Conjecturas

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Morphometry of *Tabebuia aurea* (Manso) Benth. & Hook. f. ex S. Moore subjected to different substrates

Morfometria de mudas de *Tabebuia aurea* (Manso) Benth. & Hook. f. ex S. Moore submetidas a diferentes substratos

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ABSTRACT

The morphometry and quality of seedlings of tree species is of fundamental importance to achieve success in reforestation or commercial exploitation project. Due to the lack of information about the ideal substrate for the production of craibeira seedlings and taking into account the diversification of the use of Tabebuia aurea production of native seedlings for the recovery of degraded areas, this work was conducted with the objective of evaluating the development of seedlings of this species produced with bovine manure and coconut fiber. The present work was carried out at the plant ecophysiology laboratory at the Agrarian Engineering and Sciences Campus (CECA), in Rio Largo, north-region of the state of Alagoas. Four treatments were used, which consisted of a mixture of soil + organic material, in the proportion 3:1. The materials used were tanned bovine manure (ESCB), coconut fiber (CFS) and control (soil). Whose proportions of the treatments were: T1: soil + 0% coconut fiber; T2: soil + 11% coconut fiber; T3: soil + 22% coconut fiber; T4: soil + 33% coconut fiber and T5: soil + 33% cattle manure. Macro and micronutrient analyses of the substrates used were performed. To meet the work objective, the following parameters were evaluated: plant height, stem diameter, number of leaves and leaf dry matter, stem and root and chlorophyll content index. It can be concluded that the substrates chosen for evaluation showed few significant differences in relation to seedling development; the mixture of treatment 2 (soil+coconut fiber 11%) provided a higher percentage of survival and the quality of seedlings were higher; The substrate treatment 4 (soil+coconut fiber 33%) showed much lower results in all evaluated results. However, statistically there were no significant differences in relation to the other treatments and the presence of bovine manure (soil+bovine manure 33%) results in benefits such as greater nutrient supply and possible reduction of seedling costs.

Keywords: recovery of degraded areas, reforestation, seedling production.

RESUMO

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A morfometria e qualidade de mudas de espécies arbóreas é de fundamental importância para se obter êxito em projeto de reflorestamento ou de exploração comercial. Em virtude da carência de informações a respeito do substrato ideal para a produção de mudas de craibeira e levando em consideração a diversificação do uso da *Tabebuia aurea* produção de mudas nativas para a recuperação de áreas degradadas, conduziu-se esse trabalho com o objetivo de avaliar o desenvolvimento das mudas dessa espécie produzidas com esterco bovino e fibra de coco. O presente trabalho foi realizado nas instalações do Laboratório de Ecofisiologia Vegetal no Campus de Engenharias e Ciências Agrárias (CECA), em Rio Largo, região-norte do estado de Alagoas. Foram utilizados quatro tratamentos, que consistiram de uma mistura de solo + material orgânico, na proporção 3:1. Os materiais utilizados foram esterco bovino curtido (SEBC), fibra de coco (SFC) e a testemunha (solo). Cuja às proporções dos tratamentos foram: T1: solo + 0% fibra de coco; T2: solo + 11% fibra de coco; T3: solo + 22% fibra de coco; T4: solo + 33% fibra de coco e T5: solo + 33% esterco bovino. Foram realizadas análises de macro e micronutrientes dos substratos utilizados. Para responder ao objetivo de trabalho foram avaliados os seguintes parâmetros: altura da planta, Diâmetro do caule, número de folhas e matéria seca da folha, caule e raiz e o índice do teor de clorofila. Pode-se concluir que, os substratos escolhidos para avaliação apresentou poucas diferenças significativas com relação ao desenvolvimento das mudas; a mistura do tratamento 2 (solo+fibra de coco 11%) proporcionou maior porcentagem de sobrevivência e na qualidade de mudas foram superiors; O substrato tratamento 4 (solo+fibra de coco 33%) apresentaram resultados bastantes inferiores em todos os resultados avaliados. Entretanto, estatisticamente não houve diferenças significativas em relação aos demais tratamentos e a presença de esterco bovino (solo+esterco bovino 33%) resulta em benefícios como maior fornecimento de nutrientes e na possível diminuição de custos com mudas.

