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Different substrates for seedling production of *Euterpe oleracea* Mart.

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Key words: alternative substrates, morphological characteristics, seedling production.

Abstract: The aim of this study was to evaluate the effect of substrates involving different combinations of soil, cattle manure, burnt rice husks, sand and commercial substrate on growth in the açai palm (*Euterpe oleracea* Mart.) under nursery conditions in the State of Roraima. The experiment was conducted in the Fruit-Farming Sector of Embrapa Roraima, located in the district of Boa Vista. The experimental design was completely randomised, with nine treatments and four replications of five plants per replication. The treatments were T1: sand, T2: commercial substrate (OrganoAmazon©), T3: 25% T1 + 75% manure, T4: 50% T1 + 50% manure, T5: 75% T1 + 25% manure, T6: 25% T1 + 75% burnt rice husks, T7: 50% T1 + 50% burnt rice husks, T8: 75% T1 + 25% burnt rice husks and T9: 25% soil + 25% sand + 25% manure + 25% burnt rice husks. The morphological characteristics plant height (H), stem diameter (SD) and number of leaves (NF) were evaluated every 30 days from transplanting to the end of the experiment (210 days). The root dry weight (RDW), shoot dry weight (SDW), total dry weight (TDW) and the Dickson quality index (DQI) were obtained at 210 days. The substrates composed of 50% sand + 50% manure and 25% soil + 25% sand + 25% manure + 25% burnt rice husks are indicated for the production of seedlings of *Euterpe oleracea* Mart., as they provide superior growth in plant height and stem diameter, and improve total dry-weight production in the plants.

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1. Introduction

The species *Euterpe oleracea* Mart., known throughout the world as açaí, is a palm tree, native to the Brazilian Amazon, belonging to the Arecaceae family (Oliveira *et al.,* 2019). It has recently been the target of several studies, as it is a functional food rich in proteins, fibre, lipids, vitamins and minerals, and has antioxidant properties, making it an indispensable part of the most varied diets and recommended to those who practise physical exercise and enthusiasts of healthy living (Kang *et al.,* 2010; Oliveira *et al.,* 2019). According to Honorio *et al*. (2017), the açai palm is considered a species with multiple uses, however, its economic potential is mainly related to marketing the fruit and stems, the origin of the palm heart. Since Brazil is the largest producer, consumer and exporter of these products, large-scale cultivation is attractive to both industry and rural producers, who can obtain a varied income from the products and by-products throughout the year (Monteiro *et al.,* 2019).

Considering the health benefits as well as the high added value of the products of this species, studies that contribute with information concerning cultivation are extremely relevant, especially as the açai palm occurs naturally in such areas as low-lying plains and flooded woodlands that have unique climate conditions which can compromise the initial planting stage of the crop if quality seedlings are not used (Neves *et al.,* 2019). Both the planting and maintenance of homogeneous plantations of the açai palm therefore require the acquisition of vigorous seedlings to guarantee a return on investment and success in establishing the plantation; for this, it is necessary to improve the techniques for producing açai seedlings of a high commercial standard (Silva *et al*., 2017).

The production of quality seedlings depends on various factors such as the composition of the substrate, which has the role of supporting the plants and providing suitable chemical and physicals conditions for the initial development of the roots and shoots (Bilderback *et al*., 2005). Normally, the large-scale production of seedlings makes use of commercial substrates; however, besides the high cost of acquiring the substrate, the great majority contain only small concentrations of nutrients and require the use of fertilisers, a factor that increases the costs of the activity (Olle *et al.,* 2012).

As an alternative, several authors propose the use of substrates consisting of agricultural by-products that can be used mixed with commercial substrate or other products, for example, rice husks, charcoal, coffee chaff and animal manure, as well as by-products from agroindustry, which vary according to the region (Rinaldi *et al.,* 2017).

According to Olle *et al*. (2012), the choice of substrate, in addition to considering the cost of acquisition and availability for seedling production, should be based on technical and scientific results that show the material is able to promote high rates of initial plant growth and survival after planting; this will reduce the costs of establishing the crop, making it possible to expand and/or set up new plantations. There are several materials that can be used as substrates for the production of seedlings of forest species, either alone or in combination, such as sand, soil, expanded clay, vermiculite, sawdust, rice husk, pine bark, bark fiber among others (Olle *et al.,* 2012). According to Silva *et al*. (2018) when compared to exclusive use, the combination of different materials may result in satisfactory results, especially regarding the maximization of seedling growth, a fact possibly related to the combination of factors that favorfavorable conditions for availability, absorption, translocation, and nutrient use by plants.

