Viability and Vigor of Bacaba Seed (Oenocarpus bacaba) in Different Substrates

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Authors’ contributions

This work was performed in collaboration with all authors. Authors DIB and HVN designed the study and performed the statistical analysis. Authors CTS, BHNN and RSO wrote the protocol and wrote the first draft of the manuscript. Authors LSSL, COCS, AFPR and LFC managed the study analyzes. Finally, authors MALC, DMS and FACA managed the bibliographic searches. All authors read and approved the final manuscript.

ABSTRACT

The Bacaba (Oenocarpus bacaba) belongs to the Arecaceae family, is a palm tree native to the Amazon, in which it is distributed throughout the Amazon basin, mainly in the regions of Pará, Tocantins, Acre, and in southern Maranhão, having as habitat the high virgin forest. The production of quality seedlings depends on several factors, and the composition of substrates is a major factor, because seed germination, root initiation, and rooting are directly linked to the chemical, physical and biological characteristics of the substrate. The experiment was carried out at the
Federal Institute of Education - IFTO, Sciences, and Technology of Tocantins, in the city of Gurupi - TO, between September 5, 2018, and December 30, 2018. For the realization of the same, Bacaba seeds (Oenocarpus bacaba) were used, which were purchased at the street fair in the municipality of Gurupi - TO. Root and shoot length, number of leaves, root and shoot dry mass, first emergency count and seedling emergence were evaluated. The substrates: Washed Sand, Commercial Substrate, Pinus Bark + Sawdust Powder + Commercial Substrate, and Worm Humus + Coconut Shell + Commercial Substrate + Sawdust Powder provided the highest values of viability and vigor in Bacaba seeds.

Keywords: Germination; physiological quality; substrate.

1. INTRODUCTION

Brazil is considered the third country with the highest diversity of native palms, with approximately 37 genera and 387 species described. Among these total, 32 genera and 232 species are present in the Amazon region, most of which are potentially economical for the agribusiness of fruits, palm heart, and edible oil [1,2]. Among these palm trees, Oenocarpus bacaba Mart., belonging to the genus Oenocarpus, which comprises 6 species native to Brazil, not endemic [3].

The Bacaba (Oenocarpus bacaba) belongs to the Arecaceae family, is a palm tree native to the Amazon, in which it is distributed throughout the Amazon basin, mainly in the regions of Pará, Tocantins, Acre, and southern Maranhão, having as habitat the high virgin forest [4]. The Bacaba palm can reach from 7 to 22 meters high and 12 to 25 cm in diameter. It features regularly distributed leaves, measuring between 6 to 8 meters long and target-yellowish flowers. Its fruits that form bunches, black-violet, with mucilaginous pulp, high lipid content, with a pleasant flavor, widely used in the production of juices, ice cream, and cough syrup. Its leaf has antioxidant properties such as flavonoids, saponins and tannins that the fruit being antioxidant compounds and bioactive components, such as anthocyanins and phenolics. Bacaba juice is recommended for people who need a diet rich in vitamins and proteins or gain weight because it is extremely caloric [5].

In Brazil, Oenocarpus bacaba is used in many ways, in the construction of houses, as a supplemental source of fiber for animals and its inflorescences are often used to make brooms and crafts. In addition, the extracted oil can be used for medicinal purposes, in the treatment of pulmonary infections, such as bronchitis and in the treatment of tuberculosis [6].

The production of quality seedlings depends on several factors, and the composition of substrates is a major factor, because seed germination, root initiation, and rooting are directly linked to the chemical, physical and biological characteristics of the substrate [7]. The substrate should present important characteristics, such as availability of acquisition and transport, absence of pathogens, richness in essential nutrients, adequate pH, texture, and structure [8]. However, each species has different behavior on the same substrate, being necessary to verify which substrate or combination of these allows obtaining seedlings with higher physiological quality [9].