Palavras-chave: recuperação de áreas degradadas, reflorestamento, produção de mudas.

INTRODUCTION

The demand for seedlings of native forest species has increased every year, mainly due to the need to reforest or remake degraded areas, aiming to minimize environmental impacts and biodiversity maintenance (FERNANDES et al., 2000).

To adequately meet this demand, there is a need to produce good quality seedlings, since the success of a planting depends directly on the genetic potentialof the seeds and the quality of the seedlings produced (SANTOS et al., 2000). Among the factors that influence seedling production, the substrate plays a fundamental role, as it is the environment in which the roots develop, supporting and providing water, oxygen and nutrients to the plants (OLIVEIRA et al., 2009).

The fiber of the green coconut shell, which has not yet been widely used, may become an important raw material in the production of good quality substrates for seedling production or in crops without the use of soil. In this 21 case, the use of green coconut shell is feasible because its fibers are almost inert and have high porosity. The ease of production, low cost and high availability are other additional advantages presented by this type of substrate (CARRIJO et al., 2002). It is a substrate of easy

handling, with good water absorption capacity, does not require daily reumding and provides good germination performance of seeds (FAVALESSA, 2011, p 21).

Another extremely important substrate for seedling production is bovine manure is a large organic source used in the composition of substrate for seedling production (ANDRADE NETO et al., 1999). Organic fertilization with bovine manure, in addition to improving drainage and substrate aeration, increases water storage capacity, nutrient levels and the population of microorganisms beneficial to the substrate and plant, stimulating root development (MALAVOLTA et al., 2002).

Due to the lack of information about the ideal substrate for the production of craibeira seedlings and taking into account the diversification of the use of Tabebuia aurea production of native seedlings for the recovery of degraded areas, this work was conducted with the objective of evaluating the development of seedlings of this species produced with bovine manure and coconut fiber.

Based on the premise that based on the literature the substrates used in this experiment act as promoters of plant development, it is expected that the treatment with the coconut fiber substrate will present better development, since this substrate presents good moisture retention, release of nutrients such as sodium and good aggregation.

MATERIAL AND METHODS

Study site

The present work was carried out at the facilities of the Laboratory of Plant Ecophysiology of the Center for Agrarian Sciences (Ceca), in Rio Largo, north region of the state of Alagoas, located at 9° 28'02' latitude and 35°49'65' longitude with an altitude of 135m, the average annual precipitation is 1200 to 1800 mm and relative humidity ranging from 76 to 90% with minimum annual average temperature and 20° and maximum of 29°. The work was developed from June to August 2019 and kept on screen during the development and evaluation period.

Soil collection, substrate preparation and seeds

The seeds, from trees growing in The UFAL, Campus A.C Simões, being removed the side wings and selected for size and color. Then, the sandy latosol was collected from the laboratory of Plant Ecophysiology was sifted, placed in bags, labeled and taken to be

made physiochemical analyses in the Soil Laboratory in the Center of Agrarian Sciences. According to the results of this analysis contained in Table 1.

Table 1. Physical-chemical characteristics of the soil used in the experiment.

Chemical characteristics															
pH	MO	P_{resina}	Al^{3+}	H+Al	K	Ca	Mg	CTC	Na	V	B	Cu	Fe	Mn	Zn
$CaCl_2$	g dm^{-3}	mg dm^{-3}	----	---------- cmol$_c$ dm^{-3} ----------						%	---------- mg dm^{-3} ----------				
4,6	27,5	26,5	----	4,0	0,85	1,65	1,05	7,55	0,35	47	0,27	0,25	100	1,3	0,5

Physical characteristics			
total sand ---------- g	Clay Kg^{-1}	Silt	Textural classification
599	368	33	Clay eno

* pH = Hydrogenionic Potential; MO= Organic matter; P = Phosphorus; K= Potassium; Na = Sodium; H+Al= Total acidity; Ca= Calcium; Mg= Magnesium; B = Boron; Cu = Copper; Fe = Iron; Mn = Manganese; Zn = Zinc; CTC= Effective Cation exchange capacity; CTCt= Total Cation exchange capacity; V= Base Saturation.
*Determinations: (1) Mehlich extractor-1; (2) 1.0 M KCL extractor; (3) Calcium Acetate Extractor at pH 7.0; (4) Welkley-Black method; (5) Base saturation.