Based on the above, the aim of this study was to evaluate the effect of substrates involving different combinations of soil, cattle manure, burnt rice husks, sand and commercial substrate on growth in the açai palm (*Euterpe oleracea* Mart.) under nursery conditions in the State of Roraima.

2. Materials and Methods

The experiment was conducted in the Fruit-Farming Sector of Embrapa Roraima (at 2°23'45.31" N and 60°58'44.34" W), located in the district of Boa Vista in the State of Roraima. Mature fruit of the açai were harvested in the town of Anori, in Amazonas, and taken to the seed laboratory of Embrapa Roraima for the experiment.

The fruit was first pulped with the help of a pulp processor for mechanical extraction of the seeds, which were then washed in running water until the residue was completely eliminated, and kept at room temperature. The propagating material was later sown in a bed containing washed sand as a substrate for germination and initial development of the seedlings. Substrate moisture was maintained by manual irrigationwith distilled water, four times a day.

The process of seedling emergence began around 30 days after sowing. Once the seedlings had reached a height of approximately 2.0 cm, they were transplanted into polyethylene bags (17 x 22 cm) containing different combinations of commercial substrate, soil, cattle manure, burnt rice husks and sand according to the predetermined treatments. The plants were then housed in a nursery under 50% shading, and irrigated by sprinkler for five minutes, three times a day.

The experimental design was completely randomised (CRD), with nine treatments, four replications and five plants per replication, for a total of 180 plants. The treatments were T1: sand, T2: commercial substrate (OrganoAmazon©), T3: 25% T1 + 75%

manure, T4: 50% T1 + 50% manure, T5: 75% T1 + 25% manure, T6: 25% T1 + 75% burnt rice husks, T7: 50% T1 + 50% burnt rice husks, T8: 75% T1 + 25% burnt rice husks and T9: 25% soil + 25% sand + 25% manure + 25% burnt rice husks. According to Silva *et al*. (2009), a composite sample of substrate for each treatments was collected, air-dried and sieved through a 2.0 mm mesh, for chemical characterization, whose results are presented in Table 1.

The morphological characteristics of plant height (H), stem diameter (SD) and number of leaves (NL) were evaluated every 30 days from transplanting to the end of the experiment. Plant height was measured with a ruler graduated in centimetres (cm), and considered the height of the plant from the surface of the soil to the apex of the plant. The stem diameter was measured with the aid of a digital calliper in millimetres (mm), 1 cm above the surface of the substrate. At the end of the experiment (210 days after transplanting), the following plant characteristics were evaluated: shoot dry weight (SDW), root system dry weight (RDW) and total dry weight (TDW). For this, the plants were removed from the polyethylene bags, the roots were separated from the substrate by washing under running water and the shoots then separated from the root system. To obtain the dry weight, the two materials were placed in a forced air circulation oven at ±70°C to constant weight. The Dickson Quality Index (DQI) was then determined (Dickson *et al*., 1960). The data were submitted to analysis of variance (ANOVA) and the mean values of the treatments compared by Tukey's test at 5% probability with the aid of the SISVAR software.

3. Results and Discussion

The analysis of variance revealed significant differences between the plants submitted to the different combinations of substrates for all the morphological characteristics under evaluation (Table 2), demonstrating that the different combinations can have a direct influence on the growth characteristics of plants of the açai palm (*Euterpe oleracea* Mart.) under nursery conditions.

It can be seen from the result of the mean-value comparison test that the plants grown in T4, comprising 50% sand + 50% cattle manure, obtained on average greater or statistically equal values for all the morphological characteristics under evaluation. A similar result, except for the variable SD that was slightly lower, was obtained for the plants submitted to T9, a substrate consisting of a mixture of 25% soil + 25% sand + 25% manure + 25% burnt rice husks.

Among the components in the treatments (T4 and T9) that resulted in better results for all the morphological characteristics under evaluation, cattle manure and sand should be highlighted. These results reinforce those obtained in an experiment by Menezes and Oliveira (2009) with the organic production of açai seedlings; the authors determined that the greatest growth in seedling height was obtained in the substrate containing cattle manure.

