IBGE 10 nov. 2024.
- Lacerda, M. R. B. L.; Passos, M. A. A.; Rodrigues, J. J. V.; Barreto, L. P. Características físicas e químicas de substratos à base de pó de coco e resíduo de sisal para produção de mudas de sabiá (*Mimosa caesalpinhiifolia* Benth). Revista Árvore, Viçosa, v. 30, p. 163 - 170, 2006.
- Leal, C.C.P.; Torres, S.B.; Brito, A.A.F.D.; Freitas, R.M.O.D. & Nogueira, N.W. – Emergência e desenvolvimento inicial de plântulas de *Cassia grandis* L. f. em função de diferentes substratos. Ciência Florestal, vol.26, p. 727-734, 2016.
- Leonel, S.; Pedroso, C.J. Produção de mudas de maracujazeiro doce com uso de biorregulador. Revista Brasileira de Fruticultura, v. 27, p.107-109, 2005.
- Maia, Antonio Alfredo. Desenvolvimento de substrato formulado com composto orgânico e casca de arroz para a produção de mudas de hortaliças. 44 f, 2020.
- Maranhão, Á. S.; Paiva, AV de. Produção de mudas de *Physocalymma scaberrimum* em substratos compostos por diferentes porcentagens de resíduo orgânico de açaí. Floresta, v. 42, p. 399-408, 2012.



- Meletti, L. M. M.; Cavichioli, J. C.; Pacheco, C. A. Cultivares e produção de mudas. Informe Agropecuário, v.33, p.35-42, 2012.
- Mexal, J. L.; Landis, T. D. Target seedling concepts: height and diameter. In: TARGET SEEDLING SYMPOSIUM, COMBINED MEETING OF THE WESTERN FOREST NURSERY ASSOCIATIONS. 1990, Roseburg. Proceedings... Fort. Collins: USDA, Forest Service, p. 17 – 35, 1990.
- Minami, K.; Tessarioli Neto, J.; Penteado, S. R. & Escarpari Filho, J. A. Produção de mudas hortícolas de alta qualidade. Piracicaba: ESALQ/SEBRAE, 155p, 1994.
- Nicoloso, F. T.; Fortunato, R. P.; Zanchetti, F.; Cassol, L. F.; Eisinger, S. M. Recipientes e substratos na produção de mudas de Maytenus ilicifolia e Apuleia leiocarpa. Ciência Rural, Santa Maria, v. 30, p. 987 - 992, 2000.
- Nogueira, R. S. et al. Diferentes fontes e produção de adubo orgânico na produção de mudas de açaí-solteiro (pp. 65-70). Anais do Seminário da Embrapa Acre de Iniciação Científica e Pós-Graduação, 2019, Contribuição da ciência para a agropecuária no Acre. Rio Branco, AC, Brasil, 2, 2020.
- Nunes MUC; Oliveira HJC; Lima IS; Jesus AF; Santos LS. Efeito de substratos formulados com resíduos agroindustriais no desenvolvimento de mudas de tomateiro. Horticultura Brasileira. 30: S5620-S5626, 2012.
- Pasqual, M.; Chalfun, N. N. J.; Ramos, J. D. et al. Fruticultura comercial: Propagação de plantas frutíferas. Lavras: UFLA/FAEPE, 137p, 2001.
- Pinto, V. V. F.; Bueno, M. M.; Antunes, L. F. S.; ALONSO, J. M.; ABAURRE, G. W. Crescimento de mudas de Poincianella pluviosa em diferentes substratos e lâminas de irrigação. Madera y bosques, v.27, e2712173, 2021.
- Pinto, J.L.B.; Tavares, J.C.; Almeida Neto, A.J.; Freitas, R.S.; Rodrigues, G.S.O. Efeito de diferentes substratos na produção de mudas de goiabeira. Revista Verde de Agroecologia e Desenvolvimento Sustentável, v.2, p.127-134, 2007.
- Reis, J. M. R; Rodrigues, J. F.; Reis, M. de A. Produção de mudas de maracujazeiro amarelo com diferentes substratos. Enciclopédia Biosfera, Centro Científico Conhecer, Goiânia, v. 10, p. 2423-2427, 2014, 2024.
- Ribeiro, M. C. C., Moraes, M. D., Sousa, A. D., Linhares, P. C. F., & Barros Junior, A. P. Produção de mudas de maracujá-amarelo com diferentes substratos e recipientes. Caatinga, Mossoró, 18(3), 155-158, 2005.
- Saidelles, F. L. F. et al. Casca de arroz carbonizada como substrato para produção de mudas de tamboril-da-mata e garapeira. Seminário: Ciências Agrárias, v. 30, Sup1, p. 1173-1186, 2009.
- Serrano, L. A. L. et al. Utilização de substrato composto por resíduos da agroindústria canavieira para produção de mudas de maracujazeiro-amarelo. Revista Brasileira de Fruticultura, v. 28, p. 487-491, 2006.



- Silva, R. P. da; Peixoto, J. R.; Junqueira, N. T. V. Influência de diversos substratos no desenvolvimento de mudas de maracujazeiro azedo (*Passiflora edulis* Sims f. *flavicarpa* DEG). *Revista Brasileira de Fruticultura*, v.23, p.377-381, 2001.
- Silva, A. C. D. et al. Tamanho da semente e substratos na produção de mudas de açaí. *Advances in Forestry Science*, 4 (4), 151-156, 2017.
- Stüpp, A. M. et al. Crescimento de mudas de *Mimosa scabrella* Benth em função de diferentes tamanhos de recipientes e doses de fertilizante. *Ecologia e Nutrição Florestal*, v. 3, n. 2, p. 40-47, 2015.