The analysis indicates a clayey sandy soil with low Ca, Mg and pH contents, favoring the availability of exchangeable aluminum, thus lowering the availability of phosphorous, forming aluminum phosphate. Therefore, the introduction of substrates rich in plant-essential macronutrients help in the correction of soils with nutritional deficiencies.

Treatments

Four treatments were used, which consisted of a mixture of soil + organic material, in the proportion 3:1. The materials used were tanned bovine manure (ESCB), coconut fiber (CFS) and control (soil). Whose proportions of the treatments were: T1: soil + 0% coconut fiber; T2: soil + 11% coconut fiber; T3: soil + 22% coconut fiber; T4: soil + 33% coconut fiber and T5: soil + 33% cattle manure.

Sowing

Sowing was carried out by placing three seeds per three-liter plastic bag. Thirteen days after emergence, the seedlings with minor developments were thinning, using scissors for cutting, with only one seedling per plastic bag remaining, as shown in Figure 1. The moisture of the experiment was maintained with watering in an interval of two days.

Figure 1. *Tabebuia aurea* seedlings chopped eight days after emergence (D.A.E)

Source**:** The authors

Evaluated parameters

At seven days after seedling emergence, the first evaluations of plant height, stem diameter and number of leaves were performed with the aid of a graduated ruler and a digital caliper. The biometric parameters evaluated were:

- Plant height (cm): Considered as the length of the stem from the part close to the soil to the apex of the plant, with a graduated ruler;
- Stem diameter (mm): With the aid of a digital caliper;
- Number of leaves: Counted per plant;
- Dry matter (Root, Leaf and Stem): Plants will be fractionated in part aerial (stem, leaves) and roots. Then the material will be placed to dry separately in a forced air circulation oven, at a temperature of 65ºC until it reaches constant weight, which will occur after 48 hours, and then weighed in analytical balance.
- Chlorophyll content index (Spad Index): Chlorophyll content index will be determined every three days by non-destructive method using chlorophyllmeter (SPAD-502 - Minolta, Japan). Ten random readings will be performed on one leaf each plant and with the average of these values will be obtained the final value of the SPAD index.

Experimental Design

The experimental design was used in randomized blocks, in factorial scheme 5 (substrates) x 1 (container size), totaling five treatments, with 5 replications, and 25 plants per plot. Isolated effects were determined.

To verify if the coconut fiber varies in the treatments, first the normality test of the data will be performed, if they present normal distribution will be analyzed by the parametric test and the data obtained will be submitted to variance analysis at 5% probability by the F test, and the means of the treatments are compared by the Tukey test. The Statistical Program Sisvar will be used for the analyses.

RESULTS

All morphological characteristics did not present statistical differences when compared between treatments (Table 1).

Height of aerial part

The highest mean occurred in the T2 treatment (soil + 11% coconut fiber), differentiating from the other. The treatments T1 (soil + 0% coconut fiber), T3 (soil + 22% coconut fiber), T4 (soil + 33% coconut fiber) and T5 (soil + 33% cattle manure) showed the lowest average growth in height ranging from 18.0 to 20.0 cm plant, (Table 1).

Table 2. Mean values of morphological variables: plant height (AP), number of leaves (NF), stem diameter (DC) in Tabebuia Aurea seedlings under different treatments.