Honorio *et al*. (2017), carrying out the test for germination and emergence in seeds of the açaí in alternative substrates, suggested a combination of cattle manure + sand (1:1) as the most efficient in promoting the variables of physiological seed quality. Araujo

Table 1 - Chemical composition of the different combinations of soil, cattle manure, rice husks, and commercial substrate using açaí seedlings (*Euterpe oleracea* Mart.) growing seedlings, under nursery conditions

Treatments	H potential	OM dag/kg	K mg/dm³	P mg/dm³	Ca cmol/dm³	Mg cmol/dm³	Al cmol/dm³	H+Al cmol/dm³	Zn mg/dm³	Fe mg/dm³	Mn mg/dm³	Cu mg/dm³	B mg/dm³	S mg/dm³
T1 *	6.7	2.6	108.0	145.0	10.4	0.5	0.0	1.0	26.7	40.4	139.0	1.1	0.6	18.8
T2	5.7	10.0	312.0	263.9	13.8	7.4	0.0	1.9	26.9	62.3	160.2	0.6	0.7	49.1
T3	5.8	6.2	112.0	314.9	10.2	5.0	0.0	1.7	24.4	13.5	90.9	0.6	0.8	50.7
T4	6.5	4.0	92.0	218.2	10.0	2.9	0.0	1.3	23.5	20.3	107.0	0.8	0.8	34.9
T5	6.2	3.8	92.0	151.2	9.9	1.6	0.0	1.2	24.3	27.9	111.2	1.0	0.7	25.9
T6	6.1	4.9	106.0	71.7	12.2	1.4	0.0	1.9	16.5	13.5	88.6	0.3	0.5	17.2
T7	6.6	4.3	120.0	93.0	11.0	0.9	0.0	1.1	20.8	18.0	127.3	0.6	0.6	17.7
T8	6.7	3.7	122.0	132.9	11.0	0.7	0.0	1.1	23.3	33.5	132.3	0.8	0.4	19.4
T9	6.4	4.1	120.0	170.2	9.9	1.8	0.0	1.2	23.1	15.1	100.5	0.7	0.6	28.1

* T1= sand, T2= commercial substrate (OrganoAmazon©), T3= 25% T1 + 75% manure, T4= 50% T1 + 50% manure, T5= 75% T1 + 25% manure, T6= 25% T1 + 75% burnt rice husks, T7= 50% T1 + 50% burnt rice husks, T8= 75% T1 + 25% burnt rice husks, T9= 25% soil + 25% sand + 25% manure + 25% burnt rice husks.

Table 2 - Mean values for plant height, stem diameter, number of leaves, root dry weight, shoot dry weight, total dry weight and Dickson Quality Index, in açaí seedlings (*Euterpe oleracea* Mart.) grown in different combinations of substrates under nursery

Substrate	Plant height (cm)	Stem diameter (mm)	Number of leaves	Root dry weight (g plant^{-1})	Shoot dry weight (g plant^{-1})	Total dry weight (g plant^{-1})	Dickson quality index
T1	8.50 e *	3.77 f	3 e	2.14 c	2.39 c	4.53 c	1.34 c
T2	16.47 bc	6.80 c	5 b	6.67 bc	2.09 c	8.76 bc	1.56 c
T3	17.43 b	6.18 d	4 c	25.99 a	20.90 a	46.89 a	12.94 a
T4	24.19 a	8.21 a	5 a	28.62 a	13.76 ab	42.38 a	12.37 a
T5	15.35 c	5.77 d	4 c	10.24 b	9.39 bc	19.63 b	5.49 b
T6	11.47 d	5.00 e	4 d	5.05 bc	4.46 c	9.50 bc	2.99 c
T7	9.71 de	3.88 f	3 e	3.50 c	2.82 c	6.32 bc	1.91 c
T8	11.02 d	3.93 f	3 e	4.37 bc	3.17 c	7.54 bc	2.14 c
T9	24.16 a	7.57 b	5 a	29.00 a	21.26 a	50.26 a	12.81 a
Mean	15.37	5.68	4.00	12.84	8.91	21.76	5.95
CV %	22.01	16.06	14.76	24.16	29.91	31.38	27.10

* Mean values followed by the same lowercase letter in a column do not differ at 5% probability by Tukey's test. T1= sand, T2= commercial substrate (OrganoAmazon©), T3= 25% T1 + 75% manure, T4= 50% T1 + 50% manure, T5= 75% T1 + 25% manure, T6= 25% T1 + 75% burnt rice husks, T7= 50% T1 + 50% burnt rice husks, T8= 75% T1 + 25% burnt rice husks, T9= 25% soil + 25% sand + 25% manure + 25% burnt rice husks.

et al. (2019) describes how cattle manure is a basic substrate for obtaining vigorous seedlings, since its main function is to improve water retention, in addition to supplying macro and micronutrients and increasing their availability to the plants, resulting in improvements in seedling performance.