According to Figliolia et al. [10], the substrate function is to provide the seeds with adequate environmental conditions for germination as well as to provide physical support to seedling development. In the choice of substrate, it should be considered, mainly, its characteristics such as density, water absorption, and retention capacity, aeration and drainage, absence of pests, diseases, and toxic substances, but also the size of the seed and its requirement about water and light. Also, the substrate should provide ease for the evaluation of seedlings during the germination test [11]. Thus, the choice of substrate is of fundamental importance, because it is where the root system will develop, determining the growth of the aerial part of the plant [12].

This study aimed to evaluate different substrates on the viability and vigor of Bacaba seeds.

2. MATERIALS AND METHODS

The experiment was carried out at the Federal Institute of Education - IFTO, Science, and Technology of Tocantins, in the city of Gurupi - TO, between September 5, 2018, and December 30, 2018. To accomplish the same, the seeds of
Bacaba (Oenocarpus bacaba) were purchased at the Street market in the municipality of Gurupi - TO, and submitted to the extraction process through the macerated of the fruits (where it was placed in water for 12 hours to facilitate the process) for separation of the seed pulp.

Six substrates were used to perform the experiment: Washed Sand (WS); Black Soil (BS); Commercial Substrate (CS); Washed Sand + Black Soil + Sawdust Powder (WS + BS + SP); Pinus Bark + Sawdust Powder + Commercial Substrate (PB + SP + CS); Worm Humus + Coconut Shell + Commercial Substrate + Sawdust Powder (HW + CS + SP). 100 seeds per substrate were used, divided into 4 replicates with 25 seeds each. All trays with substrates already sowed were submitted to two irrigation per day throughout the seedling formation period. From the installation of the experiment, the procedure of data collection and evaluation was initiated. The following characteristics were evaluated.

2.1 Root Length (RL) and Shoot Length (SL)

Seedlings were removed from trays and with the aid of a ruler graduated in centimeters, measured from apical cell to the end of the apical root, and measuring from the lap to the apex of the seedling. The results were expressed in cm, according to recommendations [13].

2.2 Number of Leaves (NL)

After the seedlings were removed, the number of leaves was counted. The results were expressed in units.

2.3 Dry Weight of Shoot (DWS) and root (DWR)

Seedlings after removal of substrates were properly cut and separated into roots and shoots, placed in paper bags, taken to a regulated greenhouse with forced air circulation at a temperature of 55ºC, where they remained until they achieved a constant weight. The results were expressed in grams by repetition.

2.4 First Emergency Count (FEC)

The first emergency count was performed at 15 days after sowing. The collected data were corresponding to the cumulative percentage of normal seedlings, with recorded values for each substrate.

2.5 Seedling Emergence (SE)

The count of the number of germinated seeds started 22 days after sowing and extended to emergence stabilization in all substrates. The criterion used was that of normal seedlings that present the perfect essential structures [14].

The data were submitted to variance analysis and the means compared by the Tukey test, using the statistical program Sisvar.

3. RESULTS AND DISCUSSION

In general, the evaluated characteristics showed sensitivity by indicating differences in the quality of the substrates (Table 1), where the highest values obtained from root length, were acquired with seeds sowing on substrates: WS (28.2 cm), CS (22.7 cm), PB + SP + CS (27.1 cm) and HW + CC + CS + SP (26.3 cm), respectively, lower values were found in BS (17.2 cm) and WS + BS + SP (19.1 cm), respectively. Notaro et al. (2012) [15], working with pine rootstock also verified that, the commercial substrate was the one that provided the best root development, due to its higher fertility. Regarding shoot length and number of leaves, the variation was small and insignificant (12.9 to 16.6 cm) and (4.0 to 4.1), respectively, for the period studied, these characteristics are not indicated in the evaluation of substrates in Bacaba seeds. However, Gomes et al. (2002) [16], states that, the variable shoot length makes it possible to estimate the morphological quality of seedlings as a function of its measurement being easy and presenting a good contribution in the determination of quality. The substrate plays an important role in plant growth, having to ensure through its solid phase the growth of the aerial part and the development of the root system, with restricted volume. It also performs the functions of supporting plants, providing root growth, and providing the appropriate amounts of air, water, and nutrients [17].