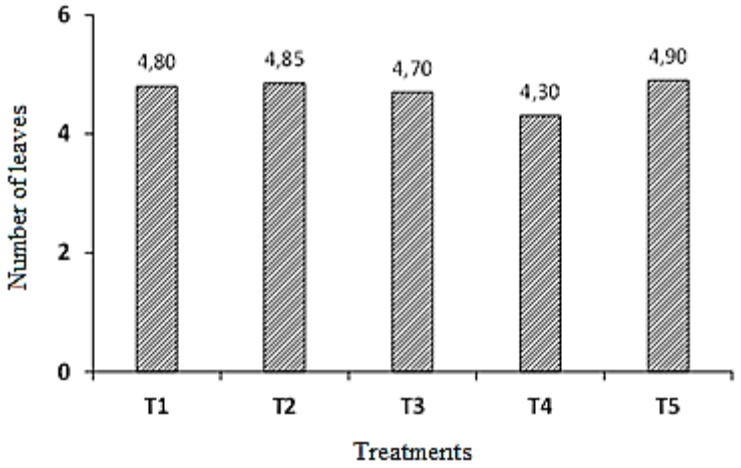
Treatments	H (cm)	NF	DC(mm)
T1 (soil + 0% coconut fiber)	18,18 a	4,80 a	2,47 a
T2 (soil + 11% coconut fiber)	20,49 a	4,85 a	2,55 a
T3 (soil + 22% coconut fiber)	19,35 a	4,70 a	2,56 a
T4 (soil + 33% coconut fiber)	18,41 a	4,30 a	2,36 a
T5 (soil + 33% cattle manure)	20,00 a	4,90 a	2,61 a

Source: The authors

Number of leaves

As for the number of leaves, there was a variation in plant development in all treatments, the leaf count is based on the emergence of the true leaves, obtaining an amplitude of 2 to 10. Thus, the highest mean occurred in the T5 treatment (soil + 33% cattle manure), when compared to the other treatments, as shown in Figure 2.

Figure 2. Number of leaves in *Tabebuia aurea* seedlings under different treatments.

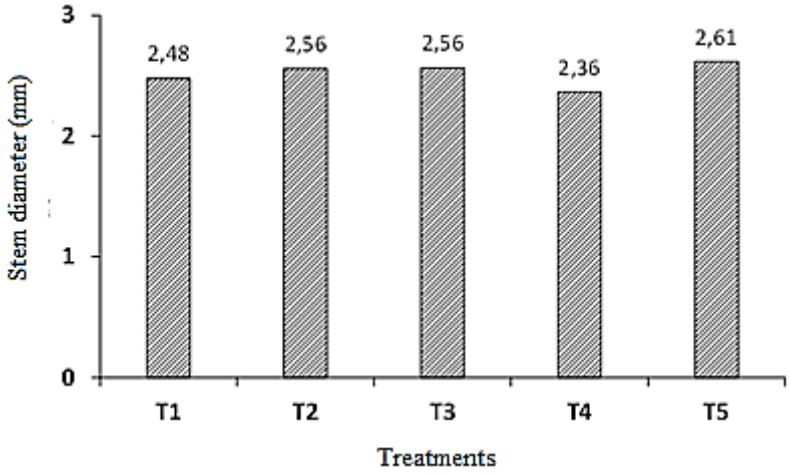


Source: The authors

Stem diameter

Based on the statistical analysis, for the variable stem diameter, it was observed that the T5 treatment (soil + 33% cattle manure) presented higher values, whose variation was from 1.45 to 3.76 mm, but there was no significant difference when compared to the other treatments (Figure 3).

Figure 3. Stem diameter in *Tabebuia aurea* seedlings under different treatments.



Source: The authors

Relative Chlorophyll Content

The summary of the mean values of the analysis of variance for relative chlorophyll content (SPAD Index) is represented in Table 3, where there was no statistical difference.