According to Olle *et al*. (2012), another basic component to be used in small proportions when combining substrates for plants is sand, as it provides the ideal conditions for aerating the substrate and gives good drainage. Furthermore, promoting the use of this material is based on its low cost and easy availability in some regions.

The superior results obtained for RDW, SDW, TDW and DQI in the plants submitted to T3, composed of 25% sand + 75% cattle manure, should also be pointed out. According to Menegatti *et al.* (2019), the DQI is a good indicator of plant quality, since robustness and the balance of biomass distribution in the plants are considered in its calculation and it includes several parameters which are regarded as important; the higher its value, the better the quality standard of the seedling.

However, since the performance of the plants in T3, despite an expressive DQI, was poor for the other characteristics under analysis (H and SD), and considering their importance in evaluating seedling quality, this shows the need for combining characteristics to obtain a better evaluation.

Conversely, plants submitted to treatment T1, comprising 100% sand, displayed inferior values for all the morphological characteristics under evaluation. As mentioned above, sand is a conditioner to be used in small proportions in the composition of a substrate, as it is practically an inert material and not associated with any nutrients that can be made available to the plant. In addition, sand shows high drainage potential, which may reduce water availability to the plant, making it impossible to maintain all the physiological processes essential to growth.

Furthermore, according to Smiderle *et al*. (2015), high-density materials such as sand, when used alone or in large proportions within a mixture, are unsuitable due to their excessive weight, which makes it difficult to handle the plants in their containers and to trade or transport them to their final planting site.

Similar to the results obtained for the plants submitted to the substrate of 100% sand, the T7 substrate, comprising a mixture of 50% sand + 50% burnt rice husks also resulted in poor plant performance for the morphological characteristics under evaluation. According to Smiderle *et al*. (2015), caution is needed when using combinations of burnt rice husks and sand in the composition of plant substrates, since both materials allow high water drainage and may result in water deficiency in the plants, which would compromise the processes of photosynthesis and respiration and consequently the maintenance of cellular elongation, resulting in smaller plant growth (Souza *et al*., 2020).

As a result of the water deficit and the reduction in photosynthetic rates, the plants accumulate a smaller amount of biomass, thereby showing a reduction in total dry mass - the behaviour shown by the plants in T1 and T7 (4.53 and 6.32 g plant^{-1} respectively). The plants grown in these two substrates had a total dry mass of less than around 6.5 times the dry mass found in the plants from the treatments considered superior, T9 and T4 (50.26 and 42.38 g plant^{-1} respectively).

The total dry weight is the sum of SDW and RDW; the higher this value, the better the quality of the produced seedlings (Adamipour *et al*., 2019). According to Chiomento *et al*. (2019), the total dry weight indicates the hardiness of a seedling, with the highest values representing more lignified and hardier seedlings, which may take hold faster under field conditions soon after planting.

It should be emphasized that the satisfactory morphological characteristics showed by plants grown in the commercial substrate (OrganoAmazon©) (T2) can be related to the chemical composition of the substrate, which showed higher levels than the other treatments for the macro and micronutrients, including organic matter (OM), which when decomposed tends to release nutrients, especially nitrogen, and other mineral elements such as phosphorus, magnesium, calcium, sulphur (Aalipour *et al*., 2019). However, it is also assumed that this substrate did not result in plants with superior morphological characteristics to the other plants due to the pH of the substrate, which was less than 6.

According to Aalipour *et al*. (2019), soils with a pH below 6 tend to reduce the availability of some nutrients, compromising the absorption and supply of the required amount of each element to enhance some of the physiological processes that culminate in growth.

The growth in plant height and stem diameter of the plants cultivated in different combinations of substrates throughout the period of the experiment can be seen in figure 1 and 2, respectively. All the curves, irrespective of the morphological characteristic under evaluation, show a linear trend, but the plants in T4 and T9 showed faster growth when compared to the plants of the other treatments being tested, achieving greater values for these variables by the end of the experiment (Table 3).