According to the data found in Table 1, the highest values obtained from the root and shoot dry mass were acquired with seeds sanded on substrates: WS (5.9 and 9.0 g), CS (5.3 and 8.6 g), PB + SP + CS (4.2 and 8.5 g) and HW + CC + CS + SP (5.4 and 8.1 g), respectively, lower values for BS (2.2 and 4.6 g) and WS+BS+SP (4.5 and 5.9 g), respectively. Probably, the black soil allowed greater compaction, justifying the low performance in all evaluated characteristics.
Table 1. Root length (RL), shoot length (SL), a number of leaves (NL), root dry mass (DWR), shoot dry mass (DWS), first emergency count (FEC), and seedling emergence (SE) of bacaba, submitted to different substrates

| Treatments           | RL   | SL   | NL  | DWR | DWS | FEC  | SE  |
|----------------------|------|------|-----|-----|-----|------|-----|
| WS                   | 28.2a| 16.6a| 4.0a| 5.9a| 9.0a| 70.0a| 90.0a|
| BS                   | 17.2b| 12.9ab| 4.0a| 2.2b| 4.6b| 10.0bc| 50.0bc|
| CS                   | 22.7ab| 15.5a| 4.0a| 5.3a| 8.6a| 61.5ab| 79.0ab|
| WS + BS + CS + SP    | 19.1b| 14.2a| 4.0a| 4.5ab| 5.9b| 26.2bc| 68.7b|
| PB + SP + CS         | 27.1a| 16.4a| 4.1a| 4.2ab| 8.5a| 65.0a| 83.7a|
| HW + CC + CS + PS    | 26.3a| 16.3a| 4.0a| 5.4a| 8.1ab| 63.7a| 82.5a|
| CV (%)               | 7.9  | 3.5  | 1.3 | 4.2 | 4.4 | 12.4 | 11.7 |

CV - Coefficient of variation (Tells how much the standard deviation represents in relation to the averages). The different letters mean differences between the means of the treatments in the column. Means followed by the same letter in the column do not differ from each other by the Tukey test at 5%

The data referring to the first count of emergence and emergence of seedlings (Table 1), despite having presented identical behavior, were greatly influenced by the substrates, obtaining higher values the substrates WS (70.0 and 90.0%), CS (61.5 and 79.0%), PB + SP + CS (65.0 and 83.7%) and HW + CC + CS + SP (63.7 and 82.5%), respectively, lower values for BS (10.0 and 50.0%) and WS + BS + SP (26.2 and 68.7%), respectively. Similar results were obtained by Ledo et al. [18] when they observed that the sand substrate provided a higher percentage of the emergence of "pupunheira" seedlings (Bactris gasipaes Kunth) when compared with other substrates. Fachinello et al. (1995) [19], states that, the washed sand substrate is important for the formation of seedlings because it promotes the aeration condition, low cost, easy availability, and allows good drainage. Godoy and Farináció (2007) [20], highlight that, the sand substrate, in addition to performing the role of supporting seedlings, provides adequate water supply, air, free of phytopathogens, easy handling, low cost, high availability, and long durability. Silva et al. (2019) [21] in guava seeds of the white and red variety also verified that the mixture of substrates provided the best viability and vigor results, indicating the organic compound substrates + black sand + commercial substrate and washed sand + rice straw + black soil as the best. Nunes et al. (2020) [22], working with Cagaita seeds, verified that, the humus substrates of worm humus + black soil + commercial substrate and commercial substrate + poultry manure + black soli + washed sand provided the highest values of viability and vigor in Cagaita seeds.

4. CONCLUSION

The substrates Washed Sand and the mixture of Commercial Substrate + Pine Bark + Sawdust Powder provided the highest values of viability and vigor for Bacaba seedlings.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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