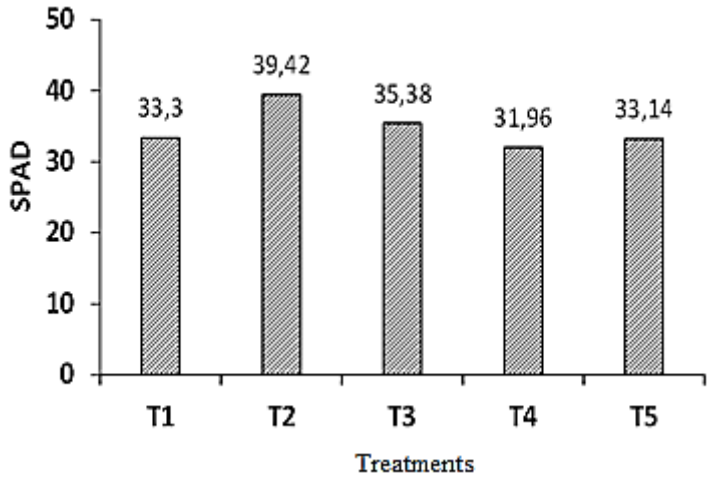
Table 3. Mean values of the physiological variable: relative chlorophyll content (SPAD) in Tabebuia Aurea seedlings under different treatments.

Treatments	SPAD
T1 (soil + 0% coconut fiber)	31,33 a
T2 (soil + 11% coconut fiber)	39,42 a
T3 (soil + 22% coconut fiber)	35,38 a
T4 (soil + 33% coconut fiber)	31,96 a
T5 (soil + 33% cattle manure)	33,14 a

Source: The authors

Analyzing Figure 4, it is observed that the highest meanSPad Index is represented in the T2 treatment (soil + 11% coconut fiber), whose mean value was 39.42, not differing statistically from the other treatments. Treatments T1, T3, T4 and T5 showed a reduction of 20.53%, 7.21%, 43.20% and 34.36%, respectively, and these treatments were the lowest mean values of the SPAD Index.

Figure 4. Relative chlorophyll content (SPAD Index) in Tabebuia Aurea seedlings under different treatments.



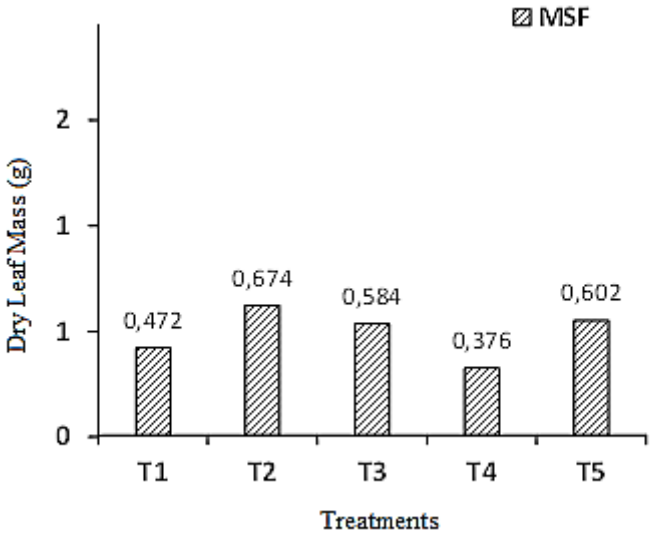
Source: The authors

Dry Leaf Mass (MSF)

Regarding the variable dry mass of the leaf, the highest values were obtained were the T2 treatment (soil + 11% coconut fiber), with an average value of 0.674g. The treatments T1 (soil + 0% coconut fiber), T3 (soil + 22% coconut fiber), T4 (soil + 33%

coconut fiber) and T5 (soil + 33% cattle manure) showed the lowest mean values of dry mass of the leaf ranging from 0.470 to 0.602g of leaves, as shown in figure 5.

Figure 5. Dry leaf mass in Tabebuia Aurea seedlings under different treatments.