Chiomento *et al.* (2019), among the morphological characteristics under evaluation, the stem diameter is the most indicated for evaluating the survival capacity of the seedling in the field, due to a greater capacity for the formation and growth of new roots. According to Nascimento *et al*. (2019), the substrate that provides the seedlings with a balance between stem diameter growth and height, also provides greater robustness and more resistance to the adverse conditions found in the field, resulting in a higher survival rate and consequently reducing the costs of replanting.

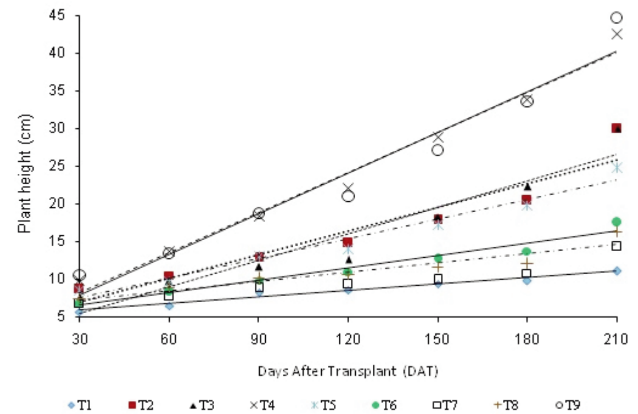

Fig. 1 - Effect of different combinations of substrates on plant height in açai seedlings (*Euterpe oleracea* Mart.) under nursery conditions. T1= sand, T2= commercial substrate (OrganoAmazon©), T3= 25% T1 + 75% manure, T4= 50% T1 + 50% manure, T5= 75% T1 + 25% manure, T6= 25% T1 + 75% burnt rice husks, T7= 50% T1 + 50% burnt rice husks, T8= 75% T1 + 25% burnt rice husks, T9= 25% soil + 25% sand + 25% manure + 25% burnt rice husks (n=4).

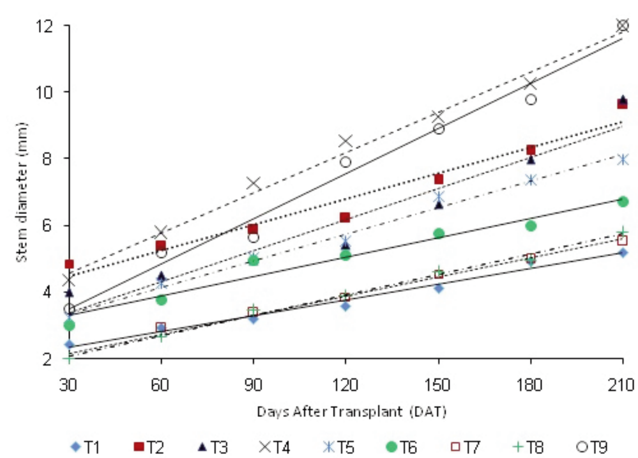

Fig. 2 - Effect of different combinations of substrates on stem diameter in açai seedlings (*Euterpe oleracea* Mart.) under nursery conditions. T1= sand, T2= commercial substrate (OrganoAmazon©), T3= 25% T1 + 75% manure, T4= 50% T1 + 50% manure, T5= 75% T1 + 25% manure, T6= 25% T1 + 75% burnt rice husks, T7= 50% T1 + 50% burnt rice husks, T8= 75% T1 + 25% burnt rice husks, T9= 25% soil + 25% sand + 25% manure + 25% burnt rice husks (n=4).

Table 3 - Mean values for plant height (cm), stem diameter (mm), number of leaves and nivel significative for treatments obtained in açaí seedlings (*Euterpe oleracea* Mart.) grown in different combinations of substrates under nursery conditions

Treatments	Plant heigh (average)	Stem diameter (average)	Number of leaves (average)
T1	8.50 e *	3.77 f	3.24 e
T2	16.47 bc	6.80 c	4.56 b
T3	17.43 b	6.18 d	4.03 c
T4	24.19 a	8.21 a	5.01 a
T5	15.35 c	5.77 d	4.30 bc
T6	11.47 d	5.00 e	3.71 d
T7	9.71 de	3.88 f	3.13 e
T8	11.03 d	3.93 f	3.23 e
T9	24.16 a	7.57 a	4.97 a
DMS	1.78	0.48	0.31
Error	0.40	0.11	0.07
CV %	22.01	16.06	14.76

* Means followed by the same small letter in the column do not differ from one another by the Tukey test (p≤0.05%). T1= sand, T2= commercial substrate (OrganoAmazon©), T3= 25% T1 + 75% manure, T4= 50% T1 + 50% manure, T5= 75% T1 + 25% manure, T6= 25% T1 + 75% burnt rice husks, T7= 50% T1 + 50% burnt rice husks, T8= 75% T1 + 25% burnt rice husks, T9= 25% soil + 25% sand + 25% manure + 25% burnt rice husks.

According to Silva *et al*. (2017), the presence of manure may have improved both the structural characteristics of the soil and the water retention, and may also have acted as a nutrient reservoir, including larger quantities of nitrogen, nutrient which may be indirectly discriminated for variable O.M. (Table 1). For Figueiredo *et al*. (2019), N is an essential element for components of the photosynthetic system, such as the chlorophylls, proteins and enzymes that allow satisfactory rates of carbon assimilation to be maintained (Taiz *et al.*, 2017; Figueiredo e*t al.*, 2019), and thereby guarantee the production of photoassimilates that drive plant growth.

In turn, Cattle manure mixed with soil has been widely used as a substrate for the production of seedlings of various species, as it provides ideal nutritional conditions for plant development, demonstrating that the presence of organic material in the substrate may be decisive in the growth of seedlings in the nursery and better initial start-up in the field (Steffen *et al*., 2010; Silva *et al*., 2017).

Considering further the relationship between the chemical characteristics of the substrate in each treatment and growth over time, it can be seen that treatments T1 and T7, which had lower values for these two morphological characteristics (H and SD), had low levels of organic matter and Mg.

This result can be understood in view of the materials used in the substrate of each treatment. T1, consisting entirely of sand, can be described as a substrate devoid of mineral nutrients; this may have compromised the production of several enzymes, proteins and other compounds which are indispensable to the metabolism of the plant.

Whereas T7, a substrate composed of a mixture of sand and burnt rice husks (1:1), induced higher values for the variables H and SD, these are not statistically superior to obtained for T1 (Table 3 and 4), suggesting that burnt rice husks, being an organic material, may have provided the plants with a certain level of nutrients.

However, according to Smiderle *et al*. (2015), sand and burnt rice husks degrades relatively slowly, which together with the high drainage it exhibits,

Table 4 - Linear equations, R^2 values and significance for the plant heigh, stem diameter and number of leaves of açai seedlings *(Euterpe oleracea* Mart.) grown in different combinations of substrates under nursery conditions

Treatment	Plant heigh		Stem diameter		Number of leaves	
	Equation	R^2 (sign)	Equation	R^2 (sign)	Equation	R^2 (sign)
T1	0.0286x + 5.0629	0.96 **	0.0157x + 1.88	0.97 **	0.0137x + 1.60	0.98 **
T2	0.1055x + 3.805	0.90 **	0.0257x + 3.7129	0.95 **	0.0139x + 2.8857	0.81 **
T3	0.1173x + 1.9929	0.90 **	0.0311x + 2.4486	0.92 **	0.0161x + 2.10	0.93 **
T4	0.177x + 2.95	0.98 **	0.0403x + 3.3686	0.98 **	0.0098x +3.828	0.47 *
T5	0.0869x + 4.921	0.96 **	0.0266x + 2.5514	0.98 **	0.0130x + 2.728	0.51 *
T6	0.0545x + 4.927	0.96 **	0.0195x + 2.7043	0.98 **	0.0121x + 2.257	0.83 **
T7	0.0358x + 5.4	0.89 **	0.0191x + 1.5857	0.98 **	0.0133x + 1.5286	0.99 **
T8	0.0411x + 6.1	0.89 **	0.0205x + 1.4543	0.99 **	0.0121x + 1.7714	0.98 **
T9	0.1799x + 2.571	0.95 **	0.0452x + .1329	0.98 **	0.0100x + 2.771	0.51 *

** significative for P<0.01; * significative for P<0.05. T1= sand, T2= commercial substrate (OrganoAmazon©), T3= 25% T1 + 75% manure, T4= 50% T1 + 50% manure, T5= 75% T1 + 25% manure, T6= 25% T1 + 75% burnt rice husks, T7= 50% T1 + 50% burnt rice husks, T8= 75% T1 + 25% burnt rice husks, T9= 25% soil + 25% sand + 25% manure + 25% burnt rice husks.

may lead to leaching of the available nutrient content, explaining the smaller growth.