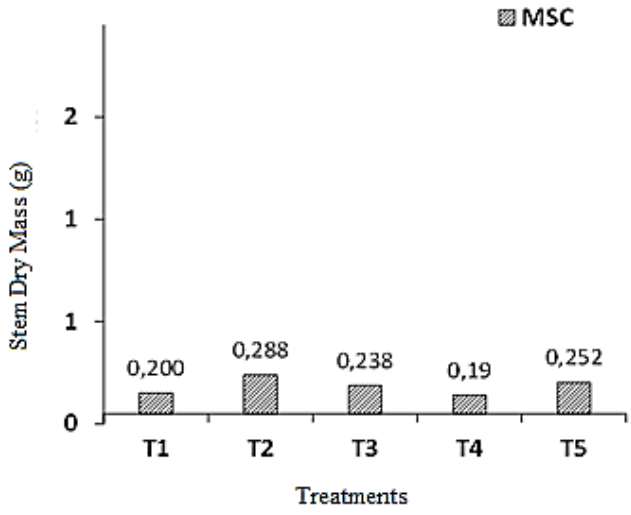


Source: The authors

Stem Dry Mass (MSC)

The dry mass of the stem varied between 0.190 and 0.288g of stem. The highest values of dry mass of the stem were obtained by the T2 treatment (soil + 11% coconut fiber), with an average value of 0.288g, where the higher its value, the higher the probability of survival in the field. The T4 treatment (soil + 33% coconut fiber) presented the lowest mean dry mass of the stem, as shown in Figure 6.

Figure 6. Dry stem mass in *Tabebuia aurea* seedlings under different treatments.



Source: The authors

DISCUSSION

Regarding the height at 62 days, there was greater growth in the seedlings produced in treatment 2 (soil + 11% coconut fiber), According to Wendling and Gatto (2002) coconut fiber presents excellent aerating combined with a good water retention capacity, still presenting high physical stability, because it decomposes very slowly and presents high wetability, that is, it does not rescare water when it is dry. These factors may have contributed to the development and growth of *Tabebuia aurea* seedlings.

Regarding the stem diameter and number of leaves, the T5 treatment (soil + 33% cattle manure) presented better mean values, these results corroborate with Costa et al. (2012), where in the preliminary evaluation of the experiment with (30 DAS) it was observed that the seedlings of baruzeiro cultivated in substrates with higher amount of manure (80% E + 20% F) showed better development, in height, diameter and number of leaves.

According to PENG 1993, the chlorophyll content index is a fast, inexpensive and precise method in determining the nutritional status of plants, being a very important tool in defining the need for nitrogen complementation for the crop. According to the values obtained in this study, the average chlorophyll content index values of treatment 2 (soil+coconut fiber 11%) were the best result with 39.42%, even though there was no significant difference between the other treatments evaluated (OLIVEIRA JUNIOR, 2009) states that a direct relationship between number of leaves and SPAD can be established, because the higher the values found in the SPAD index, the better the nutritional status of the seedlings, especially for nitrogen levels. This statement corroborates the results of this study where T2 presented the second highest mean among the treatments evaluated.

In addition, the spad chlorophyll content index is quite feasible, as it is a non-destructive method that does not require the use of chemical reagents for analysis (DIDONET et al., 2005), which facilitates the management of seedlings in nurseries.

Oliveira and Perez (2012) observed in Tabebuia aurea that the highest shoot dry matter values were obtained when the plants were grown at higher light intensities and, as the cultivation time increased, there was a greater difference in growth, with lower carbohydrate accumulation in more shaded environments. The best averages were treatments 2 and 5, where T2 obtained better results, with little significant difference between them, treatment 4 stood out for the lowest mean.

CONCLUSION

1. The substrates chosen for evaluation showed few significant differences in relation to seedling development.

2. The mixture of treatment 2 (soil+coconut fiber 11%) provided a higher percentage of survival and the quality of seedlings were higher.

3. The substrate treatment 4 (soil+coconut fiber 33%) showed much lower results in all evaluated results. However, statistically there were no significant differences in relation to the other treatments.

4. The presence of bovine manure (beef soil+manure 33%) results in benefits such as greater nutrient supply and possible reduction of seedling costs.

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