It should be noted that the low levels of Mg in treatments T1 and T7 may also have compromised plant growth in these substrates, since Mg is the central atom in the chlorophyll molecule. Substrates with less available Mg therefore tend to a reduced synthesis of this molecule. The reduction in leaf chlorophyll decreases the capacity for light absorption, promoting the fixation of a smaller amount of carbon, which reduces the production of carbohydrates and consequently reduces the energy for maintaining the rate of plant growth (Cartelat *et al*., 2005).

The number of remaining leaves per plant over the experimental period for each substrate under test can be seen in figure 3. The treatments showed different behaviour according to the materials used in the substrate. Treatments T9 and T4 displayed a quadratic trend when adjusting the regression equations, showing that throughout the growing period the number of leaves per plant tend to decrease due to the fall of older leaves.

These results suggest that plants submitted to these treatments (T4, consisting of 50% sand + 50% cattle manure, and T9, a substrate consisting of 25% soil + 25% sand + 25% manure + 25% burnt rice husks) throughout the development period, employ a greater amount of energy for growth in H and RD, instead of increasing the number of leaves.

A reduction in the number of leaves during plant growth can be beneficial, since after transplanting

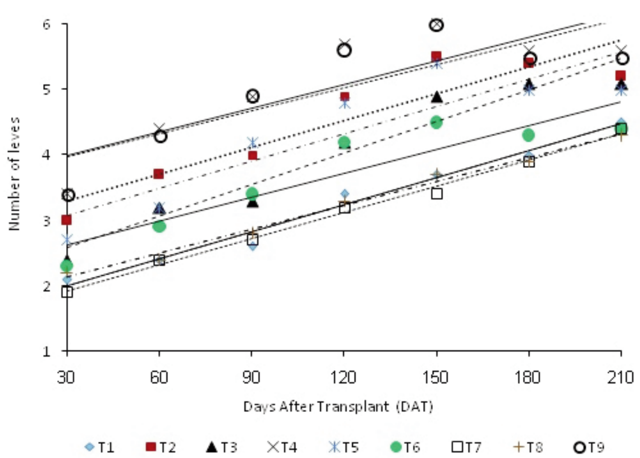

Fig. 3 - Effect of different combinations of substrates on the number of leaves per plant in açaí seedlings (*Euterpe oleracea* Mart.) under nursery conditions. T1= sand, T2= commercial substrate (OrganoAmazon©), T3= 25% T1 + 75% manure, T4= 50% T1 + 50% manure, T5= 75% T1 + 25% manure, T6= 25% T1 + 75% burnt rice husks, T7= 50% T1 + 50% burnt rice husks, T8= 75% T1 + 25% burnt rice husks, T9= 25% soil + 25% sand + 25% manure + 25%

the seedlings in the field, the smaller number of leaves per plant will result in lower rates of transpiration enabling the plant to direct the energy produced during the process of photosynthesis towards root growth and development, initially helping the plants to take hold under climate conditions which differ from those of the greenhouse.

4. Conclusions

The use of different materials in the substrate composition influenced the growth of *Euterpe oleraceae* Mart., seedlings, highlighting for treatment 50% sand + 50% manure and the most diverse composition (25% soil + 25% sand + 25% manure + 25% burnt rice husks).

The substrates which consisted of the combinations 50% sand + 50% manure and 25% soil + 25% sand + 25% manure + 25% burnt rice husks are indicated for the production of seedlings of *Euterpe oleracea* Mart., as they provide superior growth in plant heightand stem diameter, and improve total dry-weight production in the plants.

These treatments suggest the plants employ a greater amount of energy for growth in H and SD, instead of increasing the number of leaves, and this can be a strategy will result in lower rates of transpiration enabling the plant to direct the energy produced during the process of photosynthesis towards growth faster and ensuring high field survival rates.

These results could have of great interest to producers of seedling *Euterpe oleracea* Mart., as they show an increase in the quality of the seedlings produced, which is an advantage when planting, as better-quality seedlings tend to take hold faster and display better growth in the field, besides helping to reduce production costs.

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